ATTACHMENT 1

San Mateo County 101 Express Lanes Initial Performance Evaluation Study March 2026

Rev. 2 Prepared by

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Revision History

Rev.	Date	Page	Prepared By
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Acronyms

AADT	Annual Average Daily Traffic
BAIFA	Bay Area Infrastructure Financing Authority
BATA	Bay Area Toll Authority
C/CAG	City/County Association of Governments of San Mateo County
Caltrans	California Department of Transportation
CHP	California Highway Patrol
EL	Express Lane
EPA	Environmental Protection Agency
EPX	East Palo Alto Express
FCX	Foster City Express
FHWA	Federal Highway Administration
GHG	Greenhouse Gas
GP	General Purpose (lane)
HOV	High occupancy vehicle
HOV-2	High occupancy vehicle with two occupants
HOV-3+	High occupancy vehicle with three or more occupants
I-	Interstate
MPH	Miles Per Hour
MVMT	Million Vehicle Miles Traveled
NB	Northbound
PeMS	Performance Measurement System
PTI	Planning Time Index
SB	Southbound
SFO	San Francisco International Airport
SMCEL-JPA	San Mateo County Express Lanes Joint Powers Authority
SMCTA	San Mateo County Transportation Authority
SOV	Single occupancy vehicle
SR-	State Route
SWITRS	Statewide Integrated Traffic Records System
VHT	Vehicle Hours Traveled

1 Executive Summary

The San Mateo County 101 Express Lanes Performance Evaluation Study (the "Study") evaluates the corridor-wide impacts of the **San Mateo County 101 Express Lanes Project** (the "Project"). The Project was built in two phases, with a southern segment opening in 2022 (Phase 1) and a northern segment opening in 2023 (Phase 2). Overall, it activated 22 miles of express lanes (EL) on US 101 between the San Mateo County/Santa Clara County line and I-380. It is designed to maintain travel speeds of 45 miles per hour (mph) or greater while advancing the following five key benefits:

- Reduce traffic congestion and delays in the corridor
- Improve travel time and reliability for EL users
- Encourage carpooling and transit use
- Increase person throughput (the number of people moved)
- Use modern technology to manage traffic

As discussed in Section 3.3, the study compares pre-Project (2018 for traffic data, 2016-2018 for collision data) and post-Project (2024 for traffic data, 2023 for collision data) conditions and compares the EL to General Purpose (GP) lanes. For vehicle occupancy data, the study compares data ranging from project opening in 2023 through 2025. Date ranges for each dataset were determined by the most recent year of availability for each data type. The Study prioritized the most recent and complete date range for each performance indicator over consistency between indicators but strived for as much consistency as possible.

Overall, the Project has achieved **clear operational improvements** across core performance indicators, particularly in **congestion reduction, travel time reliability, and person throughput**. For context, note that the analysis covers a relatively short post-Project timeframe and occurs amid shifts in regional travel behavior. This includes an estimated 10% average daily traffic decrease between 2019 and 2023 following post-COVID-19 recovery. In contrast to the expected effects of this decrease, the study also shows the full recovery of traffic volumes in the GP lanes during the morning and evening commute peaks. These conflicting trends suggest that **ELs provide a more predictable travel time through San Mateo County during peak periods**, with some influence from pandemic recovery patterns. A clearer picture of the continued benefits of the Project will be possible when additional years of data become available.

Figure 1-1: 101 Express Lane Benefits Assessment Summary

✓ Met   Partially Met; Monitor

BENEFIT	ASSESSMENT	KEY RESULT(S)	METRIC CHANGE
REDUCE CONGESTION	✓ (Met)	Express Lane and General Purpose Lane Avg Speed ↑; Bottlenecks ↓	Express Lane Speeds +7-13 mph; General Purpose Lane Speeds: +1-7 mph
IMPROVE RELIABILITY	✓ (Met)	Buffer Time Needed ↓; Total Hours Spend Traveling Corridor ↓	Planning Time Index: -70%; Travel Time on the Top 5% Worst Travel Days: −44%; Vehicle Hours Travelled: -16%; CO_2 Emissions: -22%
ENCOURAGE CARPOOLING	Partially Met; Monitor	HOV-3+ ↑; Transit Data Limited	HOV-3+: +14% from 32% → 46% (Self-Reported)
INCREASE PERSON THROUGHPUT	✓ (Met)	Passengers per Lane per Quarter ↑ from 2023 to 2025	Person Throughput: +4.8M from 3.1M → 7.9M (2.5×)
USE MODERN TECHNOLOGY	✓ (Met)	Dynamic Pricing & Real-Time Data Enabled Improvements	Influenced All Other Metrics

Key Project Benefits Assessment

The Project was evaluated against five key intended benefits, in addition to safety.

1. Reduce traffic congestion and delays in the corridor

Assessment: Benefit Met

The implementation of the ELs contributed to **significant improvements in traffic flow** in both the southbound (SB) and northbound (NB) directions.

- **Average Speed Increases:**
    - **ELs:** substantial speed increases, with **average gains of 7-13 mph** during peak periods across the corridor.
    - **GP Lanes:** improved speed conditions, especially in the southbound direction, showing **average gains of 1-7 mph** during peak periods.
- **Bottleneck Reduction:** Severe pre-Project bottlenecks near **I-380, Millbrae Avenue, and Ralston Avenue were shortened in both duration and severity**. Some improvements were significant. For example, the southbound bottleneck between I-380 and Millbrae Ave. disappeared, with speeds increasing from below 30 mph to over 65 mph. However, **some long-standing geometric bottlenecks (recurring slowdowns caused by a highway's physical design) at SR-92 and San Francisco International Airport (SFO) persist**.
- **Phase Impact:** The 101 ELs were constructed in two Phases (see Figure 2-1). The **greatest improvements occurred following Phase 2** (Whipple Ave. to I-380), where the Project added a **new continuous, managed lane**. In Phase 1, where the EL was **converted from an existing High-Occupancy Vehicle (HOV) lane**, average **speed improvements were more modest**.

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2. Improve travel time and reliability for EL users

Assessment: Benefit Met

The Project successfully provided users with **faster and more predictable trips**.

- Average Travel Time Savings:
    - **Southbound EL:** Average of **22% (up to 30%) travel time savings.**
    - **Northbound EL:** Average of **13% (up to 20%) travel time savings.**

- **Travel Time Reliability (95th Percentile Travel Time):** The time needed to travel the corridor on a "bad traffic day" – a day when travel time is worse than 95% of all other days – was reduced significantly by the ELs.
    - **ELs:** Showed the largest improvement, with a **28-44% decrease** in the travel time on "bad traffic days." The SB EL saw a reduction from 45.4 minutes to 25.5 minutes.
    - **GP Lanes:** Saw smaller, but still positive, improvements with a **3-14% decrease**.
- **Planning Time Index (PTI):** This measure describes how much buffer time travelers need to budget to arrive on time. It also dropped substantially.
    - Pre-Project (2018): Travelers needed to budget up to **2.3 times** the free-flow travel time (130% extra time).
    - Post-Project (2024): EL users only need to plan 30% extra time, and GP users only need to plan 60-90% extra time.
- **Vehicle Hours Traveled (VHT) Reduction:** The total time all vehicles spent on the roadway decreased. This reflects both reductions in how long it takes vehicles to travel the corridor and how many vehicles are using the corridor. Decreases represent shorter travel times, congestion relief, more reliable operations, and lower overall emissions.
    - **Corridor-wide VHT** (EL + GP) declined by **16%** from 2018 to 2024.
    - **ELs VHT** dropped significantly by **42%** (NB) and **58%** (SB).
- This efficiency improvement contributed to a **22% decrease in total estimated CO_2 emitted** during peak periods, as described in Sections 6.1.4 and 6.2.3.
- **Analytical Limitations:** For Phase 1, the HOV lane data was used as baseline. Since Phase 2 of the Project converted the leftmost GP lane into an EL, this Study used the leftmost GP lane as a baseline for comparison with After conditions. The study also reiterates that it is not possible to isolate the effects of the ELs from regional post-pandemic traffic trends for statistics like VHT reduction. Continued monitoring is needed as post-pandemic traffic continues to recover.

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3. Encourage carpooling and transit use

Assessment: Benefit Partially Met

Early indicators suggest increased carpooling, but gaps in data limit a complete assessment.

- **HOV-3+ Usage:** Self-reported **HOV-3+ declarations** (toll-free trips) **increased from 32%** of vehicle trips in 2023 **to 46%** in 2025. This upward trend suggests the toll exemption is encouraging a shift toward higher-occupancy travel.
- **Data Reliability Concern:** This benefit is subject to limitations due to reliance on **self-reported occupancy** from transponders, which is susceptible to misdeclaration (cheating). Additional study is needed to confirm this trend.
- **Transit Use:** SamTrans offers two express routes, the East Palo Alto Express (EPX) and the Foster City Express (FCX) that use the EL. At the time of the Study the use of these routes could not be evaluated quantitatively due to the lack of availability of complete corridor-specific data.

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4. Increase person throughput (the number of people moved)

Assessment: Benefit Met

The ELs are successfully moving more people through the corridor over time.

- **Person Throughput Growth:** The number of users per lane more than **doubled** from 3.1 million (Q2 2023) **to 7.9 million (Q4 2025)**[1].
- **Phase 2 Impact:** Following the opening of Phase 2, throughput saw the most significant increases, jumping by nearly **2 million users per lane** when comparing the third and fourth quarters of 2023.
- **Analytical Limitations:** This result also relies on self-reported vehicle occupancy, meaning misdeclaration could inflate the estimated numbers.

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5. Use modern technology to manage traffic

Assessment: Benefit Met

The positive performance documented across the other benefits is directly enabled by the **active management** provided by the Project's technology systems.

[1] This report defines fiscal quarters according to the following: Q1 = July – September; Q2 = October – December; Q3 = January – March; and Q4 = April – June. All quarters as periods in this report refer to fiscal quarters.

- **Dynamic Pricing:** The system **adjusts toll rates in real-time** based on traffic conditions **to maintain reliable speeds** and prevent EL oversaturation.
- **Data Generation:** The system provides continuous speed, volume, occupancy, travel time, and transaction data, enabling the San Mateo County Express Lanes Joint Powers Authority (SMCEL-JPA) to **make immediate adjustments and inform long-term planning**.

Corridor Safety Trends (Additional Assessment)

Assessment: Data Insufficient

Initial safety data shows an increasing trend in collision rates, but limited data and external factors prevent definitive conclusions.

- **Data Limitations:** Only **nine months of post-project collision data (March – December 2023) is available**, which limits the ability to draw long-term conclusions or confirm a direct causal link to the ELs. This analysis is preliminary and highlights the need for continued monitoring as more data becomes available. SMCEL-JPA will update this analysis when data from subsequent years is released.
- **Collision Rates:** Analysis of the initial data shows that **project corridor collision rate increased** from **0.40** collisions per million vehicle miles traveled (MVMT) (2016-2018 average) to **0.57** (2023). Collision rates remain **lower than statewide averages** for freeways, which is 0.82 collisions per MVMT[2]. Observed increases during this initial adjustment period likely reflect drivers learning how to navigate the lane rather than structural safety risk.
- **Regional Trend:** The **control corridor** (immediately north of the EL) also showed an increase from 0.32 to 0.34 collisions per MVMT, suggesting a broader regional or post-pandemic trend. This could be tied to noted changes in driving behavior resulting from the pandemic, including increases in risky driving due to lighter traffic, distracted/inattentive driving behaviors like smartphone use, driving skill atrophy, and changes in the frequency and types of trips that drivers take.
- **Collision Hotspots:** Collisions remain concentrated in areas with known geometric constraints and heavy merging, such as **Woodside Road, the SR-92**

[2] 2023 Crash Data on California State Highways (road miles, travel, crashes, crash rates) (Caltrans, 2025)

Interchange, the SFO/San Bruno merge area, and the Peninsula Avenue curve.

Overall Conclusion and Recommendations

The San Mateo County 101 Express Lanes Project has been successful in achieving its core mobility and efficiency objectives, resulting in faster, more reliable travel and increased person throughput.

To sustain these gains and address remaining challenges, the study recommends:

- **Operational Enhancements:**
  - **Continuing to refine dynamic pricing** using segment-level data to address demand surges and changing traffic patterns.
  - **Evaluating advanced occupancy-verification technology** to deter misdeclarations, protect the integrity of the pricing system, and preserve reliability.
- **Safety and Enforcement:**
  - **Targeted CHP enforcement** in high-weaving areas to address the post-Project increase in sideswipe incidents.
  - **Continued safety monitoring** as more years of collision data become available.
- **Transit Data Collection and Analysis**
  - **Collaborating with local transit agencies** to share and analyze ridership, travel time, and reliability data alongside EL operations to better understand and communicate transit benefits.
  - **Using insights** to identify opportunities for operational improvements, targeted investments, and outreach that further encourage transit use on the 101 Express Lanes.
- **Public Education:**
  - **Expanding public outreach** to clarify HOV-3+ rules, proper occupancy declaration, and safe merge practices to reduce misdeclaration and improve safety.
- **Monitoring and Data Strategy:**

- **Expanding the data framework** to include behavioral metrics like occupancy compliance and speed variance for a more robust long-term assessment.

These actions will ensure that the initial operational improvements are matched by long-term safety and sustainability, helping the Project to fully realize its benefits across the corridor.

2 Introduction

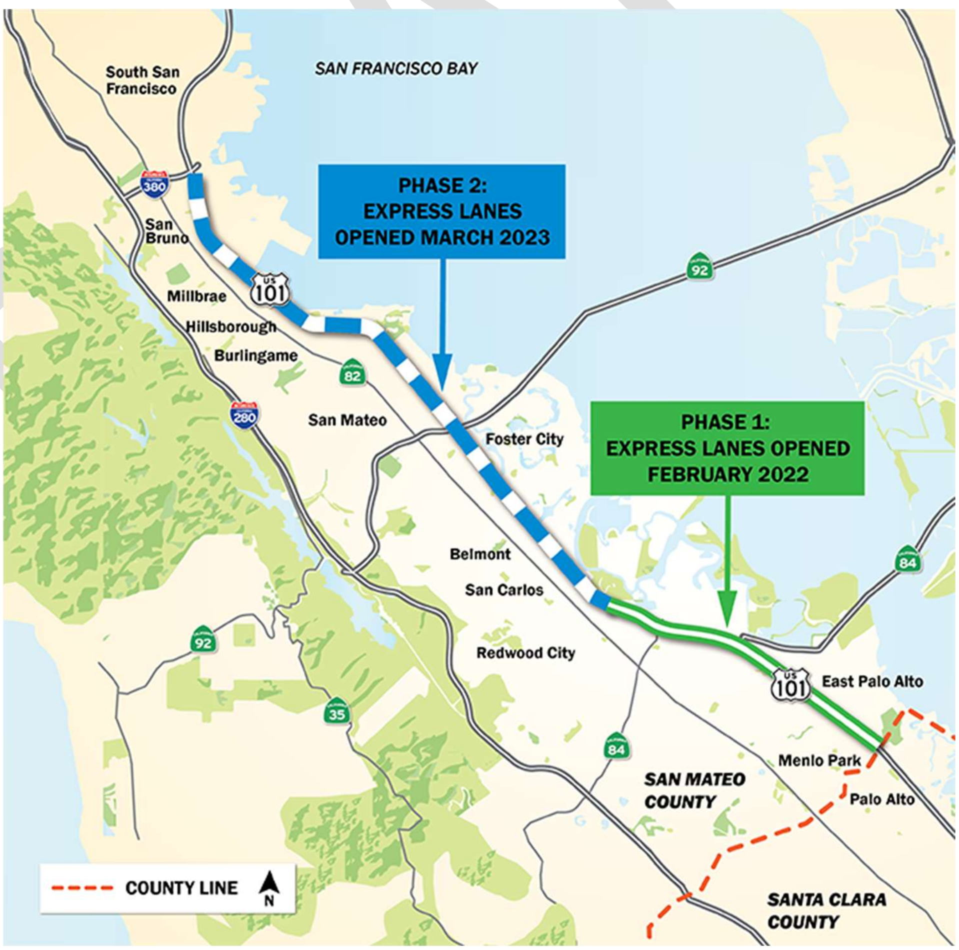
2.1 Corridor Description and Project Background

The San Mateo County101 Express Lanes (the "Project") is a multi-agency effort that activated 22 miles of ELs in both directions on US 101 from the San Mateo County/Santa Clara County line to Interstate 380 (I-380) in South San Francisco. ELs operate similarly to carpool lanes, but allow any vehicle, regardless of occupancy, to use the lane during operating hours for the posted price or at a discounted rate when meeting specific occupancy requirements. Prices are dynamic, meaning they are automatically adjusted depending on how crowded the lane is to maintain high speed and reliability.

The Project is administered and operated by the San Mateo County Express Lanes Joint Powers Authority (SMCEL-JPA) as outlined in the Toll Facility Ordinance adopted in June 2021.

The Project was constructed in two phases, as shown in Figure 2-1.

Figure 2-1: San Mateo County 101 Express Lanes Project Location



- **Phase 1 – San Mateo County/Santa Clara County line to Whipple Avenue:** Phase 1 added a 7-mile segment, spanning the lower third of the corridor, which stretches northward from the San Mateo County/Santa Clara County line to Whipple Avenue. In this portion of the corridor, no new capacity was added to the roadway. Instead, the leftmost carpool lane was converted into the Phase 1 EL. This change enabled vehicles that were not eligible before Project implementation to pay a toll to use the facility. Construction began in February 2019, and the lane started tolling in March 2022.
- **Phase 2 – Whipple Avenue to I-380:** Phase 2 built an additional 15-mile segment, spanning the upper two-thirds of the corridor, which stretches northward from Whipple Avenue to the I-380 Interchange. This segment of the corridor added capacity to the mainline by connecting existing auxiliary lanes to create a continuous, rightmost lane in each direction. The leftmost lane in each direction was converted to an EL. Construction of Phase 2 began in February 2020, and the EL was opened for tolling in March 2023.

Since the ELs opened, SMCEL-JPA has been monitoring operational performance on a weekly, quarterly, and annual basis to assess the effectiveness of the toll system in managing traffic. Dashboards describing this performance monitoring are publicly available on the 101 Express Lanes website.[3]

The dashboard metrics include:

- Number of EL trips
- EL trip types (single occupancy vehicle [SOV], high occupancy vehicle with 2 -person [HOV-2] carpools, high occupancy vehicle with 3-persons or more [HOV-3+] carpools, and violations)
- Revenue and Expenses
- Travel speeds in the ELs and GP lanes in both directions
- Assessed tolls
- FasTrak® adoption (i.e., number of vehicle and trips using FasTrak®)
- Enforcement contacts
- Equity program benefits distribution

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[3] San Mateo US 101 Express Lanes Quarterly Performance reports, https://101expresslanes.org/documents.

These data points allow SMCEL-JPA to make operational and policy adjustments to improve the performance of the Project. Specifically, the dynamic pricing algorithm can be adjusted at certain locations when degradation is observed over a period of time with the intent of shifting driver behavior for more free flowing traffic.

2.2 Project Benefits

The overall goal of the Project is to enable travel speeds of 45 mph or greater, resulting in reduced and more reliable travel times. The Project also seeks to provide a seamless connection to the ELs in Santa Clara County.

In pursuit of these goals, the Project is intended to provide five key benefits to customers:

- **Reduce traffic congestion and delays in the corridor:** Reduce bottlenecks to minimize the impact of traffic congestion on the environment, public health, and quality of life.
- **Improve travel time and reliability for EL users:** Provide an option for customers to access fast and consistent travel times through San Mateo County.
- **Encourage carpooling and transit use:** Provide toll-free (HOV-3+) or reduced price (HOV-2) trips to encourage customers to reduce SOV usage.
- **Increase person throughput** (the number of people per vehicle moving through): Incentivize travel choices to allow more people to move through the corridor without increasing cars on the road.
- **Use modern technology to manage traffic:** Use sensing technology and transaction processing systems to read highway conditions and automatically adjust pricing to maintain traffic flow in real-time and inform long-term planning decisions.

2.3 Purpose of Study

Since the 101 Express Lanes have been operational for more than two years, the purpose of this study is to evaluate the impact of the Project on the corridor and assess the extent to which the Project is achieving the key project benefits described above. It accomplishes this by comparing data from before and after the Project was implemented, and by comparing data between the EL and GP lanes.

Specifically, the study provides insights into:

- How **travel speed and bottleneck analysis** illustrates impacts on reducing traffic congestion and delays;

- How analysis of **travel time and total hours traveled by vehicles** on the corridor shows improved travel time reliability;
- How SMCEL-JPA's **regular tracking of trip types** displays shifts in self-reported carpooling behavior (note that transit use is outside the scope of this study due to unavailability of comprehensive data);
- How **changes in demand to use the corridor and in occupancy** have increased person throughput; and
- How these systems work together to improve traffic conditions **supported by technology**.

In addition to assessing the five key benefits, the study also preliminarily assessed short-term effects on safety using limited available data. Safety is an overarching goal for all highway projects, and the study seeks to be responsive to public concerns about safety with the implementation of the new ELs.

2.4 Report Organization

This Report is organized around the five desired benefits plus safety described above. It begins with a general description of Data Sources and Methodology, which provides reference points of what years were used to analyze the periods before and after the Project was implemented, which data sources were used, and how the Project's two phases influence analysis.

It then provides a Traffic Conditions Overview to provide a reference on how travel behaviors in the region have changed, particularly considering the impact of the COVID-19 pandemic and recovery.

Following this, there are several sections which correspond to each of the five benefits plus safety. Each section describes the method by which the data was analyzed and the results of the analysis.

Finally, the Conclusions section summarizes the results, assesses the extent to which the Project achieved its benefits, and makes recommendations for further study.

3 Data Sources and Methodology

This section supplies a high-level overview of data sources and considerations that applied to the methods for all analysis. More detailed methods are explained in each of the sections for the Project's five benefits plus safety.

3.1 Study Periods

To assess the impact of the Project on the five benefits plus safety, the study compared corridor performance pre- and post-Project implementation. For "pre" data, the study used available data before construction began: 2018 for traffic data and an average of three years of collision data from 2016 through 2018 as a metric for safety. For post-implementation, the study used 2024 traffic data and 2023 collision data, which were the most recent, complete years of data available for each of these data types. For occupancy data, the study compares data at opening of ELs to 2025.

3.2 Data Sources Summary

The study relied on the data collected from the sources listed below.

3.2.1 Performance Measurement System (PeMS)

PeMS is a source for traffic data that is maintained by the California Department of Transportation (Caltrans). PeMS is a publicly available data source if users apply for an account at the PeMS website. It integrates a variety of real-time information collected from over 39,000 individual detectors across all major metropolitan areas of California. This data is collected from a variety of Caltrans and local agency systems including traffic detectors, incidents, lane closures, toll tags, vehicle classification, and more.

The traffic data (volume and speed) was collected from detectors along the San Mateo County Express Lane corridors. The analysis examined traffic data for weekdays (Monday-Friday) from April to September in 2018 and 2024, during the peak periods of 6-10 AM and from 3-7 PM. The April to September period was chosen because these months have the highest traffic volumes. Sets of 10-17 detectors per direction (southbound and northbound) were identified by lane type (Express/High Occupancy Vehicle (HOV) lanes and GP lanes) to compare traffic performance.

An important consideration when using PeMS to study traffic trends over time is ensuring that the detection stations in the periods before and after Project implementation are consistent. Detection stations can be decommissioned, damaged, or otherwise unavailable over the course of several years, so the stations used for analysis were carefully selected for their availability over the entire study period.

The PeMS data used in the analysis was vetted by Caltrans to exclude unreliable detector readings to ensure data integrity. A multi-step process was taken to validate the data. The data collection and evaluation methodology are provided in Appendix A: Traffic Flow Analysis Data Collection and Evaluation Methodology.

PeMS data was used to support all analysis under Benefit 1 and Benefit 2.

3.2.2 Bay Area Infrastructure Financing Authority (BAIFA) Express Lanes Network Toll Collection System

BAIFA provides the toll collection system and integration with BATA (Bay Area Toll Authority) back office for the 101 Express Lanes toll system, meaning that BAIFA is responsible for processing toll transactions and providing performance and financial reporting for the Project. The study was able to access a variety of data via the Toll Collection System's online data portal to support analysis. Data from the Toll Collection System is not publicly available because it contains personally identifiable information, however aggregated data from this system is available through the 101 Express Lanes website.

Toll Collection System data is used to support SMCEL-JPA's weekly, quarterly, and annual performance reporting. The study utilized these reports to summarize the Project's carpooling trends under Benefit 3 and person throughput analysis under Benefit 4.

3.2.3 California Statewide Integrated Traffic Records System (SWITRS)

SWITRS is a database that collects and processes collision data gathered by California Highway Patrol (CHP) and other law enforcement agencies. SWITRS data was obtained directly from California Highway Patrol, however public access to this data is available via the University of California, Berkeley's Transportation Injury Mapping System.

SWITRS data is used to analyze safety trends before and after the Project was implemented in the Safety section below.

3.3 Framework

3.3.1 Analysis by Project Phase 1 v. Phase 2, Pre- v. Post-Implementation, and Express v. GP Lanes

Because the impacts on congestion, travel times, and reliability in Phase 1 and Phase 2 may have been distinctly different, this study separated analysis of Benefits 1 and 2 by phases. For example, solo drivers who previously could not use the HOV lane in the Phase 1 segment due to occupancy rules could now use the ELs by paying a toll. The expected impact would lead to a more balanced traffic flow, reducing congestion in the GP lanes. For Phase 2, the increased physical capacity would be expected to result in overall traffic flow improvement. For a clearer understanding of EL impacts, the following approach was applied in the study:

Phase 1 – San Mateo County/Santa Clara County line to Whipple Avenue: For this segment, the leftmost lanes by the median, the HOV lanes, in 2018 was compared with the ELs in 2024, while the remaining adjacent lanes were used for GP lanes comparison.

Phase 2 – Whipple Avenue to I-380: For the Phase 2 segment (Whipple Avenue to I-380), a direct historical comparison for the EL does not exist as no managed lane was present in 2018. To provide a performance benchmark, this study uses the 2018 leftmost GP lane as a surrogate baseline. Improvements in this segment reflect a combined impact of added physical capacity and active lane management. Furthermore, the comparison between Express and GP lane performance is provided for contextual reference only. GP lanes do not represent an independent control condition, as traffic dynamics are influenced by the operation of the EL, shifts in regional travel demand, and lane-choice behavior. While these factors limit direct attribution, the data provides a consistent basis for evaluating observed corridor trends.

3.3.2 Analysis from Project Opening

Occupancy data is only available from project opening. Comparisons from month to month show significant trends in the share of users who are carpooling and person throughput described under Benefits 3 and 4. The approach to analyzing these data points relies on visualizing data trends through time starting with the second quarter of 2023 and continuing through the fourth quarter of 2025.

3.3.3 Peak Definitions

Several of the benefits describe results by comparing AM peak and PM peak, which are the periods of the day with the highest volume of traffic, often coinciding with the typical morning and evening commute. Peak periods are defined for the 101 Express Lanes according to the following:

- AM Peak: 6:00 AM – 10:00 AM
- PM Peak: 3:00 PM – 7:00 PM

3.4 Analytical Limitations

Several factors influence how the results of this study should be interpreted:

- Limited Date Range for Post-Implementation Data Set: This evaluation represents an early, snapshot-in-time assessment of EL performance based on the data currently available following implementation. In many cases, post-implementation data are limited to as little as nine months, which constrains the ability to fully isolate the effects of the EL from broader regional travel trends or from changes in driver behavior as travelers gradually adapt to the new facility. As a result, the findings presented should be interpreted as preliminary. The analytical framework established through this study is designed to support ongoing evaluation and will yield greater insight as additional years of post-implementation data become available. This will allow future analysis to more clearly distinguish long-term operational impacts from short-term adjustment effects and other external influences.

- **Seasonal Constraints:** For performance measures which utilize PeMS data, the study compares travel conditions using data from April through September, which are typically the highest-volume months on US 101. While this provides a consistent basis for comparison, traffic patterns during these months may differ from conditions during the winter or holiday seasons. As a result, the findings represent typical peak-season conditions rather than year-round performance.

- **Peak Period Focus:** The effects of ELs on corridor travel are most impactful during periods of higher traffic congestion. Outside of these periods, traffic typically flows freely in all lanes, leading to fewer differences in speeds, volumes, and other performance indicators that lend themselves to comparison. The analysis therefore focuses on peak-period averages, which may not capture short-term fluctuations caused by incidents, weather, or construction.

- **Post-Pandemic Travel Pattern Changes:** As described in Section 4.1, regional travel behavior has shifted significantly since the COVID-19 pandemic. Changes in commute frequency, remote work adoption, travel timing, and mode choice continue to evolve. These broader societal shifts influence congestion levels and travel speeds independently of the ELs. However, volume data also suggests that during morning and evening peak periods, traffic has returned to pre-pandemic levels in the GP lanes. While this suggests that peak period benefits can be ascribed to the Project, against the backdrop of regional shifts, the Study does not attribute all differences between 2018 (pre-pandemic) and 2024 (post-pandemic) conditions as resulting directly from the Project.

- **Occupancy Data:** The study uses available data sources to evaluate carpooling and person throughput; however, comprehensive data on actual vehicle occupancy is not collected in the corridor. Carpooling trends rely on self-reported toll system data, which may under- or over-represent actual behavior. This is important to note because HOV-3+ customers have access to toll-free trips as part of EL operating rules to encourage carpooling. Assessments conducted by SMCEL-JPA to compare observed and declared occupancy indicated that a significant portion of HOV-3+ vehicles are not carpooling and are instead occupancy misdeclaration by single drivers.[4]

- **Transit Data:** At the time of the Study, complete transit ridership and travel time data were not available across all routes operating on US 101, particularly the EPX and FCX routes, limiting the Study's ability to thoroughly assess changes in transit performance or use. However, buses utilizing the ELs benefit from the positive impacts on travel time and reliability identified in this Study.
- **Safety Data:** The safety analysis relies on collision data from the SWITRS database, which is subject to reporting delays. Because collision records often take a year or more to be finalized and released, long-term trends cannot yet be fully assessed. Since the post-Project period currently includes only available data from March-December 2023, this limits the ability to compare conditions before and after the ELs with similar statistical confidence. Because some increase in incidents is expected after major changes to highway striping and rules of the road, it also prevents the study from understanding how incident patterns may have already changed since 2023 as users have become more used to the ELs. Additionally, changes in collision rates and spatial collision patterns may also be influenced by numerous external factors outside the scope of this study, including regional traffic trends, enforcement levels, driver behavior, weather, and post-pandemic travel patterns. Continued monitoring over multiple years will be necessary to determine whether the patterns observed in the initial post-Project period represent lasting trends or short-term variability.
- **Safety Analysis Control Corridor:** The selection of the Control Corridor used to compare collision data on the Project Corridor is described in Section 10.1. While the selected Control Corridor provides a reasonable comparison for this early analysis, it is not without limitations. The segment immediately north of the Project differs in several respects from the Project, including its shorter length and proximity to major interchanges such as San Francisco International Airport and I-380, potentially resulting in different traffic demand patterns and driver decision-making compared to the longer EL corridor. In addition, relying on a single control corridor limits the ability to fully account for broader regional trends, seasonal effects, and systemwide changes in travel behavior that may influence

[4] SMCEL-JPA Board of Directors Meeting, May 2023, Agenda Item 4.2, https://101expresslanes.org/media/95/download?inline.

collision outcomes. Future evaluations could strengthen the before-after analysis by incorporating multiple control corridors with similar geometric, operational, and demand characteristics, which would improve the ability to isolate project-related effects from external influence and support more robust conclusions.

- **Attributing Changes to EL Implementation:** Although the analysis identifies clear changes in speeds, bottlenecks, and user behavior after the ELs opened, these changes occur alongside numerous external factors, including economic activity, corridor construction, regional travel demand, adaptive ramp metering, and adjacent land-use growth. For this reason, the study describes observed patterns but does not assume that all improvements or declines were caused exclusively by the Project.

4 Traffic Conditions Overview

4.1 Volume Trends

Understanding how overall traffic demand has changed over time provides important context for interpreting EL performance.

Figure 4-1: US-101 Traffic Volume Trends

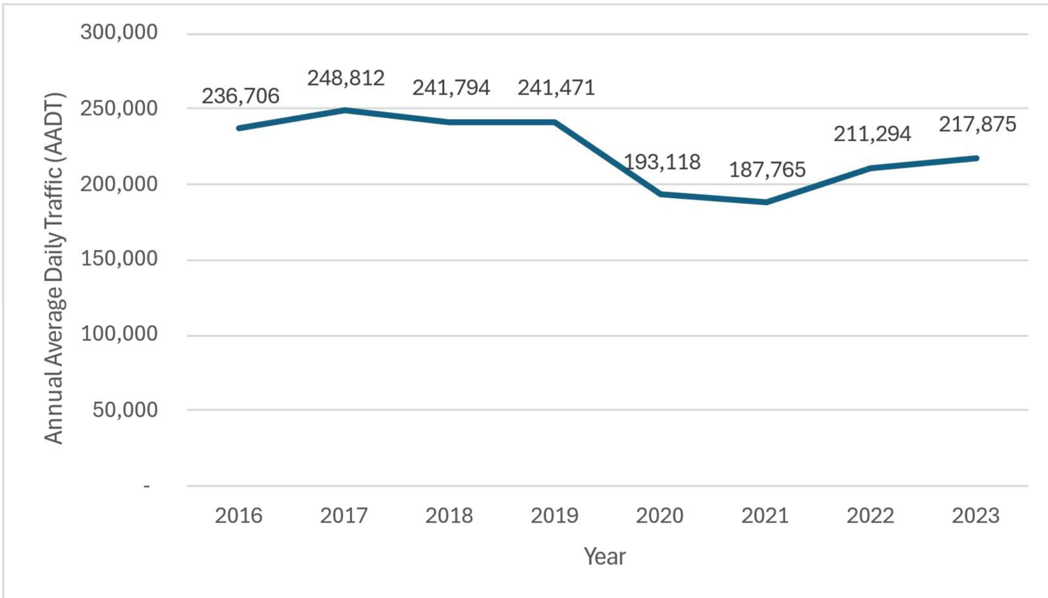
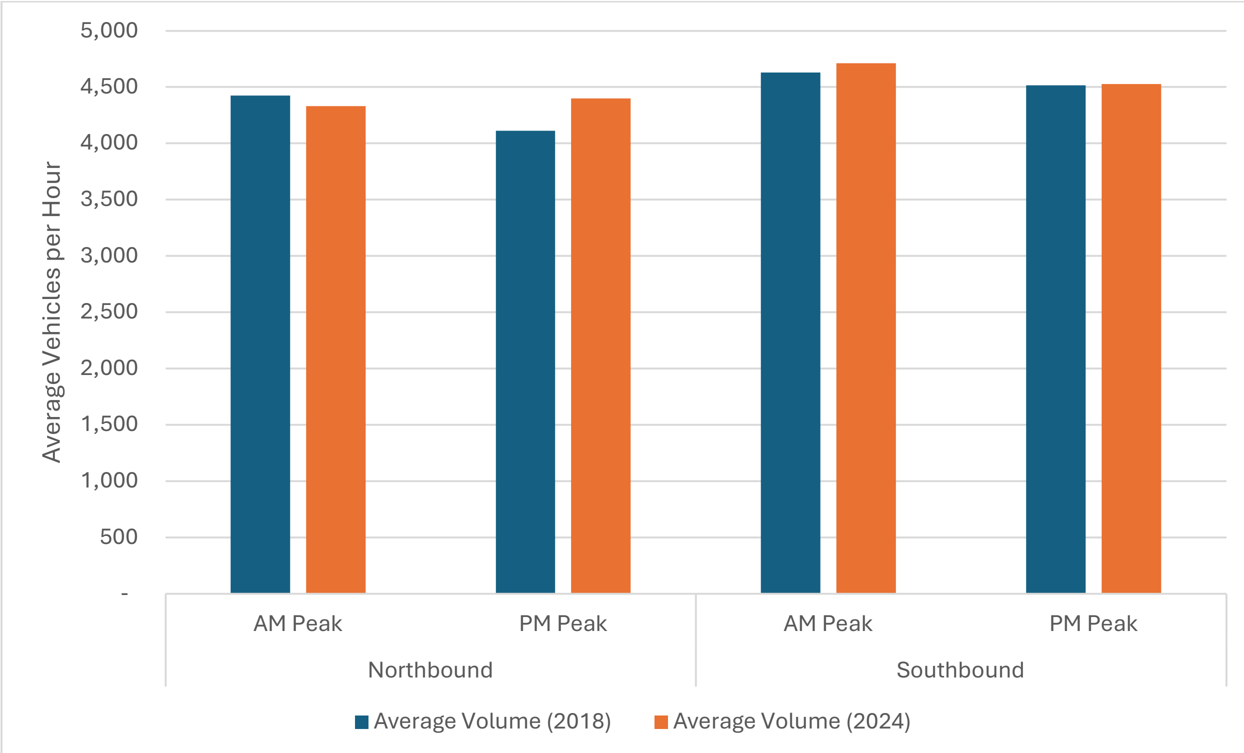


Figure 4-1 displays the Annual Average Daily Traffic (AADT), a datapoint provided by Caltrans which counts the average vehicles on US-101 (within Project bounds for Phase 1 and 2) by year. Traffic volumes on US 101 have not followed a steady pattern between 2019 and 2024. Instead, they reflect the broader effects of the COVID-19 pandemic and the region's ongoing recovery. Traffic volume has increased since the COVID-19 pandemic but has not returned to its 2019 numbers. As of 2023, the latest date at which AADT data is available, volumes are approximately 10% lower than 2019 but have been increasing since 2021. As more offices continue to shift away from remote and hybrid work, we can expect volume to continue to rise in the future.

While AADT has not returned to pre-pandemic levels, peak period traffic has. Figure 4-2 shows that in the GP lanes, except for the Northbound AM Peak, traffic flow has returned to or exceeded pre-pandemic levels. This indicates a strong return of traffic concentrated in commute times, while traffic throughout the day remains lower.

Figure 4-2: Peak Period GP Lane Volumes Pre- and Post-Project



Because daily volumes are still below pre-pandemic levels, the study does not attempt to conclusively ascribe benefits exclusively to the implementation of the Project. Project benefits must be evaluated against the context of these broader societal trends. However, the speed and reliability benefits described in sections below, taken in context with the return of pre-pandemic traffic volumes in the peaks, does indicate that the Project has significantly contributed to improvements during these periods.

5 Benefit 1: Reduce traffic congestion and delays in the corridor

Traffic congestion is a condition on a roadway in which the number of drivers who want to use the roadway is greater than the number of cars it can hold. When demand is greater than capacity, this results in slower speeds, increased travel times, unstable traffic flow, and reduced reliability. One of the primary ways to identify the level of congestion on a roadway is by measuring **average speed**. Additionally, by looking at where speeds are unusually low along a corridor, we can identify **bottlenecks**, or areas where capacity is particularly constrained, and traffic tends to degrade more in comparison to the rest of the roadway.

To help answer whether the Project has reduced congestion and delays, the study examines changes in average speed and bottlenecks, comparing conditions in 2018 to 2024, ELs to GP lanes, and Phase 1 to Phase 2.

5.1 Methodology

5.1.1 Performance Measures

The traffic flow analysis compares traffic conditions along US 101 in San Mateo County between 2018 and 2024, focusing on two primary indicators of congestion: average speed and traffic volume through identified bottlenecks. These metrics were evaluated for the Phase 1 EL (HOV converted to EL), the Phase 2 EL (lane reconfiguration), and the GP lanes to assess the overall impact of the Project and capture nuances by lane type.

As described in Section 3.2.1, travel speed performance was analyzed using traffic data from PeMS. Average speeds were calculated hourly during peak periods by using corresponding sets of detectors assigned by lane type and by direction. Average speeds for 2018 and 2024 were compared for each phase, and differences were calculated to note the direction and extent of the change.

Additionally, to identify bottlenecks, heatmaps were created to further illustrate the average speeds by location along the corridor. Heatmap locations do not correspond exactly to the phase boundaries described earlier because they are related to the location of PeMS detectors. Each heatmap highlights areas and times where speeds were particularly low, with a bottleneck defined as an area where speeds dropped below 45 mph. Heatmaps from 2018 and 2024 are compared to highlight changes in the duration and extent of the bottlenecks along the US 101 corridor. Each heatmap also compares bottlenecks in the EL and GP lane to illustrate differences between the facilities.

5.2 Results

5.2.1 Summary

The analysis of the San Mateo US 101 corridor shows significant improvements in traffic flow following the implementation of ELs in both southbound and northbound directions. These improvements are described in Table 5-1 and Table 5-2 below, which summarize results by EL vs. GP Lane, and Phase 1 vs. Phase 2**.** Subsequent sections go into further detail about each performance measure.

Table 5-1: Southbound Results Summary for Benefit 1: Reduce congestion and delays in the corridor

	Express Lanes	General Purpose Lanes
Phase 1 (County Line to Whipple Avenue)	• Average speeds increased by 10.4 mph during AM peak and by 13.1 mph during PM peak. • The bottleneck between Woodside Rd and University Ave disappeared, with speeds increasing from 30 mph to over 45 mph.	• Average speeds increased by 4.4 mph during the AM peak and by 7.4 mph during the PM peak. • The bottleneck from north of Willow Rd to University Ave improved, with speeds increasing from below 30 mph to between 30 and 45 mph.
Phase 2 (Whipple Avenue to I-380)	• Average speeds increased by 10.5 mph during AM peak and by 7.0 mph during PM peak. • The bottleneck between 1-380 and Millbrae Ave. disappeared, with speeds increasing from below 30 mph to over 65 mph	• Average speeds increased by 8.0 mph during the AM peak and by 0.8 mph during the PM peak. • The bottleneck around 3rd Ave was improved with speeds increasing from below 30 mph to 45-55 mph.
Performance Focus Areas	• There is persistent congestion south of Millbrae Ave during the PM peak and south of Woodside Rd during the AM peak.	• There is persistent congestion in Phase 1, especially during the AM peak.

Table 5-2: Northbound Results Summary for Benefit 1: Reduce congestion and delays in the corridor

	Express Lanes	General Purpose Lanes
Phase 1 (County Line to Whipple Avenue)	• Average speeds decreased by 0.6 mph during AM peak and by 3.6 mph during PM peak. • Congestion increased between Willow Rd and University Ave.	• Average speeds decreased by 1.5 mph during the AM peak and by 1.0 mph during the PM peak.
Phase 2 (Whipple Avenue to I-380)	• Average speeds increased by 10.3 mph during AM peak and by 10.2 mph during PM peak. • The bottleneck between Hillsdale Blvd. and Ralston Ave improved, with speeds increasing from under 30 mph to between 30 mph and 45 mph. • The bottleneck around I-380 disappeared.	• Average speeds increased by 1.1 mph during the AM peak and by 2.8 mph during the PM peak. • The bottleneck around 3rd Ave improved, with speeds increasing from below 30 mph to between 45 and 55 mph.
Performance Focus Areas	• Average speeds decreased marginally between University Ave and Willow Rd, likely due to the increased ability to access the EL leading in from Santa Clara.	• There is persistent congestion from Whipple Ave to Millbrae Ave.

5.2.2 Travel Speed Performance

5.2.2.1 Southbound Express and GP Lanes

5.2.2.1.1 Southbound ELs

Across all peak times, average speeds improved in both segments of the corridor following the implementation of the ELs, when compared to pre-Project lane conditions. A summary of average speeds along the southbound HOV/EL during peak periods is provided in Table 5-3 for Phase 1 and the southbound GP lane/EL during peak periods is provided in Table 5-4 for Phase 2.

Table 5-3: Average Southbound Speeds - Phase 1 (HOV converted to EL)

		Average Speed (Miles per Hour)			
		HOV Lane	Express Lane	HOV Lane/ Express Lane	HOV Lane/ Express Lane
Peak	Time (Hour)	Before (2018)	After (2024)	Average Hourly Speed Difference	Average Peak Period Speed Difference
AM Peak Period	6:00 AM	73.4	74.6	+ 1.3	+ 10.4
	7:00 AM	50.7	58.4	+ 7.6	
	8:00 AM	36.1	50.1	+ 13.9	
	9:00 AM	39.3	54.6	+ 15.2	
PM Peak Period	3:00 PM	53.4	64.1	+ 10.7	+ 13.1
	4:00 PM	43.5	58.3	+ 14.8	
	5:00 PM	44.6	58.5	+ 13.9	
	6:00 PM	54.2	69.1	+ 14.9	

Legend: GREEN for improvement, RED for worsening

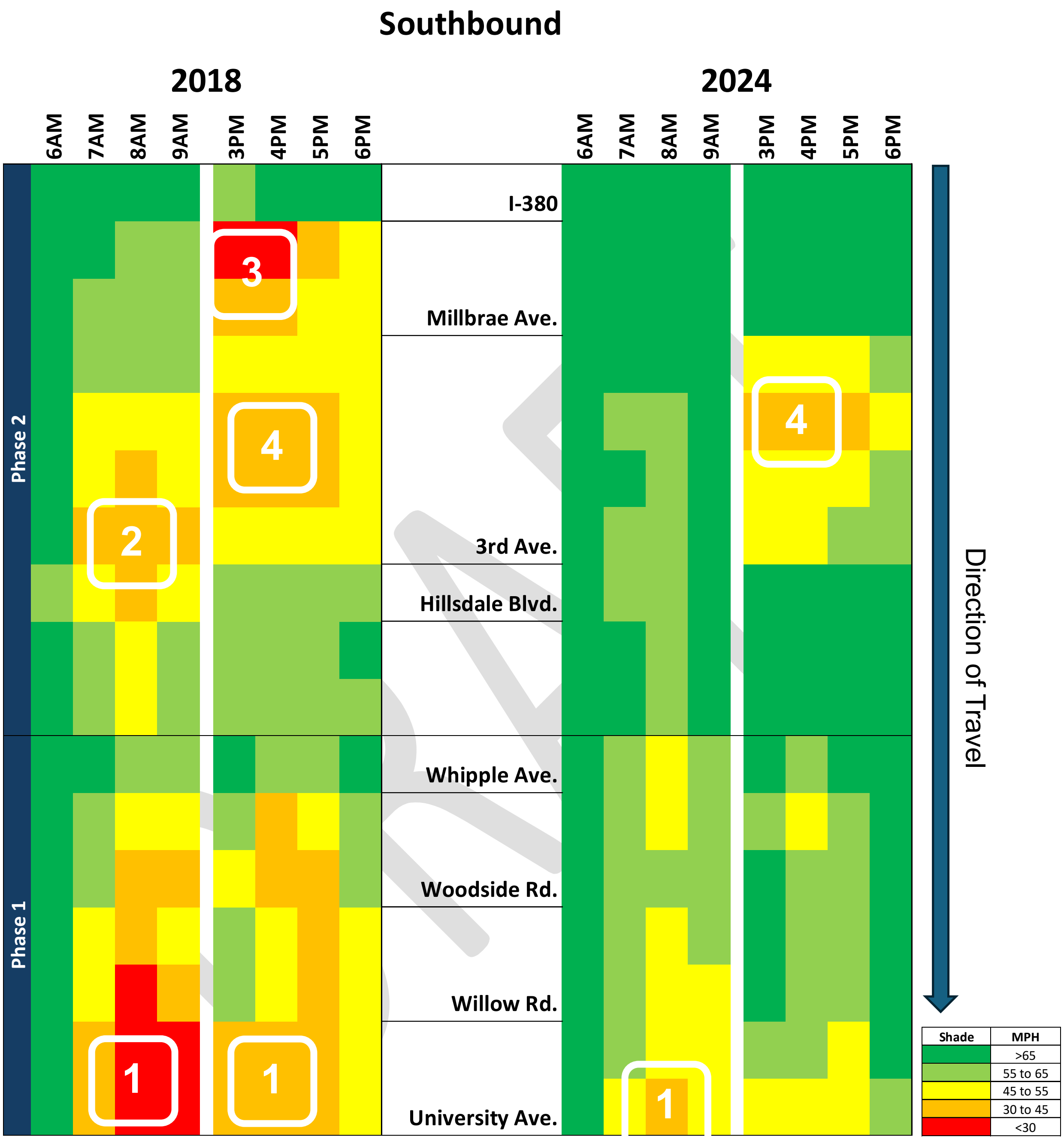
Table 5-4: Average Southbound Speeds - Phase 2 (Lane Reconfiguration)

		Average Speed (Miles per Hour)			
		GP Lane	Express Lane	GP Lane / Express Lane	GP Lane / Express Lane
Peak	Time (Hour)	Before (2018)	After (2024)	Average Hourly Speed Difference	Average Peak Period Speed Difference
AM Peak Period	6:00 AM	68.0	74.9	+ 6.8	+ 10.5
	7:00 AM	56.1	67.1	+ 11.0	
	8:00 AM	50.4	64.6	+ 14.1	
	9:00 AM	55.7	70.9	+ 15.2	
PM Peak Period	3:00 PM	49.6	56.4	+ 6.8	+ 7.0
	4:00 PM	48.9	56.7	+ 7.8	
	5:00 PM	51.8	57.8	+ 6.0	
	6:00 PM	55.5	65.0	+ 9.5	

Legend: GREEN for improvement, RED for worsening

Figure 5-1 presents heatmaps of average speed along the San Mateo US 101 southbound corridor HOV/EL for Phase 1 and GP lane/EL for Phase 2 during peak periods, highlighting areas of congestion. The series of heatmaps highlight areas of congestion and are organized to show hourly average speeds during AM and PM peak periods from left to right, with locations aligned in the direction of travel with labels for Phase 1 and Phase 2 of the Project area. As illustrated in Figure 5-1, bottlenecks, or congestion areas with average speeds below 45 mph, were present in both phases in 2018.

Figure 5-1: Phase 1 (HOV Converted to EL) and Phase 2 (Lane Reconfiguration) EL Southbound Speed Heatmaps



Phase 1 Bottlenecks:

1. Woodside Rd. to University Ave. (AM, PM): Significant congestion was observed in 2018 between Woodside Road and University Avenue during both peak periods. Speeds dropped below 30 mph during the AM peak. By 2024, this bottleneck had largely dissipated, and average speeds consistently exceeded 45 mph. There is notable congestion relief in 2024 compared to 2018.

Phase 2 Bottlenecks:

2. Millbrae Ave. to Hillsdale Blvd. (AM): Congestion was observed in 2018 during the AM peak with speeds averaging between 30 and 55 mph. This bottleneck was largely dissipated by 2024 with speeds in the AM peak averaging between 55 and over 65 mph. There is notable congestion relief and more balance in lane usage in 2024 compared to 2018.

3. I-380 to Millbrae Ave. (PM): Congestion was observed in 2018 during the PM peak between I-380 and Millbrae Ave. with average speeds going lower than 30 mph. This bottleneck was fully resolved in 2024, with speeds averaging above 65 mph during the PM peak.

4. Millbrae Ave. to 3rd Ave. (PM): Congestion was observed in 2018 between Millbrae Ave. and 3rd Ave. during the PM peak with average speeds between 30 and 55 mph. This bottleneck was slightly improved by the ELs, though congestion is still present. The 6 PM hour now has speeds between 55 and 60 mph.

5.2.2.1.2 Southbound GP Lanes

Average speeds in the southbound GP lanes improved across both Phase 1 and Phase 2 by 2024, with major congestion relief in areas with previous bottlenecks. Some localized slowdowns—particularly south of Millbrae Avenue—persisted during the PM peak due to roadway geometry. The area south of Millbrae Avenue is notable in this regard for two curves in the highway in quick succession, which cause slowing due to reduced visibility and lower turning speeds. A summary of average speed along the southbound GP lanes during peak periods is provided in Table 5-5 and Table 5-6 for Phases 1 and 2, respectively.

Table 5-5: Average Southbound Speeds - Phase 1 (GP Lane)

		Average Speed (Miles per Hour) General Purpose Lanes			
Peak	**Time (Hour)**	**Before (2018)**	**After (2024)**	**Average Hourly Speed Difference**	**Average Peak Period Speed Difference**
AM Peak Period	6:00 AM	62.6	64.9	+ 2.3	+ 4.4
	7:00 AM	44.8	51.7	+ 6.9	
	8:00 AM	34.7	40.5	+ 5.8	
	9:00 AM	38.6	44.3	+ 5.8	
PM Peak Period	3:00 PM	51.2	57.6	+ 6.4	+ 7.4
	4:00 PM	42.6	52.7	+ 10.1	
	5:00 PM	44.3	52.2	+ 7.9	
	6:00 PM	54.5	60.1	+ 5.5	

Legend: GREEN for improvement, RED for worsening

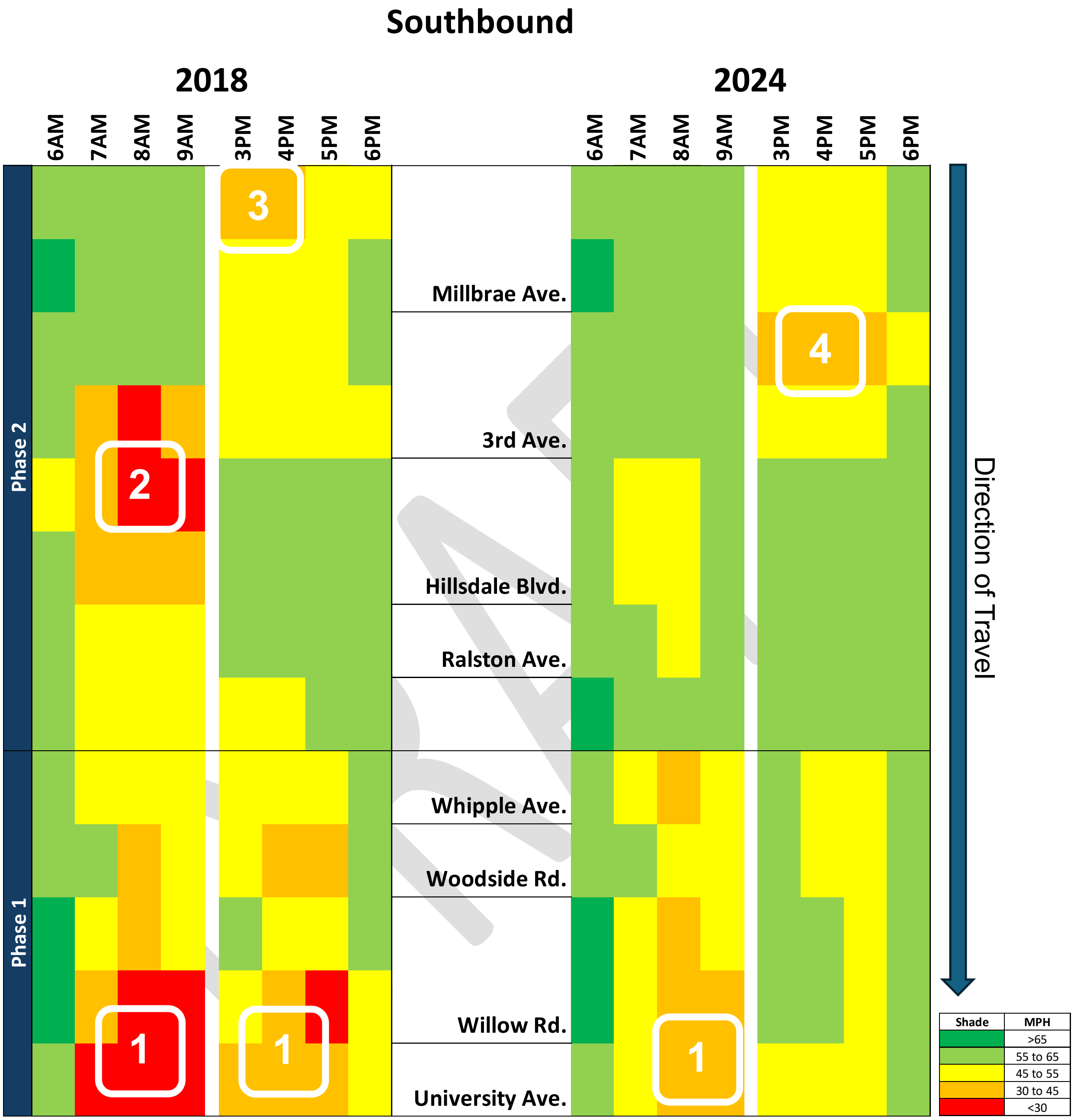
Table 5-6: Average Southbound Speeds - Phase 2 (GP Lane)

		Average Speed (Miles per Hour) General Purpose Lanes			
Peak	**Time (Hour)**	**Before (2018)**	**After (2024)**	**Average Hourly Speed Difference**	**Average Peak Period Speed Difference**
AM Peak Period	6:00 AM	60.3	64.4	+ 4.1	+ 8.0
	7:00 AM	49.7	57.3	+ 7.6	
	8:00 AM	44.9	55.8	+ 10.9	
	9:00 AM	47.3	57.5	+ 10.2	
PM Peak Period	3:00 PM	51.7	52.9	+ 1.2	+ 0.8
	4:00 PM	52.4	52.9	+ 0.5	
	5:00 PM	53.5	53.0	- 0.5	
	6:00 PM	56.6	58.8	+ 2.1	

Legend: GREEN for improvement, RED for worsening

Figure 5-2 presents heatmaps of average speed along the San Mateo County US 101 southbound corridor GP lanes during peak periods, highlighting areas of congestion. As illustrated in Figure 5-2, significant bottlenecks were observed in the following locations.

Figure 5-2: Phase 1 (HOV Converted to EL) and Phase 2 (Lane Reconfiguration) GP Lanes Southbound Speed Heatmaps



Phase 1 Bottlenecks:

1. Willow Rd. to University Ave. (AM, PM): Significant congestion was observed in 2018 between Willow Road and University Avenue during both peak periods. Average speeds dropped below 30 mph during AM and PM peaks. By 2024, these bottlenecks had improved, though congestion still lingers. Average speeds in the AM are now between 30 and 45 mph. In the PM peak, average speeds range from 45 to 65 mph.

Phase 2 Bottlenecks:

2. North of 3rd Ave. to Hillsdale Blvd. (AM): Congestion was observed in 2018 during the AM peak with speeds averaging from below 30 to 55 mph. This bottleneck was greatly improved by 2024, with speeds in the AM peak averaging between 45 and 65 mph. There is notable congestion relief in 2024 compared to 2018.

3. North of Millbrae Ave. (PM): Congestion was observed in 2018 during the PM peak north of Millbrae Ave. with average speeds between 30 and 55 mph. This bottleneck was improved in 2024, with speed remaining above 45 mph.

4. Millbrae Ave. to 3rd Ave. (PM): There was low congestion observed in 2018 during the PM peak between Millbrae Ave and 3rd Ave with average speeds between 45 and 55 mph. Congestion worsened in 2024, with a drop in speed to 30-45 mph from 3 PM to 5 PM. It is possible that this was caused by the improvement in Bottleneck 3, which allowed more traffic to flow toward Bottleneck 4 than there was capacity to serve.

5.2.2.2 Northbound Express and GP Lanes

5.2.2.2.1 Northbound ELs

Average speeds in the Phase 1 segment were marginally slower than in 2018, as the EL conversion and direct connection to the 101 Express Lanes in Santa Clara County may have led to greater demand for the lane, while average speeds in Phase 2 showed significant increases. A summary of average speeds along the northbound HOV/EL during peak periods is provided in Table 5-7 for Phase 1 and for the northbound GP lane/EL in Table 5-8 for Phase 2.

Table 5-7: Average Northbound Speeds - Phase 1 (HOV converted to EL)

		Average Speed (Miles per Hour)			
		HOV Lane	Express Lane	HOV Lane/ Express Lane	HOV Lane/ Express Lane
Peak	Time (Hour)	Before (2018)	After (2024)	Average Hourly Speed Difference	Average Peak Period Speed Difference
AM Peak Period	6:00 AM	69.9	73.8	+ 3.9	- 0.6
	7:00 AM	65.8	65.8	+ 0.1	
	8:00 AM	63.8	61.7	- 2.1	
	9:00 AM	67.4	65.8	- 1.6	
PM Peak Period	3:00 PM	69.1	64.5	- 4.7	- 3.6
	4:00 PM	64.4	59.2	- 5.2	
	5:00 PM	62.8	59.9	- 2.9	
	6:00 PM	64.4	62.9	- 1.5	

Legend: GREEN for improvement, RED for worsening

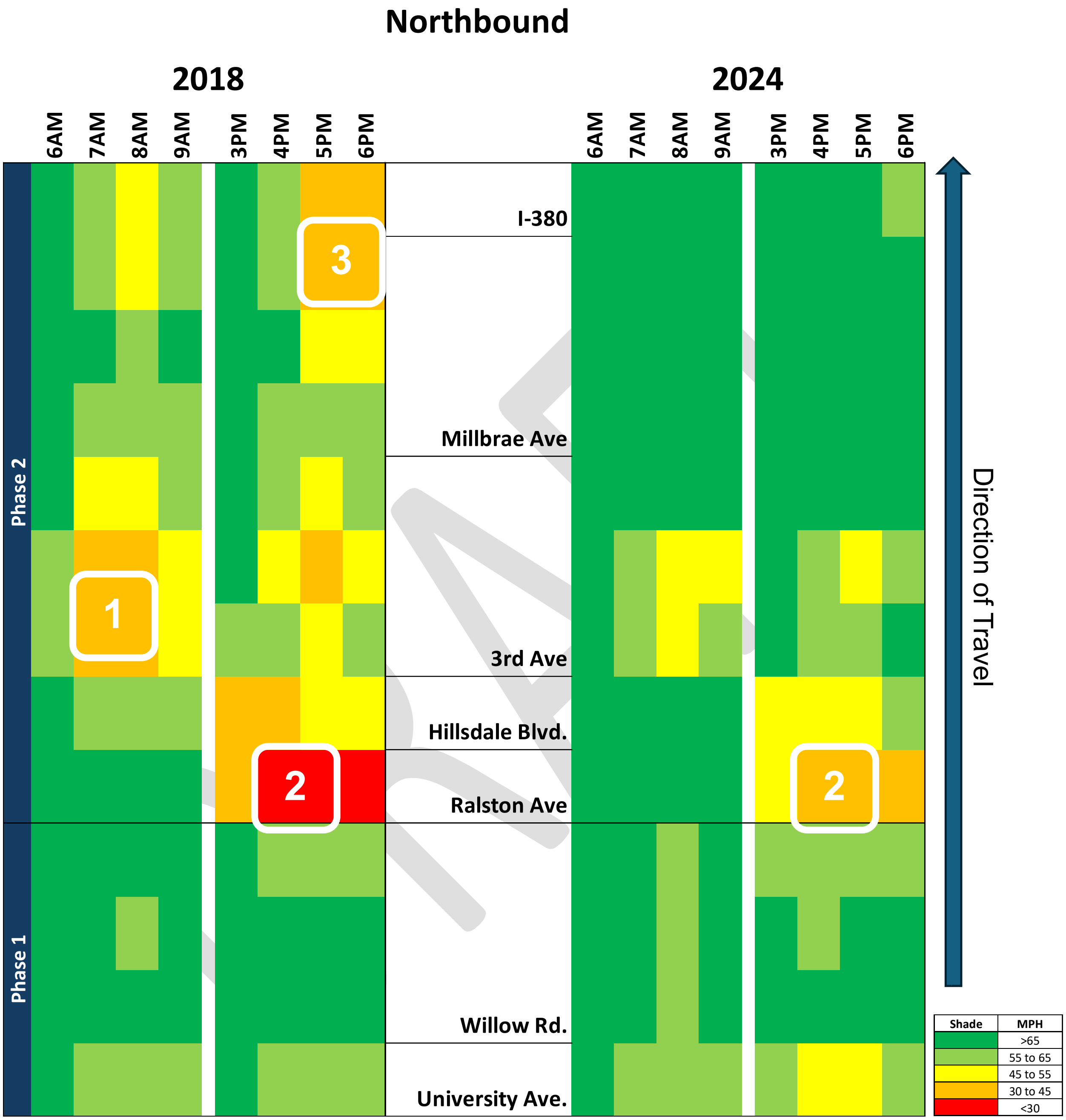
Table 5-8: Average Northbound Speeds - Phase 1 (Lane Reconfiguration)

		Average Speed (Miles per Hour)			
		GP Lane	Express Lane	GP Lane / Express Lane	GP Lane / Express Lane
Peak	Time (Hour)	Before (2018)	After (2024)	Average Hourly Speed Difference	Average Peak Period Speed Difference
AM Peak Period	6:00 AM	67.5	74.5	+ 7.0	+ 10.3
	7:00 AM	56.1	69.5	+ 13.4	
	8:00 AM	51.9	66.3	+ 14.4	
	9:00 AM	59.0	68.1	+ 9.1	
PM Peak Period	3:00 PM	60.2	66.7	+ 6.5	+ 10.2
	4:00 PM	54.3	61.8	+ 7.5	
	5:00 PM	45.3	59.7	+ 14.4	
	6:00 PM	49.7	63.9	+ 14.2	

Legend: GREEN for improvement, RED for worsening

Figure 5-3 presents heatmaps of average speed along the San Mateo US 101 northbound corridor HOV/EL for Phase 1 and GP lane/EL for Phase 2 during peak periods, highlighting areas of congestion. As illustrated in Figure 5-3, bottlenecks were present only in Phase 2 in 2018.

Figure 5-3: Phase 1 (HOV Converted to EL) and Phase 2 (Lane Reconfiguration) EL Northbound Speed Heatmaps



Phase 1 Bottlenecks:

There were no identified bottlenecks in Phase 1. In 2024, the area between University Ave. and Willow Rd. saw a slight increase in congestion from 2018, which may result from more people being permitted to use the lane. Average speeds during the PM peak decreased to between 45 and 55 mph.

Phase 2 Bottlenecks:

1. 3rd Ave. to Millbrae Ave. (AM): Congestion was observed in 2018 during the AM peak with speeds averaging from below 30 to 65 mph. The length of the bottleneck decreased, and average speeds increased by 2024 with speeds in the AM peak averaging between 45 to 65 mph. There is notable congestion relief in 2024 compared to 2018.

3. Ralston Ave. to 3rd Ave. (PM): Congestion was observed in 2018 during the PM peak between Ralston Ave. and 3rd Ave. with average speeds from below 30 mph to 45 mph. This bottleneck improved slightly in 2024 with average speeds no longer dropping below 30 mph, though significant congestion remains. Average speeds range from 30 to 55 mph.

3. I-380 (PM): There was significant congestion in 2018 around the I-380 interchange during the PM from 5 PM to 6 PM. Speeds averaged between 30-45 mph. This bottleneck was completely resolved in 2024 with speeds ranging from 55 to over 65 mph.

5.2.2.2.2 Northbound GP Lanes

In the northbound GP lanes, Phase 2 showed modest gains in speed and reduced congestion, while Phase 1 remained relatively stable with minor declines, maintaining speeds above 45 mph overall. A summary of average speed along the northbound GP lanes during peak periods is provided in Table 5-9 and Table 5-10 for Phases 1 and 2, respectively.

Table 5-9: Average Northbound Speeds - Phase 1 (GP Lane)

		Average Speed (Miles per Hour) General Purpose Lanes			
Peak	Time (Hour)	Before (2018)	After (2024)	Average Hourly Speed Difference	Average Peak Period Speed Difference
AM Peak Period	6:00 AM	62.9	63.7	+ 0.7	- 1.5
	7:00 AM	60.4	59.7	- 0.7	
	8:00 AM	60.0	56.6	- 3.3	
	9:00 AM	60.7	58.5	- 2.1	
PM Peak Period	3:00 PM	61.7	59.7	- 2.1	- 1.0
	4:00 PM	59.7	59.2	- 0.5	
	5:00 PM	57.9	58.3	+ 0.4	
	6:00 PM	60.1	58.4	- 1.7	

Legend: GREEN for improvement, RED for worsening

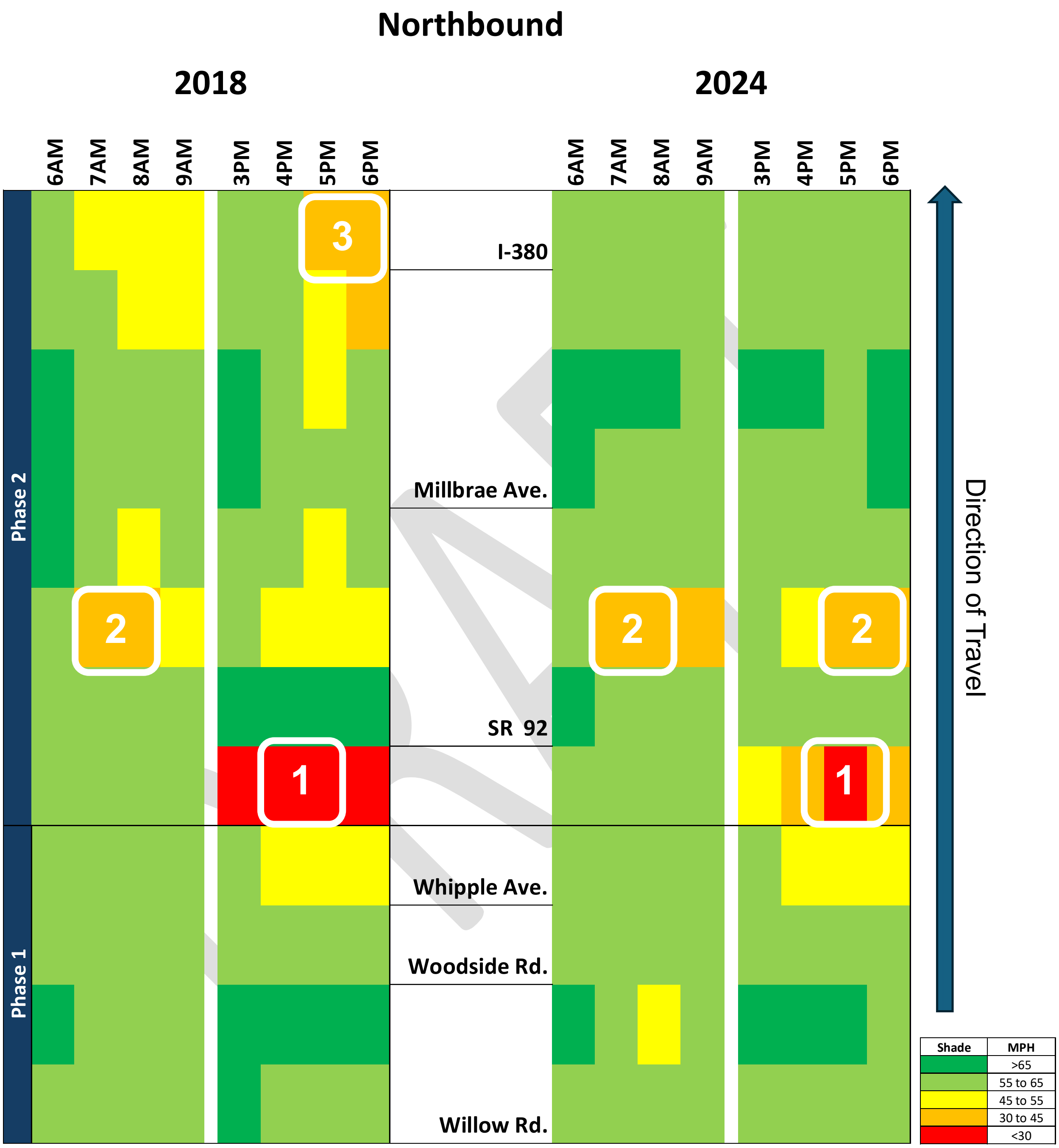
Table 5-10: Average Northbound Speeds - Phase 2 (GP Lane)

		Average Speed (Miles per Hour) General Purpose Lanes			
Peak	Time (Hour)	Before (2018)	After (2024)	Average Hourly Speed Difference	Average Peak Period Speed Difference
AM Peak Period	6:00 AM	63.5	63.5	+ 0.0	+ 1.1
	7:00 AM	56.2	58.8	+ 2.6	
	8:00 AM	53.8	56.0	+ 2.2	
	9:00 AM	57.5	57.2	- 0.3	
PM Peak Period	3:00 PM	59.4	60.6	+ 1.2	+ 2.8
	4:00 PM	56.2	57.2	+ 1.0	
	5:00 PM	49.3	53.7	+ 4.4	
	6:00 PM	52.4	57.4	+ 5.0	

Legend: GREEN for improvement, RED for worsening

Figure 5-4 presents heatmaps of average speed along the San Mateo County US 101 northbound corridor GP lanes during peak periods, highlighting areas of congestion.

Figure 5-4: Phase 1 (HOV Converted to EL) and Phase 2 (Lane Reconfiguration) GP Lanes Northbound Speed Heatmaps



Phase 1 Bottlenecks:

There were no identified bottlenecks in Phase 1. There is some slight congestion north of Whipple Ave. that has remained unchanged since 2018.

Phase 2 Bottlenecks:

1. South of SR-92 (PM): Congestion was observed in 2018 during the PM peak with average speeds falling below 30 mph. This bottleneck was slightly improved by 2024 with speeds reaching up to 55 mph at 3 PM. Speeds from 4 PM to 6 PM remained below 45 mph.

2. South of Millbrae Ave. (AM, PM): Congestion was observed in 2018 during the AM peak south of Millbrae Ave. Average speeds during 7 AM and 8 AM ranged from 30 to – 45 mph. This bottleneck was worsened slightly in 2024, with speeds at 9 AM dropping to match those in 7 AM and 8 AM. The PM peak also worsened, going from 45-55 mph to 30-45 mph, becoming a new bottleneck.

3. I-380 (PM): There was significant congestion observed in 2018 in the area around the I-380 interchange during the PM periods of 5 PM and 6 PM. Speeds averaged between 30 and 45 mph. This bottleneck was completely resolved in 2024, with speeds ranging from 55 to over 65 mph.

5.3 Interpretation

In combination with a decrease in regional travel, the implementation of the ELs has helped improve overall corridor performance, though the degree of improvement differs by phase. In Phase 2, where the Project added a new lane, both the express and GP lanes experienced substantial congestion relief. Former bottlenecks near I-380, Millbrae Avenue, and Ralston Avenue saw higher speeds and shorter slowdowns.

In Phase 1, where the HOV lane was converted but no new capacity was added, improvements were more modest. The EL attracted some traffic that would otherwise have been in the GP lanes, which helped to balance demand among the lanes. This led to noticeable speed increases southbound, while northbound speeds declined slightly due to continued high demand.

Some bottlenecks that remain in 2024 (and existed before) are likely influenced by factors beyond the ELs, such as ramp spacing, merging activity, or other design- or geography-based constraints. These areas will continue to experience slower speeds even with the ELs in place.

6 Benefit 2: Improve travel time and reliability for EL users

Improving travel time and ensuring more predictable trips were two of the primary goals of the Project. When travel times vary significantly from day to day, drivers must leave much earlier than necessary to account for unexpected delays. By providing a lane that is actively managed through variable tolling, the Project aims to maintain consistent speeds that shorten trip times and reduce the uncertainty travelers experience when planning their trip.

To evaluate progress toward this benefit, the study analyzed multiple indicators of travel-time performance, including average travel time, the 95th percentile travel time (representing the worst days on the corridor), the Planning Time Index (PTI), and Vehicle Hours Traveled (VHT). Together, these measures show not only whether EL users are saving time, but also whether their trips have become more reliable from one day to the next. The results presented in this section highlight substantial improvements in both travel time and reliability following implementation of the ELs, with the largest gains occurring in the segments where the Project added new managed-lane capacity.

6.1 Methodology

6.1.1 Performance Measures

The key performance measures the study examined to analyze whether the Project has improved travel time and reliability for EL users are:

- Travel Time: Travel time is defined as the time required to traverse a route between any two points of interest along the corridor.
- A lower travel time is preferable because people can reach their destination more quickly.
- Travel time data was collected from sensors in the PeMS system.
- Travel Time Reliability
    - Travel Time Reliability describes how predictable a trip is, not just how long it takes.
    - The 95th percentile travel time is one indicator of how predictable the length of a trip is. This metric means that out of one hundred trips on the corridor, this travel time is worse than ninety-four of them. This value typically describes how long it would take to travel the corridor on a “bad traffic day.”

- The Planning Time Index (PTI) uses the 95th percentile travel time and compares it to the time it would take to travel the corridor with no traffic. For example, a PTI of 2.0 means that to be sure a user arrives at their destination on time, they would have to plan for their trip to take twice as long as it would take with no traffic.

- Vehicle Hours Travel (VHT)
  - VHT is a measure of the total sum of the hours traveled by all vehicles along a corridor. It can be found using the formula below:
  - $Vehicle\ Hours\ Traveled = Traffic\ Flow^{5} \times Average\ Travel\ Time$
  - A lower VHT is preferable because it means that vehicles are getting through the corridor quicker and spending less time on the road. A low VHT also corresponds to lower greenhouse gas (GHG) emissions.

6.1.2 Travel Time

6.1.2.1 Analysis

6.1.2.1.1 Data

Travel time calculations are based on PeMS speed data from selected detector stations along the corridor. Consistent with the analysis for Benefit 1, the study compared:

- 2018 to 2024 traffic conditions;
- Northbound to Southbound directions; and
- ELs to GP lanes

Only data that met Caltrans data-quality criteria were included.

6.1.2.1.2 Converting Speed Data to Travel Times

Each detector station represents a known segment length of the 101 Express Lanes. PeMS reports the average speed at each station in 5-minute intervals. PeMS also summarizes this data at an hourly level for each station, smoothing out short-term fluctuations. For this analysis, the hourly data was directly obtained from PeMS.

For each segment, travel time was computed as:

[5] Traffic Flow is defined as the number of vehicles traveling in the corridor per hour and is calculated by multiplying the average speed of vehicles moving through the corridor by the density of vehicles moving through the corridor.

$$Travel\ Time = \frac{Segment\ Length}{Hourly\ Average\ Speed}$$

Segment travel times were then summed across all stations in each direction of travel. This produces the estimated time a typical vehicle would take to travel the full study corridor within that hour.

6.1.2.1.3 Summarizing and Comparing Travel Times

The analysis focused on the previously defined peak periods. For these peak periods, the travel times were calculated and aggregated to develop:

- Average travel time during each peak period;
- Percentage difference between 2018 and 2024;
- Differences between EL and GP lanes in the same year; and
- Directional differences (NB vs. SB)

6.1.3 Travel Time Reliability

Travel time reliability describes how predictable a trip is, not just how long it takes. Even when average travel times are acceptable, large day-to-day swings can make a roadway feel unreliable. The study followed standard reliability measures used by Caltrans and the FHWA.

6.1.3.1 Reliability Metrics

The 95th percentile longest travel time was calculated by using the hourly average corridor travel times calculated in Section 6.1.2.1 for every hour of each weekday in the study period .This metric represents a "bad day" of traffic and to helps identify conditions that travelers should occasionally expect.

The Study calculated a Planning Time Index (PTI). This Index is defined as:

$$\frac{95th\ percentile\ travel\ time}{Free\ flow\ travel\ time}$$

This index describes how much extra time travelers should plan to ensure that they arrive at their destination on time. For example, a PTI of 1.4 would mean that a drive that would take 20 minutes with no traffic needs to be multiplied by 1.4 to equal 28 minutes on a bad day of traffic. Lower values for PTI indicate a more reliable corridor.

6.1.4 VHT

The study evaluated VHT – which measures the total amount of time that vehicles spend traveling through a given network—rather than vehicle miles traveled (VMT), another common metric which measures the total distance vehicles travel within the network. VHT is a more comprehensive performance measure that provides a clearer understanding of the time drivers spend on the road and in congestion—an aspect of traffic operations that VMT doesn't capture. An analysis of VHT evaluates the Project's impact on *traffic volume* and *average speed*. In doing so, VHT analysis can indicate whether the project is improving performance by reducing the total amount of time that vehicles are spending on the roadway.

To support the VHT calculations, the corridor was divided into approximately 12 segments of varying length, with each segment containing one set of traffic sensors. The hourly traffic data from these sensors served as the basis of the VHT calculations. VHT for each segment was calculated by taking the average hourly flow rate, multiplying by the miles of the segment, and dividing by the average speed for that segment as shown in the formula below:

$$Hourly\ VHT\ per\ segment = \frac{Segment\ Length\ \times Flow\ Rate}{Average\ Speed}$$

The corridor VHT was then calculated by summing the VHT for each segment, in each direction. More details regarding data sources may be found in Section 3.

This analysis evaluated the percent reduction in VHT as a result of the ELs for all available weekday AM and PM peak times during the study period.

The VHT analysis was also used to conduct a high-level GHG analysis, comparing CO_2 emission trends before and after the implementation of ELs to understand their impact on air quality. The study focused on CO_2 emissions since that is the GHG with the most publicly available reporting data. The metric chosen was the amount of CO_2 released per mile, as this is the standard metric used to represent vehicle tailpipe emissions. The Environmental Protection Agency (EPA) published a report, titled *Greenhouse Gas Emissions from a Typical Passenger Vehicle*, in 2018, documenting that the average passenger vehicle emits about 404 grams of CO_2 per mile, based on a fuel economy of 22 miles per gallon.[6] The EPA has not published an updated base number for 2024. Instead, the average CO_2 emitted per vehicle in 2024 can be estimated by applying national trends against the 2018 base number. In the Bay Area, vehicle fuel efficiency has improved due to increased vehicle efficiency as well as an increased utilization of hybrid and zero emission vehicles. This has led to a decrease of roughly 2.6% in grams of CO_2/mile per year from 2018 through 2024. This means that the average vehicle in the Bay Area is roughly 86% more efficient in 2024 than it was in 2018. Applying this

[6] https://19january2021snapshot.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle_.html.

multiplier to the 2018 base number of 404 grams of CO_2 per mile, gives an estimated 348 grams of CO_2 per mile in 2024.

$$Final\ Value = Initial\ Value \times (1 - Rate)^{Time}$$

$$348 = 404 \times (1 - 0.026)^6$$

It is also reasonable to assume that the average vehicle is more efficient in the San Francisco Bay Area compared to national trends due to a higher rate of electric vehicle adoption.[7] This means that the 348 grams of CO_2 released per mile in 2024 is probably a conservative estimate of GHG.

6.2 Results

6.2.1 Travel Time Performance

6.2.1.1 Analysis

Travel time analysis calculates how long it takes to traverse the corridor under typical peak-period conditions, highlights the differences between ELs and GP Lanes, and changes between 2018 and 2024. Results are presented for both directions of travel.

6.2.1.1.1 Southbound Express and GP Lanes

As shown in Table 6-1 and Table 6-2, below, hourly average travel times during the AM and PM peak periods show that EL and GP lane travel times were lower than in 2018, indicating an improvement in congestion patterns. Drivers saved an average of about 5 minutes in the Southbound ELs and 2-4 minutes in the Southbound GP lanes.

Table 6-1: Average Southbound Travel Times - ELs

		Average Travel Time (Minutes)			
		HOV Lane	Express Lane	HOV Lane/ Express Lane	HOV Lane/ Express Lane
Peak	Time (Hour)	Before (2018)	After (2024)	Average Travel Time Difference	Average Peak Period Travel Time Difference
AM Peak Period	6:00 AM	18.5	17.3	-1.2	-4.9
	7:00 AM	24.8	20.1	-4.7	
	8:00 AM	31.4	21.8	-9.6	
	9:00 AM	28.0	20.0	-8.1	
PM Peak Period	3:00 PM	27.3	20.9	-6.3	-5.2
	4:00 PM	28.5	21.5	-7.0	
	5:00 PM	26.7	21.2	-5.5	
	6:00 PM	23.2	18.8	-4.4	

[7] *Over 100,000 ZEVs Sold in California in the Second Quarter of 2025*, https://www.energy.ca.gov/news/2025-07/over-100000-zevs-sold-california-second-quarter-2025, July 31, 2025. *Two Bay Area counties lead the stat in electric vehicle sales*, https://www.mercurynews.com/2025/03/07/marin-maintains-growth-in-electric-vehicle-sales/, May 7, 2025.

Legend: GREEN for improvement, RED for worsening

Table 6-2: Average Southbound Travel Times - GP Lanes

		Average Travel Time (Minutes)			
		HOV Lane	Express Lane	HOV Lane/ Express Lane	HOV Lane/ Express Lane
Peak	Time (Hour)	Before (2018)	After (2024)	Average Travel Time Difference	Average Peak Period Travel Time Difference
AM Peak Period	6:00 AM	20.9	20.0	-0.9	-3.9
	7:00 AM	28.5	23.3	-5.2	
	8:00 AM	35.8	26.1	-9.7	
	9:00 AM	31.2	24.7	-6.4	
PM Peak Period	3:00 PM	25.9	24.3	-1.6	-1.8
	4:00 PM	27.6	25.1	-2.6	
	5:00 PM	27.2	25.2	-2.0	
	6:00 PM	23.7	22.0	-1.7	

Legend: GREEN for improvement, RED for worsening

6.2.1.1.2 Northbound Express and GP Lanes

As shown in

Table 6-3 and Table 6-4, below, hourly average travel times during the AM and PM peaks show that EL travel times were lower for both peaks, while GP lane travel times were about the same for the AM peak period and lower for the PM peak period. EL users saved about 2-4 minutes on average, while GP lane drivers saved up to 2.5 minutes in the PM peak period.

Table 6-3: Average Northbound Travel Times - ELs

		Average Travel Time (Minutes)			
		HOV Lane	Express Lane	HOV Lane/ Express Lane	HOV Lane/ Express Lane
Peak	Time (Hour)	Before (2018)	After (2024)	Average Travel Time Difference	Average Peak Period Travel Time Difference
AM Peak Period	6:00 AM	18.9	17.4	-1.5	-1.9
	7:00 AM	21.8	18.9	-2.9	
	8:00 AM	23.2	20.0	-3.3	
	9:00 AM	20.7	19.2	-1.5	
PM Peak Period	3:00 PM	22.3	20.2	-2.1	-3.4
	4:00 PM	25.3	22.6	-2.8	
	5:00 PM	29.5	23.5	-6.0	
	6:00 PM	26.4	21.4	-5.0	

Legend: GREEN for improvement, RED for worsening

Table 6-4: Average Northbound Travel Times - GP Lanes

		Average Travel Time (Minutes)			
		HOV Lane	Express Lane	HOV Lane/ Express Lane	HOV Lane/ Express Lane
Peak	Time (Hour)	Before (2018)	After (2024)	Average Travel Time Difference	Average Peak Period Travel Time Difference
AM Peak Period	6:00 AM	20.5	20.2	-0.3	0.3
	7:00 AM	22.7	22.3	-0.4	
	8:00 AM	23.4	24.5	1.1	
	9:00 AM	22.1	23.3	1.2	
PM Peak Period	3:00 PM	23.5	21.7	-1.8	-2.5
	4:00 PM	26.1	24.0	-2.2	
	5:00 PM	29.8	26.6	-3.2	
	6:00 PM	26.0	23.1	-2.8	

Legend: GREEN for improvement, RED for worsening

6.2.2 Travel Time Reliability

Travel time reliability describes how consistent conditions are from day to day during the peak periods. Analysis focused on two measures: the 95th Percentile Travel Time (reflecting conditions on a "bad traffic day") and the Planning Time Index (PTI), which indicates how much extra time travelers must budget to ensure an on-time arrival with 95% certainty. Results are reported for both the ELs and GP lanes.

6.2.2.1 95th Percentile Travel Time and PTI

The 95th percentile travel time represents the upper end of typical congestion during peak periods. Lower values indicate fewer high-delay days for corridor users.

Table 6-5: 95th Percentile Travel Time by Direction, Lane Type, and Year

Direction	Lane Type	2018 95th Percentile TT (min)	2024 95th Percentile TT (min)	Change 2018-2024 (min)	% Change	EL Advantage in 2024 (min)
SB	GP	38.5	37.5	-1.0	-3%	12.0
	EL	45.4	25.5	-19.9	-44%	
NB	GP	37.0	31.9	-5.1	-14%	6.8
	EL	34.9	25.1	-9.8	-28%	

In both directions, the ELs show lower 95th percentile travel times than the GP lanes, meaning EL users experience fewer high-delay days. This is quantified by the difference between EL and GP lanes noted as "EL Advantage in 2024." The change from 2018 to 2024 indicates that reliability has improved over time. The ELs in both directions showed the largest improvement in reliability, especially the southbound ELs, which showed a 44% decrease in the 95th percentile travel time. The GP lanes also showed improvement, particularly in the northbound direction at a 14% decrease.

The PTI measures how much longer a trip may take on a bad day relative to free flow travel. A lower PTI indicates higher predictability and less need for travelers to budget additional buffer time.

Table 6-6: Planning Time Index (PTI) Summary by Direction, Lane Type, and Year

Direction	Lane Type	2018 PTI	2024 PTI	Change 2018-2024	% Change	EL Advantage in 2024
SB	GP	1.9	1.9	-0.1	-3%	0.6
	EL	2.3	1.3	-1.0	-44%	
NB	GP	1.9	1.6	-0.3	-14%	0.3
	EL	1.8	1.3	-0.5	-28%	

Since PTI is analogous to the 95th percentile travel time, results are identical, however the PTI values demonstrate the extent to which conditions have improved. Prior to the Project, travelers in the Southbound direction would have to budget more than twice the free-flow travel time to arrive at their destination on time (indicated by the PTI >2.0). After Project implementation, travelers can now utilize the ELs and can reliably reach their destination by planning only 30% more time.

6.2.3 VHT Analysis

6.2.3.1 Summary

The purpose of the VHT analysis was to evaluate the extent to which vehicle hours traveled through the US 101 corridor decreased as a result the Project, indicating an improvement in traffic congestion. Analysis of VHT provides a comprehensive evaluation of the Project's impact on *traffic volume* as well as its impact on *average speed*. This enables us to use one performance metric to evaluate multiple dimensions of traffic operations. The intent is to create a situation in which vehicles are spending less time on the roadway because of improved performance and minimize environmental impacts, such as GHG.

VHT analysis revealed substantial improvements in corridor efficiency between 2018 and 2024. In the ELs, VHT dropped by 42% northbound and 58% southbound, driven by reduced traffic volumes and increased average speeds. Phase 2 showed greater VHT reductions than Phase 1, reflecting the impact of converting an auxiliary lane to a tolled EL. These changes indicate that vehicles spent about half as much time on the roadway, with average speeds approaching the posted limit of 65 mph during peak periods.

The GP lanes experienced more modest improvements. Northbound GP lanes saw minimal change in VHT, while southbound lanes showed a 9.2% reduction in VHT and a 12.2% increase in average speed, suggesting spillover benefits from the ELs. While a decrease in regional travel played a role, the corridor—including both express and GP lanes—experienced a 16.1% reduction in VHT, a 9.4% drop in traffic volumes, and a 7.4% increase in average speed. These results demonstrate that the project successfully contributed to improved travel efficiency across the corridor, particularly in the southbound direction.

GHG analysis showed that the Project did not increase CO_2 emissions. Between 2018 and 2024, average hourly CO_2 emissions declined by 7.5%, and total emissions dropped by approximately 22% (see Sections 6.1.4 and 6.2.3.5 for more information), largely due to reduced VHT and increased average speeds. While external factors like post-pandemic travel behavior may have influenced these results, the data suggests that the project helped reduce time spent on the roadway and improved vehicle efficiency—supporting both mobility and regional climate goals.

6.2.3.2 EL VHT Analysis

The overall results indicate improved efficiency, allowing drivers to reduce hours spent in the corridor. The analysis of the EL VHT showed a significant drop in both directions, 42% northbound and 58% southbound, after Project implementation. Phase 2 showed greater VHT reduction than Phase 1, which was expected since the lane in Phase 2 went from an unrestricted lane to a more restricted lane type. When looking at both Phase 1 and Phase 2, traffic volumes decreased, 36% northbound and 47% southbound. Last, average speeds for the corridor also increased in both directions. Table 6-7 summarizes the changes in average volume, average speed, and VHT as recorded in the ELs. The table focuses on average hourly conditions observed during peak periods, defined as 6-10 AM and 3-7 PM since these are the times with the highest capacity constraints where vehicles are least likely to be able to travel at free flow speeds.

Table 6-7: Volume, Speed, and VHT Changes in the ELs, 2018 vs. 2024

		Average Volume			Average Speed			Average VHT		
		2018	2024	Δ	2018	2024	Δ	2018	2024	Δ
NB	Phase 1	1,238	1,036	-16.3%	65.5	63.6	-3.0%	136	117	-13.8%
	Phase 2	1,459	823	-43.6%	54.1	63.1	16.8%	389	188	-51.7%
	Corridor (Ph1 + Ph2)	**1,471**	**937**	**-36.3%**	**57.8**	**63.3**	**9.6%**	**524.6**	**305.0**	**-41.9%**
SB	Phase 1	1,185	918	-22.6%	46.0	60.0	30.2%	185.3	110.2	-40.6%
	Phase 2	1,666	708	-57.5%	54.1	65.5	21.1%	443.6	155.7	-64.9%
	Corridor (Ph1 + Ph2)	**1,488**	**782**	**-47.4%**	**51.1**	**63.6**	**24.4%**	**628.9**	**265.9**	**-57.7%**

Overall, the ELs carried less traffic at a faster speed in 2024 compared to the same lane in 2018. The analysis indicates that vehicles using the ELs spent about half as much time traveling through the corridor in 2024 compared to 2018, indicating a major improvement in traffic flow and efficiency.

6.2.3.3 GP Lane VHT

Average volume, average speed, and hourly VHT were recorded and analyzed for GP lanes in 2018 and 2024 during Phase 1 and Phase 2 of the Project.

The impact on GP lanes was marginal compared to ELs but still indicated improved conditions. In the northbound direction, change in VHT, volume, and speed was minimal. While southbound had modest improvements, including a 9.2% reduction in VHT and 12.2% increase in the average speed. The speed improvements in the GP lanes suggest spillover benefits from the ELs. As noted in the previous section, the southbound improvements may be attributed in part due to new ELs opening just south of the Project allowing for free-flowing traffic in both the ELs and GP lanes.

Table 6-8 summarizes the changes in average volume, average speed, and VHT as recorded in the GP lanes. As was the case in the EL analysis, the table focuses on average hourly conditions observed during peak periods (6-10 AM and 3-7 PM).

Table 6-8: Volume, Speed, and VHT Changes in the GP Lanes, 2018 vs. 2024

		Average Volume			Average Speed			Average VHT		
		2018	2024	Δ	2018	2024	Δ	2018	2024	Δ
NB	Phase 1	4,308	4,391	1.9%	61.6	60.1	-2.5%	524.5	548.2	4.5%
	Phase 2	4,435	4,411	-0.5%	53.6	54.7	2.0%	1,083.3	1,056.5	-2.5%
	Corridor (Ph1 + Ph2)	**4,393**	**4,404**	**0.3%**	**56.3**	**56.5**	**0.5%**	**1,607.8**	**1,604.7**	**-0.2%**
SB	Phase 1	4,458	4,494	0.8%	45.3	52.7	16.3%	727.7	630.6	-13.3%
	Phase 2	4,621	4,731	2.4%	50.6	55.7	10.0%	1,295.8	1,206.5	-6.9%
	Corridor (Ph1 + Ph2)	**4,561**	**4,647**	**1.9%**	**48.7**	**54.6**	**12.2%**	**2,023.5**	**1,837.1**	**-9.2%**

Key observations on GP lanes:

- Traffic conditions in the GP lanes in the northbound direction were almost unchanged in 2024 compared to 2018. VHT reductions in the Phase 2 portion of the corridor were largely offset by slight VHT increases in Phase 1.
- The change in the southbound direction was more pronounced. Average speeds in the GP lanes during peak periods increased by an average of about 6 mph. This improvement in speed caused VHT to decline by over 9%. In addition to the new EL service immediately south of the Project at the Santa Clara/San Mateo County line, another factor is the demand pre-project implementation. In 2018, the GP lanes in the southbound direction served **4% more traffic** than the northbound direction (4,561 vs. 4,393 vehicles per hour), and its average speed was **14% lower** than the northbound direction (48.7 vs. 56.3 mph). The combination of these two factors means that, in 2018, the southbound corridor was generating **26% more VHT** than the northbound corridor. Thus, the EL conversion had greater potential to improve southbound conditions compared to northbound, in which direction GP traffic was already moving relatively efficiently.
- Interestingly, the average speeds in each direction increased, even though each direction was carrying a slightly higher volume of traffic in 2024 compared to 2018. (Typically, higher volumes result in lower speeds.) This suggests that the addition of the ELs improved the overall efficiency of the flow of traffic within the Project area.

6.2.3.4 Total Corridor VHT

Total Corridor VHT was calculated by comparing average volume, average speed, and average VHT over the entire corridor factoring in ELs and GP lanes combined.

Results showed improvements following the implementation of the Project along the entire corridor across both express and GP lanes in volume, average speeds, and VHT. Traffic volumes decreased by 9.4%, likely influenced by post-pandemic travel behavior (e.g., remote work). Average speed increased by about 7.4%. Total VHT for the full corridor across all lanes also decreased by 16.1% from 2018 to 2024.

Table 6-9 summarizes the volume, speed, and VHT impacts on the US 101 corridor as a whole, combining both the ELs and the GP lanes.

Table 6-9: Volume, Speed, and VHT Changes – Express and GP Lanes Combined

		Average Volume			Average Speed			Average VHT		
		2018	2024	Δ	2018	2024	Δ	2018	2024	Δ
NB	Phase 1	5,546	5,427	-2.1%	62.5	60.7	-2.8%	660.5	665.5	0.8%
	Phase 2	5,895	5,235	-11.2%	53.7	56.0	4.2%	1,471.9	1,244.3	-15.5%
	Corridor (Ph1 + Ph2)	**5,865**	**5,352**	**-8.7%**	**56.7**	**57.7**	**1.9%**	**2,132.4**	**1,909.7**	**-10.4%**
SB	Phase 1	5,644	5,412	-4.1%	45.5	54.0	18.6%	913.0	740.7	-18.9%
	Phase 2	6,286	5,440	-13.5%	51.5	57.0	10.5%	1,739.4	1,362.3	-21.7%
	Corridor (Ph1 + Ph2)	**6,052**	**5,445**	**-10.0%**	**49.3**	**55.9**	**13.5%**	**2,652.4**	**2,103.0**	**-20.7%**
Total	Phase 1	11,189	10,839	-3.1%	53.9	57.4	6.4%	1,573.5	1,406.2	-10.6%
	Phase 2	12,181	10,674	-12.4%	52.6	56.5	7.4%	3,211.3	2,606.5	-18.8%
	Corridor (Ph1 + Ph2)	**11,916**	**10,797**	**-9.4%**	**52.9**	**56.8**	**7.4%**	**4,784.8**	**4,012.7**	**-16.1%**

Key observations on the corridor (combined express and GP lanes):

- Both the northbound and the southbound direction experienced a similar change in traffic volumes. Traffic was down nearly 9% in the northbound direction and by 10% in the southbound direction.
- It is noteworthy that the US 101 corridor experienced an overall decline in volumes from 2018 to 2024. Even apart from any capacity or operational improvements, one would normally expect traffic volumes to increase over time. However, one of the enduring impacts of the COVID-19 pandemic in northern California has been the percentage of employees who work from home (WFH) on either a full-time or part-time basis. This had a measurable impact on peak-period congestion. The reduction of 9-10% in peak-period traffic on US 101 was consistent with what has been observed elsewhere in the region and around the

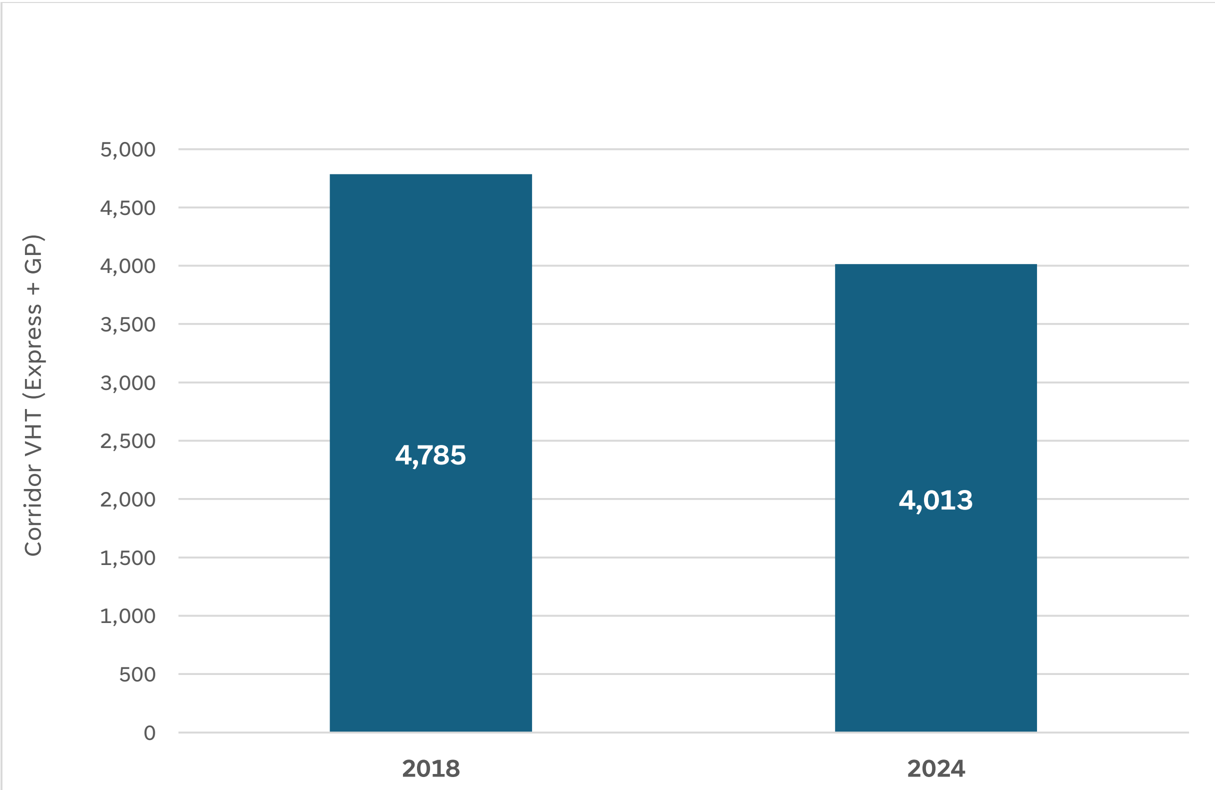
country.[8] However, more recent studies of return to office policies in the San Francisco Bay Area indicate that trends may be shifting in the future with fewer people working from home[9], and analysis in this study shows that pre-pandemic volumes have returned in peak periods specifically.

- Both the northbound and the southbound direction also experienced improvements in average speeds. The improvement in the northbound direction was modest (about 1 mph), but the improvement in the southbound direction was significant (over 6 mph).
- Overall, VHT in the corridor was 16.1% lower in 2024 as compared to 2018. This is a reduction, resulting from the aforementioned combination of lower volumes and higher speeds.
- The VHT impact in Phase 2 (-18.8%) was greater than the VHT impact in Phase 1 (-10.6%). This is likely because Phase 2 provided a true capacity improvement to the corridor, whereas Phase 1 primarily provided an operational improvement (opening the HOV lane to non-HOVs willing to pay a toll). In general, capacity improvements provide greater overall travel benefits, albeit at a higher cost.

Figure 6-1 provides a graphical summary of corridor-wide VHT before the ELs (2018) compared with after the ELs (2024). The figures in the chart represent the average VHT on US 101 during a typical peak hour (weekday between 6-10 AM and 3-7 PM).

[8] See https://www.gallup.com/401384/indicator-hybrid-work.aspx for more details on national trends regarding work from home, accessed on August 29, 2025.
[9] *Return to Office Policies Trend Toward More In-Person Work*, Bay Area Council. March 19, 2025. https://www.bayareacouncil.org/uncategorized/return-to-office-policies-trend-toward-more-in-person-work/#:~:text=The%20Bay%20Area%20Council%2C%20in,a%20workplace%20continues%20to%20evolve.

Figure 6-1: Average Hourly Corridor VHT, Before and After Implementation (2018 vs. 2024)



As Figure 6-1 illustrates, the corridor experienced an average hourly decline of 772 vehicle hours traveled during peak periods. A close look at the data indicates that roughly 75 percent of this decline (583 VHT) was experienced by vehicles traveling in the ELs. However, conditions in the GP lanes also improved following the opening of the ELs. Traffic in the remaining GP lanes experienced a decline of 189 VHT from 2018 to 2024.

The analysis revealed that the addition of the ELs resulted in lower traffic volumes, higher speeds, and a decrease in the total number of VHT. Conditions have improved in both the ELs themselves and in the GP lanes, and they have improved in both directions (with a greater relative benefit to the southbound direction). This indicates that the Project was able to provide these benefits to all users of the corridor.

While overall EL volumes and total vehicle hours traveled decreased relative to baseline conditions, post-implementation monitoring indicates that some HOV-3+ declarations may be misreported, as quarterly operations reports have shown an increase in HOV-3+ users over time. These misdeclarations do not necessarily increase total traffic, but they can distort the reported lane-use patterns used to evaluate EL performance, and they can distort pricing efficiency by allowing some vehicles to travel without paying tolls.

This effect may partially explain why congestion persists in certain areas, even as overall corridor volume has declined. Strengthening occupancy verification and enforcement would help maintain the integrity of the pricing system and ensure benefits are distributed fairly among users.

6.2.3.5 Total Corridor GHG

To determine if potential GHG reduction in the Bay Area was attributable to the implementation of the San Mateo County 101 Express Lanes, a high-level analysis of CO_2 emissions was conducted. The analysis focused on CO_2 emissions since that is the GHG with the most publicly available reporting data. As was the case in the EL analysis, all data uses the average hourly conditions observed during peak periods (6-10 AM and 3-7 PM) Using the average speed data presented in the previous section and Total Corridor VHT, the change in the amount of CO_2 emitted per hour for 2018 and 2024 can be estimated.

The analysis showed a 7.5% reduction in CO_2 emitted per peak hour from 2018 to 2024. And then using the average VHT presented in the previous section, Total Corridor VHT, the change in the total amount of CO_2 emitted from 2018 and 2024 can be estimated. This comes out to about 22,942,198 g/mi which is a 22% decrease in total CO_2 emitted from 2018 to 2024.

GHG emissions were lower because of a combination of fewer vehicles spending less time traveling, and improved emissions standards as compared to pre-Project implementation. Although the decrease cannot solely be attributed to the Project, the results indicate that the Project can yield both mobility and environmental benefits.

6.3 Interpretation

The travel time and reliability results show clear improvements for EL users, particularly in the portions of the corridor that experienced heavy congestion before the Project. In both directions, EL travel times in 2024 are generally lower than in 2018, reflecting smoother and more consistent traffic flow. These changes align with the congestion patterns described under Benefit 1, where many of the worst bottlenecks were shortened or eliminated after the Project opened.

Reliability measures, including the 95th percentile travel time and the Planning Time Index, also improved in most segments. These indicators demonstrate that trips are faster and that “bad traffic days” are less severe than before. Improvements were most notable in Phase 2, where the additional capacity provided by the Project reduced crowding in both the ELs and the GP lanes.

Table 6-10: Summary of Estimated GHG Reduction During the Peak Periods

			2018		2024		Change in estimated CO2 (g) emitted per hour from 2018 to 2024		2018		2024		Change in estimated CO2 (g) emitted per hour from 2018 to 2024	
			Average Speed (mph)	CO2 emitted per hour (g/hour)*	Average Speed (mph)	CO2 emitted per hour (g/hour)**	Δ	%	Average VHT	Total estimated CO2 emitted (g/year)	Average VHT	Total estimated CO2 emitted (g/year)	Δ	%
Total	NB	Phase 1	63	25,250	61	21,124	(4,126)	-16%	661	16,677,625	666	14,057,756	(2,619,869)	-16%
		Phase 2	54	21,695	56	19,488	(2,207)	-10%	1,472	31,932,576	1,244	24,248,918	(7,683,658)	-24%
		Overall	**57**	**22,907**	**58**	**20,080**	**(2,827)**	**-12%**	**2,132**	**48,846,460**	**1,910**	**38,346,012**	**(10,500,448)**	**-21%**
	SB	Phase 1	46	18,382	54	18,792	410	2%	913	16,782,766	741	13,919,234	(2,863,532)	-17%
		Phase 2	52	20,806	57	19,836	(970)	-5%	1,739	36,189,956	1,362	27,022,583	(9,167,374)	-25%
		Overall	**49**	**19,917**	**56**	**19,453**	**(464)**	**-2%**	**2,652**	**52,828,381**	**2,103**	**40,910,080**	**(11,918,302)**	**-23%**
	Total	Phase 1	54	21,776	57	19,975	(1,800)	-8%	1,574	34,263,907	1,406	28,089,126	(6,174,780)	-18%
		Phase 2	53	21,250	57	19,662	(1,588)	-7%	3,211	68,241,410	2,607	51,249,003	(16,992,407)	-25%
		Overall	**53**	**21,372**	**57**	**19,766**	**(1,605)**	**-8%**	**4,785**	**102,258,832**	**4,013**	**79,316,633**	**(22,942,198)**	**-22%**

***Emissions rate per unit distance: 404 g/mi**
****Emissions rate per unit distance: 345 g/mi**

As shown in Table 6-10, estimated CO_2 emissions declined by 22% between 2018 and 2024. The decrease in CO_2 is largely driven by reduced VHT in the corridor and improved vehicle efficiency. As mentioned previously, it is important to acknowledge that external factors such as the COVID-19 pandemic have influenced traffic patterns between the period of 2018 and 2024, meaning not all GHG reduction can be attributed to a decrease in VHT attributed to the San Mateo County 101 Express Lanes.

While it is difficult to determine how much of the CO_2 reduction can be attributed to the San Mateo County 101 Express Lanes, the corridor has experienced an overall reduction in GHG from 2018 to 2024, which aligns with the regional climate goals, such as Plan Bay Area 2050. Additional studies can dive deeper into this analysis by applying more regional trends and data from the Bay Area Air Quality Management District.

7 Benefit 3: Encourage carpooling and transit use

A key goal of the Project is to support higher-occupancy travel by making it easier and more attractive for people to carpool or use transit. Carpools carrying three or more people can use the ELs for free, and buses benefit from the more reliable travel times created by actively managed lanes. SamTrans offers two express routes, the East Palo Alto Express (EPX) and the Foster City Express (FCX) that use the ELs to transport riders from more southern parts of San Mateo County to San Francisco. While at the time of this Study, ridership and travel time data were not complete and available for analysis, these routes benefit from the positive impacts on travel time and reliability described in previous sections. By encouraging more people to share rides or take transit, the Project aims to move more people through the corridor without increasing the number of vehicles on the road, helping reduce congestion and improve overall mobility.

To understand whether the Project is beginning to influence travel behavior, this section examines carpool activity using HOV-3+ declarations recorded through the toll system. While carpool declaration data shows early signs of increased higher-occupancy travel, transit findings are limited due to data availability. Carpool indicators provide an initial picture of how the ELs may be shaping travel choices and where additional data collection will be needed in future evaluations.

7.1 Methodology

SMCEL-JPA publishes reports at the end of its fiscal quarters detailing the percentage of vehicles using the EL by the following trip types:

- Single Occupancy Vehicles (SOV): Vehicles with one driver using a FasTrak® transponder. SOVs pay the full toll.
- High Occupancy Vehicles with 2 Occupants (HOV-2): Vehicles with one driver and a single passenger using a FasTrak® transponder. HOV-2 pays half the toll.
- High Occupancy Vehicles with 3 or more Occupants (HOV-3+): Vehicles with one driver and two or more passengers using a FasTrak® transponder. HOV-3+ does not pay any toll.
- Image-Based Toll (IBT): Vehicles with FasTrak® accounts, but without FasTrak® transponders, whose toll transactions are processed using license plate images. IBT vehicles pay the full toll.
- Clean Air Vehicles (CAV): Low emissions vehicles which qualified for the Clean Air Vehicle decal program for reduced tolls. This program is now expired, but while it was active CAV’s paid half toll.

- Violations: IBT trips with no FasTrak® account at the time of the trip.

All trip types are captured using the FasTrak® transponder on a vehicle's dashboard or IBT. The FasTrak® transponder can be manually set to 1, 2, or 3 corresponding to the number of passengers in each vehicle. This data is processed by the BAIFA Express Lane Network Toll Collection System (described in 3.2.2) which then logs each trip according to its trip type.

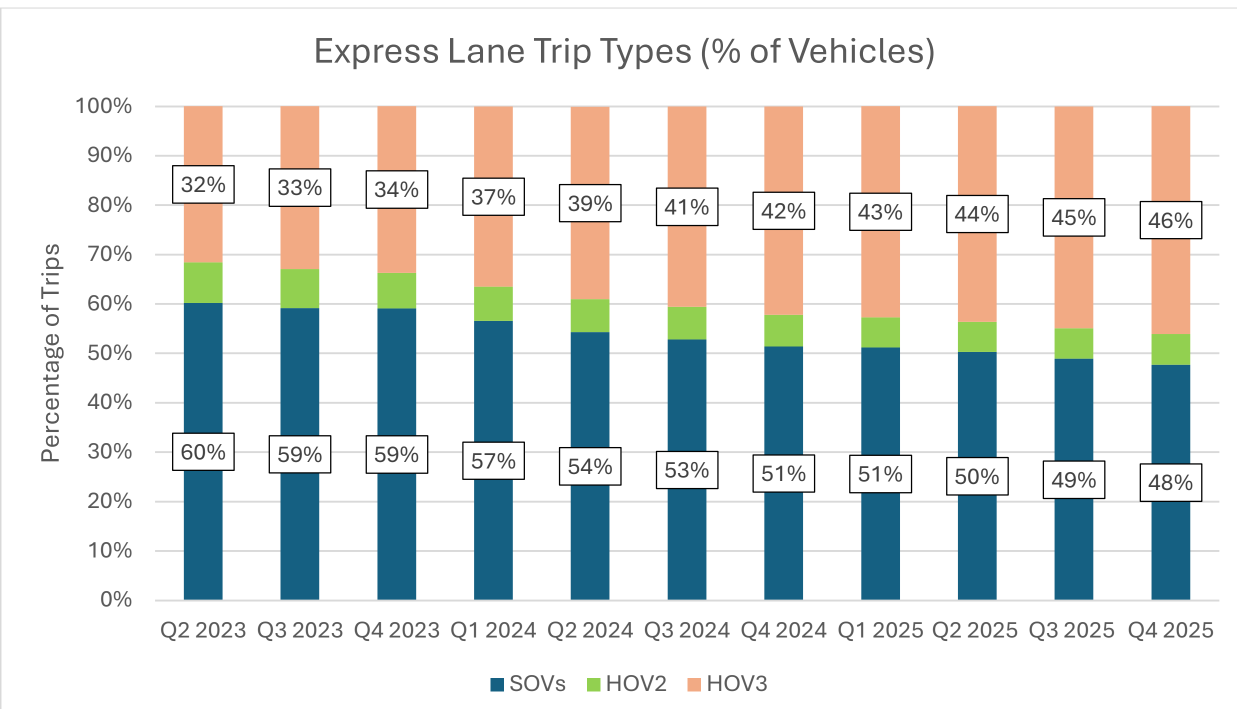
For the purposes of this study, SOVs, IBTs, CAVs, and Violations were combined into SOVs, resulting in all trip types being divided into SOVs, HOV-2s, and HOV-3+s. Any increase in non-SOV rides would amount to an increase in carpooling.

Additionally, to approximate how many individuals are using the corridor by trip type, the Study counted SOV trips as one individual, HOV-2 trips as two individuals, and HOV-3+ trips as three individuals.

7.2 Results

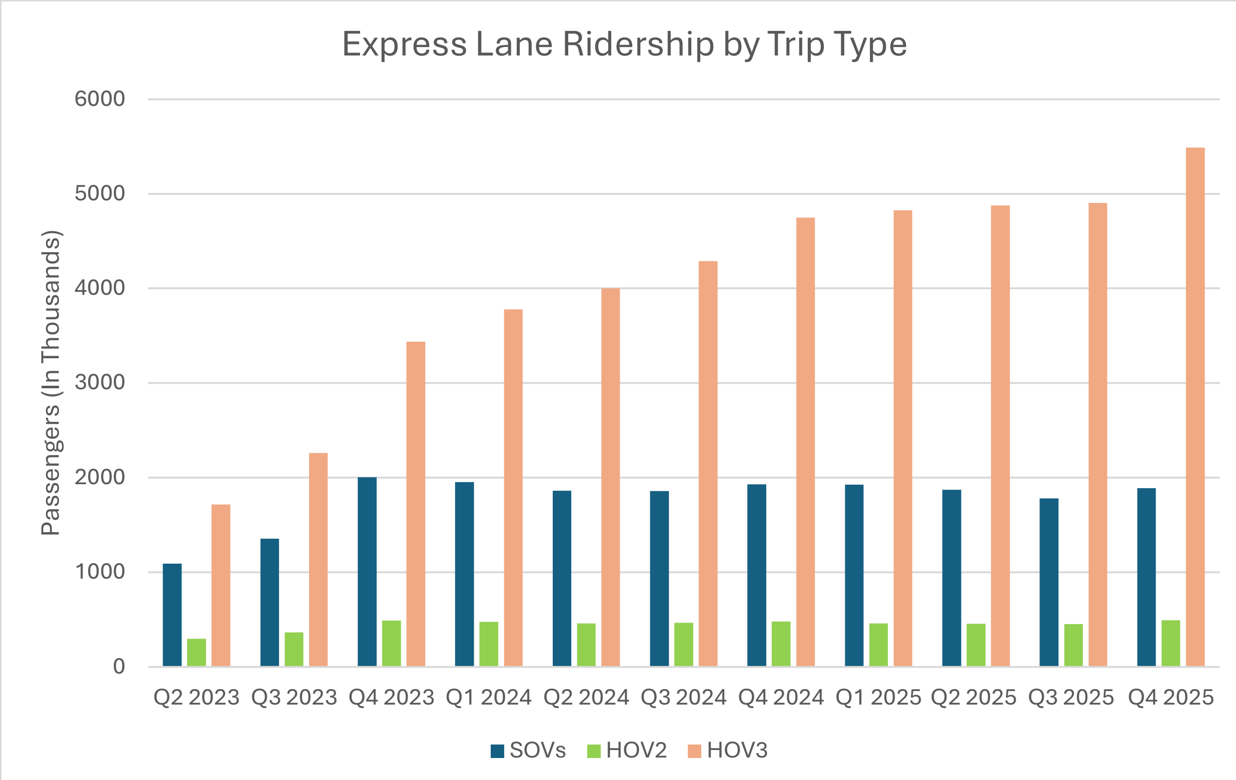
Figure 7-1 below shows that the percentage of non-SOV vehicles has been increasing since the implementation of Phase 2 in March of 2023.

Figure 7-1: EL Trips by Trip Type



Ridership results are recorded in Figure 7-2.

Figure 7-2: EL Ridership by Trip Type



At a county level, carpooling has increased from 9.4% in 2019 to 10.2% in 2023, according to MTC Vital Signs[10]. The figures above show that occupancy shares on the 101 ELs have steadily risen since the EL implementation in 2022, with HOV-3+'s increasing from 32% of vehicle trips in 2023 to 46% in 2025. This has also given HOV-3+'s the lion's share of total passengers moved through the ELs. In Q4 of 2025, 5.5 million passengers were designated as HOV-3+ compared to the 1.9 million in all forms of SOV.

Both in vehicle trip type and in type of passenger being transported, the ELs have increased carpooling along the US 101 corridor.

7.3 Interpretation

More carpooling can correlate to fewer vehicles on the road during peak hours, and therefore less traffic congestion. As more users shift towards carpooling, there will be improvements along the other key project benefits as well, such as decreases in travel time and delay frequency, and increases in speed and person throughput. However, this relies on one important factor: the reliability of carpooling data, as noted in Section 3.4.

[10] https://vitalsigns.mtc.ca.gov/indicators/commute-mode-choice

8 Benefit 4: Increase person throughput (the number of people moved)

Another key objective of the Project is to move more people through the corridor, not just more vehicles. By providing a reliable option for carpools and buses and improving overall traffic flow, the ELs are designed to carry a greater number of travelers in the same amount of roadway space. Measuring person throughput, the total number of people moving through the ELs helps show whether the Project is increasing the transportation system's overall efficiency.

This section evaluates person throughput based on passenger estimates derived from toll system data and occupancy declarations. Although person-throughput data is available only for the period after toll operations began, the results provide a clear indication of how the ELs have been used since opening. The findings show strong and sustained growth in the number of people traveling in the ELs over time. This reflects both rising demand and the benefits of new managed-lane capacity.

8.1 Methodology

Person throughput is the number of people who pass a specific point within a defined timeframe. It is distinct from other types of volume data gathered from highways, which typically focus on the number of vehicles. More people can be moved per vehicle by promoting the use of carpools and transit over single occupancy vehicles.

The study tracked this metric through the 101 Express Lanes from Quarter 2 of Fiscal Year 2023 (October 2022-December 2022) to Quarter 4 of Fiscal Year 2025 (April 2025-June 2025).

Person throughput is measured with the following formulas:

$$Person\ Throughput = \frac{Traffic\ Volume\ x\ Vehicle\ Occupancy\ Rate}{Number\ of\ Lanes}$$

Post-Phase 2 Traffic Volume was provided by the SMCEL-JPA Quarterly Reports. Pre-Phase 2 Traffic Volume was provided by the SMCEL-JPA Board of Directors Meeting Agendas in the form of Average Daily Volumes (ADVs). The ADV for each month in each direction of travel was multiplied by the number of tolling days to create a monthly northbound average and a monthly southbound average. These were added to give a monthly EL average. The monthly EL averages for each quarter were added together to calculate an estimate for Quarterly Traffic Volume.

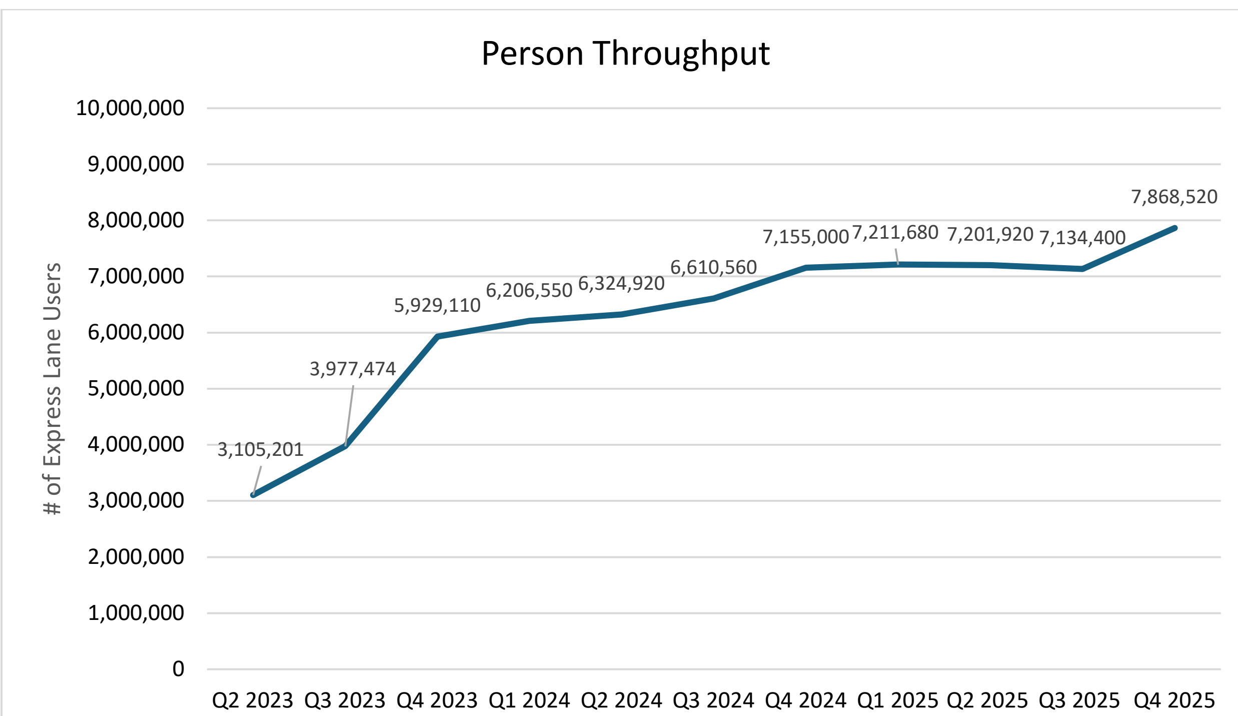
To determine the Person Throughput, the Quarterly Traffic Volume was divided into vehicle trip type according to the quarterly percentage splits described in Section 7.2: SOV, HOV-2, and HOV-3+. With the Quarterly Traffic Volume split into these three categories, an estimation of EL users could be found by multiplying HOV-2 Traffic Volume by 2 and HOV-3+ Traffic Volume by 3. There is only one EL, so the above formula simplifies itself to:

$$\begin{aligned} Person\,Throughput \\ &= Traffic\,Volume_{SOV}\ x\,Vehicle\ Occupancy\ Rate_{SOV}\ x\ 1 \\ &+ Traffic\,Volume_{HOV2}\ x\,Vehicle\ Occupancy\ Rate_{HOV2}\ x\ 2 \\ &+ Traffic\,Volume_{HOV3+}\ x\,Vehicle\ Occupancy\ Rate_{HOV3+}\ x\ 3 \end{aligned}$$

8.2 Results

Figure 8-1 below shows how the implementation of the EL has increased Person Throughput over time. Since no occupancy data is collected from the GP lanes, person throughput cannot be calculated for them. From construction to current date, the Person Throughput on the ELs has more than doubled. The most significant increases were right after Phase 2 of the ELs were completed and throughput jumped by nearly 2 million users/lane.

Figure 8-1: EL Person Throughput Over Time



8.3 Interpretation

The person-throughput results show how the ELs have performed since tolling operations began. Because vehicle occupancy reporting is only available from the toll system, this benefit focuses on how many people the ELs have been able to move over time since they opened.

The data indicates that person throughput has steadily increased from Q2 2023 through Q4 2025, more than doubling in the first year of Phase 2 operations. This growth reflects several factors: higher volumes using the ELs and a rising share of vehicles declaring HOV-3+ status. Together, these factors show that the ELs are carrying more people per lane over time.

This trend also aligns with improvements described under Benefits 1 and 2. As congestion decreased and travel times became more reliable, particularly after Phase 2 opened, the ELs became a more attractive option for both toll-paying users and carpools. Post-implementation monitoring indicates that some HOV-3+ declarations may be misreported, as quarterly operations reports have shown an increase in HOV-3+ users over time. This overrepresentation of HOV-3+ could skew data and give the illusion of a much higher person throughput than in actuality. Strengthening occupancy verification and enforcement would help maintain the integrity of the pricing system and ensure benefits are distributed fairly among users

9 Benefit 5: Use modern technology to manage traffic

The ELs rely on a system of technologies that allows the corridor to be actively managed in real time. This system includes sensors, toll readers, communications equipment, and an automated dynamic pricing algorithm that work together to monitor traffic conditions and keep the ELs flowing smoothly.

Dynamic pricing is a key part of this system. As traffic increases, toll rates adjust to maintain reliable speeds in the ELs. This helps prevent overcrowding and ensures that the ELs provide a dependable travel option even during the busiest times of day. The ability to adjust prices in real time is one of the main reasons the ELs can maintain higher speeds and more consistent travel times, as shown in the results for Benefits 1 and 2.

The toll system also supports improved person throughput. Automated tolling and occupancy declarations allow carpools and other eligible users to travel at reduced or no cost, encouraging higher-occupancy travel. This supports the increases observed under Benefits 3 and 4, where more carpools and more total people are moving through the corridor.

The speed, travel times, vehicle counts, and occupancy data generated by the system enables continuous monitoring of how the lanes are performing. This information allows SMCEL-JPA to quickly identify emerging issues, adjust pricing, and coordinate with partner agencies. The improved operational awareness contributes to the reliability and efficiency benefits documented throughout the study.

While integrating technology with highway infrastructure requires some baseline expenditure to install sensors and variable messaging signs, the Project has already established those along US 101. This Project makes it easier to integrate other technologies on US 101 in the future.

Overall, the EL technology provides the tools needed to manage traffic proactively rather than reactively. The positive results observed in congestion relief, travel time improvements, higher person throughput, and increased carpooling are made possible in large part because of the ability to use advanced technology to manage traffic.

10 Safety

As described in Section 3.4, at the time of this Study, available safety data is very limited. Only nine months (March – December 2023) are available for analysis. Incident patterns identified during this period are likely to represent a temporary trend resulting from changes in highway striping and operational rules and are unlikely to be statistically representative of the long-term effects of the ELs. Additionally, safety trends can be influenced by many factors outside the ELs themselves, including regional driving patterns, enforcement levels, weather, and broader post-pandemic travel behavior.

With this in mind, the Study does investigate the short term impacts the Project has had on incidents to highlight any significant shifts in highway safety, identify targeted opportunities for potential engineering strategies, and promote transparency with the public. The intention of this section is to describe preliminary safety trends with the intention to update with more statistically significant findings once additional years of data become available.

This section reviews collision rates, collision types, and the locations where collisions tend to occur, using data from the Statewide Integrated Traffic Records System (SWITRS). Comprehensive safety evaluations require multi-year post-implementation data; first-year results cannot establish trends and the findings should be considered preliminary. Rather than drawing conclusions about long-term safety impacts, the purpose of this section is to document initial observations and identify areas for continued monitoring as more data becomes available in future years.

10.1 Methodology

10.1.1 Performance Measures

- Safety
  - Highway safety is often measured with Collision Rates per Million Vehicle Miles Traveled (MVMT). This can be found by using the formula below:

$$Collision\ Rate\ (per\ MVMT) = \frac{Number\ of\ Collisions\ \times 1{,}000{,}000}{AADT \times 365 \times Year(s) \times Segment\ Length\ (miles)}$$

Where AADT is Average Annual Daily Traffic

- The statewide average for freeways is 0.82 incidents per MVMT[11]

[11] 2023 Crash Data on California State Highways (road miles, travel, crashes, crash rates) (Caltrans, 2025)

- Low collision rates are preferred because they indicate a safe corridor.
- Types of collisions, as defined by SWITRS:
    - Hit-Object: Vehicle collides with a stationary object
    - Overturned: Vehicle rolls over onto its roof or side
    - Broadside: One vehicle collides with the side of another
    - Rear-End: One vehicle collides with the rear of another vehicle
    - Head-On: Two vehicles traveling in opposite directions collide front-end to front-end.
    - Sideswipe: Two vehicles make contact along their sides
    - Vehicle-Pedestrian: Vehicle collides with a pedestrian or cyclist
    - Other/Unknown

10.1.2 Analysis

To assess the impact the Project had on safety within the corridor, the study evaluated collision reports before and after its implementation. Reports for State Highway Total Incidents in San Mateo County for the years of 2016, 2017, 2018, and 2023 were obtained using the SWITRS. 2024 data was not available at the time of the study and is necessary to capture long-term impacts of the Project.[12] Collision records with incorrect location coordinates or missing relevant data were excluded to ensure accuracy.

The SWITRS reports encompass traffic incidents that have occurred along US 101, also known as the Bayshore Freeway, within the boundaries of San Mateo County. Data was collected within the Project area and a Control Corridor with no EL. The Control Corridor extended 3.5 miles north of the Project, potentially capturing the same set of drivers. The following Study Corridor boundaries were used to filter the data reports:

- Location: San Mateo County/Santa Clara County line to I-380 Interchange (22 miles)
- Primary Road: US 101 northbound and US 101 southbound
- Days: Monday-Friday
- Time (hours of EL operations): 5 AM-8 PM

[12] SWITRS data for 2024 will not be finalized until mid-2026.

For the purposes of this analysis, a 3.5-mile segment north of I-380, extending to Brisbane Lagoon Fisherman's Park, has been included as a Control Corridor for comparison. This area was selected because it spans the 3.5 miles immediately following the US 101 Express Lanes and shares similar geometric characteristics with the rest of US 101 within San Mateo County, making it a potentially suitable comparison, though much shorter in length. The following boundaries were used to filter the data reports:

- Location: I-380 Interchange in San Mateo County to Brisbane Lagoon Fisherman's Park (3.5 miles)
- Primary Road: US 101 northbound and US 101 southbound
- Days: Monday-Friday
- Time: 5 AM-8 PM

Including this segment provides an opportunity to compare its incident patterns with those observed along the 22-mile EL corridor, potentially identifying whether the ELs or other factors, such as driver behavior and/or travel patterns, play a role in incident trends.

The northern segment of the EL was completed and officially opened for tolling on March 3, 2023. Consequently, data from January and February of that year reflects a period prior to the start of tolling operations. These two months were still included in the 2023 dataset, as the brief non-tolling period was considered to have minimal impact on the overall analysis – particularly because the collision counts during those months in 2023 were low, consistent with the same trend observed in 2016 through 2018. This approach ensures a more complete and timelier dataset while acknowledging the limitations in data availability.

For this analysis, corridor volume was taken into consideration and used Caltrans Annual Average Daily Traffic (AADT). The traffic count is from October 1 through September 30. Although the analysis year for this study spans from January to December, Caltrans AADT was used because it provides a reliable and standardized measure of average daily traffic over a full year. The slight offset in reporting periods is not expected to significantly affect our results, as AADT is specifically designed to smooth out short-term variations and reflect typical traffic conditions.

In addition, to control for differences in traffic volumes before and after Project opening, a collision rate was calculated. An average of the three-year period (2016-2018) prior to the implementation of the Project was used for the pre-project period and 2023 was used for the post-project results. The collision rate was calculated using the following formula from the Federal Highway Administration:[13]

$$Roadway\ Collision\ Rate = \frac{Total\ Number\ of\ Crashes\ x\ 1{,}000{,}000}{AADT\ x\ 365\ x\ Number\ of\ Years\ x\ Segment\ Length}$$

Collision data can vary from year to year due to a range of factors, including changes in traffic patterns, weather conditions, and driver behavior. While the first year of post-project data offers an early look at potential impacts, it represents a limited sample size. Nine months is not enough to draw firm conclusions about long-term trends. For a clearer understanding of how the project may be influencing collision rates, it will be important to continue monitoring and reevaluating the data over the next several years.

The study also reviewed the details of collisions to understand the trends in collisions and their severity. Rear-end and sideswipe collisions are of particular interest in this analysis due to the design and operation of the ELs. These types of collisions are often associated with lane changes, which are expected to be more frequent in areas where drivers enter or exit the ELs. Monitoring these collision types helps assess how the ELs may be influencing driver behavior and roadway safety.

10.2 Results

This preliminary analysis is based on reported collisions and calculated collision rates, which measure the number of collisions per million vehicle miles traveled (MVMT) for both the Project corridor (San Mateo County US 101 Express Lanes) and control corridor (3.5-mile segment on US 101 north of the ELs). Collision rates are calculated using the formula in the previous section, which considers the total collisions, number of years of the data, average annual daily traffic (AADT), and length of the roadway segment in miles.

10.2.1 Summary

The collision rate on the corridor increased from 0.40 to 0.57 incidents per MVMT in the nine months following opening, likely resulting from drivers adjusting to highway restriping and changes in operational rules. The collision rate on the control corridor increased from 0.32 to 0.34 incidents per MVMT. Both the Project corridor and the control corridor are below the statewide average of 0.82 incidents per MVMT. Since the data collection period was short for post-project implementation, these rates will be monitored, and this analysis will be updated as more data becomes available.

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[13] Crash Rate Calculation source: https://highways.dot.gov/safety/local-rural/roadway-departure-safety-manual-local-rural-road-owners/appendix-c-crash-rate.

10.2.2 Collision Rates Comparison

The collision rates for the Project, control corridors, and statewide averages were compared for pre-project and post-project conditions (Table 10-1). As described in the Methodology section above, collision data from 2023 is the only data available to represent the post-project conditions, so **these results represent a summary of preliminary analysis and should not be considered representative of long-term impacts of the project**. The pre-project data includes all three years (2016-2018), as the formula used for the collision rates takes into consideration the number of years of the data. Detailed data for pre-project and post-project is available in Appendix B: Collision Detail.

Table 10-1: Number of Collisions and Rates

Project Corridor Annual Collisions				
Time Period	Road Miles	Average Annual Daily Traffic (AADT)	Collisions/Year	Collision Rate (per MVMT)
2016-2018	22	242,437	786	0.40
2023	22	205,059	936	0.57
Control Corridor Annual Collisions				
Time Period	Road Miles	Average Annual Daily Traffic (AADT)	Collisions/Year	Collision Rate (per MVMT)
2016-2018	3.5	237,025	98	0.32
2023	3.5	205,250	90	0.34
California Statewide Annual Collisions				
Time Period	Road Miles	Travel (MVMT)	Collisions/Year	Collision Rate (per MVMT)
2016-2018	4,406.8	157,817	151,504	0.96
2023	4,376.2	151,874	124,537	0.82

Source: Analysis of CHP SWITRS data and Caltrans traffic volumes, Caltrans Crash Data on California State Highways Report (2016, 2017, 2018, 2023).

As shown, the collision rate in the Project corridor increased from 0.40 to 0.57 collisions per MVMT. The control corridor also experienced an increase, rising from 0.32 to 0.34 collisions per MVMT. Both collision rates are lower than the statewide average of 0.82 incidents per MVMT.

Since the control corridor also experienced an increase in collision rate, it cannot be inferred that the increase in collision rate on the Project corridor can be directly attributed to the ELs. The increase in collision rate may reflect issues such as driver adaptation, lane weaving, or speed differences between ELs and GP lanes. It could also indicate an initial adjustment period as drivers adapt to the new configuration and traffic patterns shift following the Project's implementation. However, because the post-implementation analysis for the Project corridor is based on nine months of data, the reliability of this finding is limited. Continued monitoring is recommended to better understand the long-term safety impacts of the ELs.

Appendix B: Collision Detail also describes more detailed analysis of the available collision data. Table 10-2 and Table 10-3 summarize highlights from this Appendix, highlighting incident trends around injury type and incident characteristics.

Table 10-2: Injury Type Matrix Comparing Pre- and Post-Project, Study Corridor to Control Corridor

Metric	Change in % of Incidents from Pre- to Post-Project		Interpretation
	Study Corridor	Control Corridor	
Property damage only	0.9%	-6.4%	Increase on Study Corridor, decline on Control Corridor.
Minor / visible injury	2.1%	1.8%	Minor injuries make up the same proportion of incidents on both corridors.
Serious / severe injury	0.1%	0.3%	Low absolute counts; no meaningful change in severity on either corridor.
Fatal injury	0.0%	2.2%	Fatal crashes remain rare and stable on both corridors.
Dominant collision type ranking	Rear-end → Sideswipe	Rear-end → Sideswipe	The top 2 collision types remain rear end and sideswipe in both corridors.

Table 10-3: Incident Type/Characteristics Matrix Comparing Pre- and Post-Project, Study Corridor to Control Corridor

Metric	Change in # of Incidents from Pre- to Post-Project		Interpretation
	Study Corridor	Control Corridor	
Rear-end collisions	14%	−23%	Rear-end collisions rose on Study Corridor but fell on Control Corridor.
Sideswipe collisions	29%	−4%	Strongest divergence; increase unique to Study Corridor.
Stopped movement	682%	−18%	Sharp increase only on Study Corridor.
Slowing / stopping movement	446%	0	Study-specific operational change not observed on Control Corridor.

These tables show that when comparing Pre- and Post-Project data, the main divergence between the Control and Study corridors is that proportion of incidents which cause property damage only has increased on 101. The 101 corridor is also showing an increase in rear-end and sideswipe collisions compared to the Control, and a large increase in the reason for these collisions being stopped or slowing movement. These types of collisions are representative of driver behaviors adjusting to new lane configurations and operational rules.

These findings support the need for ongoing evaluation, targeted enforcement, and public education to ensure that operational benefits are balanced with corridor safety.

11 Conclusions

11.1 Summary of Findings

The study found clear operational improvements across most performance indicators following the implementation of the Project, particularly in congestion reduction, travel time reliability, and person throughput. While some indicators, such as safety and transit use, require more data to reach definitive conclusions, the available findings show strong evidence that the Project is meeting its core objectives. Key results are summarized below by benefit, along with corridor safety trends.

Benefit 1: Reduce traffic congestion and delays

Performance Indicators: Speed, Recurring Bottlenecks

Speed Improvements

- EL speeds increased substantially across the corridor, with average gains of 7-13 mph during peak periods.
- Improved speeds were also observed in GP lanes, particularly in the southbound direction, reflecting spillover benefits. Average gains were 1-7 mph during peak periods.

Recurring Bottlenecks

- Historically severe bottlenecks near I-380, Millbrae Avenue, and Ralston Avenue shortened in both duration and severity following the Project's opening.
- Bottlenecks that remain, such as those around SR-92 and SFO, are consistent with long-standing geometric characteristics rather than EL operations.
- Ongoing corridor enhancement projects—including the 101/92 Interchange Short-Term Area Improvements Project, 101/SR 92 Interchange Direct Connector Project, and 101 Managed Lanes North of I-380 Project—may address the persistent, demand-related congestion.

Overall

Taken together, speed and bottleneck analyses show a clear reduction in recurring congestion, with the greatest improvements occurring following Phase 2, where the Project added a new continuous, managed lane.

Assessment: Benefit Met

Benefit 2: Improve travel time and reliability

Performance Indicators: Travel Time, 95th Percentile Travel Time, Planning Time Index (PTI), Vehicle Hours Traveled (VHT)

Travel Time Improvements

- In the southbound direction, EL users saved an average of 5 minutes, and a maximum of 10 minutes (depending on the hour) in 2024, compared to 2018. GP lane users saved an average of 2-4 minutes, with a maximum savings of 10 minutes.
- In the northbound direction, EL users saved an average of 2-3 minutes, and a maximum of 6 minutes (depending on the hour) in 2024, compared to 2018. GP lane users saved an average of 0-2.5 minutes, with a maximum savings of 3 minutes.

95th Percentile Travel Time (Reliability)

- 95th percentile travel time, which describes the time needed to travel the corridor on bad traffic days, was reduced by 28-44% for ELs and 3-14% for GP lanes. This reduction was particularly significant on the southbound EL, changing from 45.4 min to 25.5 min between 2018 and 2024.
- These reductions show that the worst delay days are substantially less severe post-Project.

Planning Time Index (PTI)

- Before the Project, travelers needed to budget up to 2.3 times the free-flow travel time (PTI ≈ 2.3) to be sure to arrive at their destination on time. After implementation, EL users only need to plan 30% extra time (PTI ≈ 1.3) to achieve the same reliability. GP lane users have similar reliability, but have more improvement in the northbound direction, only needing to plan 60% (PTI ≈ 1.6) extra time compared to the historical 90% extra (PTI ≈ 1.9).

Vehicle-Hours Traveled (VHT)

- Corridor-wide hourly VHT declined by 772 hours during peak periods from 2018 to 2024. ELs accounted for 583 fewer hours of delay, while GP lanes reduced by 189 hours.
- EL VHT dropped by 42% in the northbound direction and by 58% southbound.
- Corridor-wide, VHT was reduced by 16.1% and average speed increased by 7.4%.

- Phase 2 produced more significant results (-18.8% VHT) than Phase 1 (-10.6% VHT)

Overall

Across all indicators, including travel time, high-delay days, planning margin, and total hours on the roadway, the ELs contributed to large improvements, particularly in Phase 2.

Assessment: Benefit Met

Benefit 3: Encouraging carpool and transit use

Performance Indicators: HOV-3+ Usage, Transit (Data-limited)

HOV-3+ Usage

- HOV-3+ declarations increased following the opening of the ELs, increasing from 32% of vehicle trips in 2023 to 46% in 2025. This suggests that the toll exemption for 3+ carpools is encouraging a shift toward higher-occupancy trips.
- Since HOV status is self-reported, some degree of misreporting is likely, but the overall trend is upward.

Transit Use

- Transit performance could not be evaluated quantitatively due to lack of availability of complete, corridor-specific data.
- Qualitatively, vanpools, shuttles, and buses benefit from improved speeds, reduced congestion, and increased reliability in both EL and GP lanes.

Overall

Early indicators suggest increased carpooling, though more direct observation for occupancy data is needed. Transit outcomes also require additional data to confirm.

Assessment: Benefit Partially Met – Transit performance could not be quantitatively evaluated, and some uncertainty around changes in HOV-3+ use remains due to potential misdeclarations.

Benefit 4: Increase person throughput

Performance Indicator: Person Throughput

Person Throughput

- Person throughput increased from 3.1 million users per lane (Q2 2023) to 7.9 million (Q4 2025), more than doubling during the observed period.
- Following the opening of Phase 2, throughput increased by nearly 2 million users per lane, reflecting the combined effect of new capacity, improved speeds, and increased HOV usage.

Overall

ELs are moving substantially more people, supporting the Project's goal of improving person throughput. However, more direct observation is needed to confirm the accuracy of occupancy data.

Assessment: Benefit Met

Benefit 5: Use modern technology to manage traffic

- **Dynamic pricing** allows for real-time toll adjustments to maintain reliable EL speeds and prevent lane oversaturation.
- **The toll system** provides continuous speed, volume, occupancy, travel time, and transaction data. This enables SMCEL-JPA to identify hot spots, adjust pricing, and maintain consistent travel conditions.
- **Technology's role** in improving congestion reduction, reliability, and person throughput documented above depends directly on the Project's ability to actively manage the lane. This is made possible by modern electronic toll collection technology, algorithms, and real-time telemetry.

Assessment: Benefit Met

Safety

Performance Indicators: Collision Rates, Collision Types, Severity, Hotspots

Collision Rates

- Due to safety data only being available for March-December 2023, data analysis is preliminary and likely does not represent long-term impacts of the Project.
- Project corridor collision rates increased from 0.40 to 0.57 collisions per MVMT from the 2016-2018 period to 2023.

- The control corridor also increased from 0.32 to 0.34 collisions per MVMT. This indicates a regional upward trend in collision rates.

Collisions

- Fatal and severe-injury collisions remain rare within the Project limits, despite slight increases in the control corridor.

Collision Hotspots

- Persistent collision concentrations occur in areas with known geometric constraints and heavy merging, including:
  - Woodside Road
  - SR-92 Interchange
  - SFO/San Bruno merge area
  - Peninsula Avenue curve

Overall

Because only nine months of post-project SWITRS collision data is available and there is an upward regional trend in collision rates, no causal findings can be made at this time.

Assessment: Data Insufficient – With only nine months of post-project SWITRS data, more information is needed to assess the Project's impact on safety.

11.2 Overall Assessment

Across the five key benefits, the Project demonstrates significant improvements in corridor efficiency, including major reductions in delay (VHT), better travel times and reliability, increased carpool participation, and increased person throughput. Remaining challenges, including limited collision data, transit data gaps, the need for observed occupancy data, and certain persistent bottlenecks, will require continued monitoring as additional years of data become available.

While this study's results demonstrate operational and environmental improvements, the analysis is based on a limited, post-implementation dataset. Only one full year of ELs operational data was available for the study (2024), and traffic conditions continued to stabilize following pandemic-related fluctuations in regional travel behavior. As a result, some performance indicators—particularly those related to demand elasticity and long-term safety trends—reflect early operational patterns rather than steady-state conditions.

These data constraints do not diminish the validity of the improvements observed but highlight the importance of continued performance tracking. Ongoing data collection will allow SMCEL-JPA to differentiate between initial adjustment effects and long-term behavioral trends, refine dynamic pricing algorithms, and more accurately quantify benefits as traffic volumes normalize.

SMCEL-JPA's role is to strengthen operational monitoring, refine dynamic pricing, and coordinate enforcement to maintain performance gains. These actions form the foundation of the recommendations outlined in Section 11.3.

11.3 Recommendations

To sustain and enhance corridor performance, the following strategies are recommended:

1) Operational Enhancements

The San Mateo 101 Express Lanes operate under dynamic pricing supported by continuous monitoring. Between 2018 and 2024, vehicle hours traveled in the ELs declined by more than 40 percent, confirming strong corridor performance. However, limited enforcement of HOV-3+ declarations allow non-eligible vehicles to use the EL without paying tolls, increasing demand to use the EL and contributing to residual congestion near SR-92 and Millbrae Avenue.

Recommend SMCEL-JPA continue to refine operations by:

- Refining dynamic-pricing parameters using segment-level data to address demand surges; and
- Evaluating advanced occupancy-verification technology to protect fairness and preserve reliability.

These recommendations will support continued improvements for all five of the EL's core benefits by maintaining free-flow speeds and reliability on the ELs and GP lanes.

2) Safety and Enforcement

In coordination with Caltrans and CHP, SMCEL-JPA will focus enforcement on HOV compliance and safe merging behavior to reduce unauthorized express-lane use, improve traffic stability, and reduce the influence of EL cheaters on higher EL congestion and higher toll rates.

Recommended actions include:

- Deploy targeted CHP enforcement in high-weaving areas;

- Research options for using occupancy-verification technologies to enhance enforcement;
- Seek other ways to promote carpooling in the US 101 corridor, such as through partnerships and programs; and
- Coordinate data-sharing with Caltrans for corridor-wide safety evaluation and update this Study's safety analysis when more data becomes available.

These recommendations will support continued improvements for Safety performance indicators as well as for Benefits 1 and 2 by reducing potential causes of congestion and increasing reliability.

3) Transit Data Collection and Analysis

To support the ongoing goal of encouraging transit use in the 101 Express Lanes, the Study recommends expanding collaboration with local transit agencies to share and jointly analyze transit performance data. Coordinated analysis of ridership trends, travel times, reliability, on-time performance, and person-throughput, integrated with EL operating conditions, would provide a clearer, corridor-wide understanding of how transit benefits from the managed lanes and where additional opportunities exist. Working directly with transit partners can also help further elucidate data gaps, align performance metrics, and support more consistent, evidence-based messaging to the public. Over time, this approach can inform operational adjustments, transit investments, and outreach strategies that reinforce the EL's role in supporting high-occupancy and transit travel.

This recommendation supports Benefit 3 by providing data to analyze the impact of the ELs on transit use.

4) Public Education

User behavior assessments indicate that the "express" label may suggest that drivers feel entitled to faster travel and a limited understanding of HOV eligibility may contribute to misdeclaration. Recommend that SMCEL-JPA expand public outreach to clarify lane-use rules, pricing principles, and occupancy requirements.

Focus areas:

- Targeted driver education on HOV-3+ rules and proper declaration;
- Public campaigns emphasizing fair toll use and safe merge practices; and
- Clear corridor messaging conducted in coordination with regional tolling partners.

These recommendations will support the ongoing evaluation of performance indicators related to Benefits 3 and 4 by ensuring that SMCEL-JPA's understanding of impacts on carpooling behavior and increasing person throughput are accurate.

5) Monitoring and Data Strategy

Continuous evaluation remains essential to validate long-term effectiveness and manage integration with upcoming projects in the corridor that may impact EL performance. Recommend SMCEL-JPA expand its data framework to include behavioral metrics (occupancy compliance and access-point volumes) alongside VHT and travel-time monitoring.

In addition, SMCEL-JPA will continue to share data across partner agencies to support consistent corridor management and evidence-based adjustments.

These recommendations will support all key project benefits, but particularly Benefit 5, by integrating new data sources and analysis methods into ongoing monitoring processes.

In summary, while the San Mateo 101 Express Lanes have improved corridor efficiency and reduced environmental impacts, the evolving nature of EL use and post-pandemic travel behavior present new challenges. A balanced approach—combining technology, enforcement, and education—will be essential to ensuring that operational gains are matched by long-term safety and sustainability.

12 Appendix A: Traffic Flow Analysis Data Collection and Evaluation Methodology

Traffic flow performance measures were evaluated using traffic data provided by Caltrans through the Caltrans Performance Measurement System (PeMS). The data comes from detectors located along the San Mateo County Express Lane corridors. For this study, traffic data was collected using the following parameters:

- Years: 2018 and 2024
- Months: April to September
- Time Aggregation: Hourly
- Time Period:
    - AM Peak (6-10 AM)
    - PM Peak (3-7 PM)

EL data were derived from the traffic data collected from lane #1, which are the lanes next to the median. GP lanes data were aggregated across multiple lanes from lane #2 and beyond. Caltrans pre-processed the data to exclude data from unreliable detectors, ensuring a baseline level of data integrity.

Additionally, traffic data from the San Mateo Express Lane Toll System were utilized for 2024 to support validation efforts. Since the ELs were implemented in 2022, toll system data was not available to help validate data for 2018.

To ensure a valid comparison between 2018 and 2024, a multi-step filtering and validation process was applied:

- **Detector Consistency Filter**: Data from detectors that did not exist in both 2018 and 2024 were excluded. This ensured that comparisons were made using data from the same or closely located detectors across both years.
- **Minimum Data Availability Filter**: Detectors with less than two months of traffic data were excluded to maintain consistency and reliability.
- **Cross-System Validation**: 2024 PeMS traffic data was compared against the traffic data collected from the toll system. Data from detectors from each system in close proximity were compared to confirm consistency in traffic speed and volumes. This validation helped identify PeMS detectors producing reliable data in 2024. Since the toll system was implemented in 2022, 2018 traffic data was not validated from the toll system. Given that only 2024 toll data could be validated, it was assumed that data from detectors validated in 2024 would also

be reliable in 2018. This assumption was necessary to maintain consistency across 2018 and 2024.

- **Temporal Data Matching Filter**: To ensure an analogous comparison, only data points that existed for the same week, weekday, and hour in both 2018 and 2024 were used. For example, if data for Detector A was missing for Monday of Week 30 at 7 AM in 2018 but available in 2024, the traffic data from Detector A for that period was excluded from both years.

Following the filtering and validation process, distinct sets of detectors were selected based on lane type (HOV/EL vs. GP Lane) and travel direction (southbound vs. northbound). It is important to note that the final sets of detectors vary by lane type and direction due to the filtering criteria applied. As a result, the specific detectors, their locations, and coverage of the corridors may differ across these categories.

Through this process, the following outlines the number of detectors in each set of detectors were chosen by lane type and by direction:

Lane Type	Direction	Number of Detectors	Corridor Coverage
HOV/Express Lane	Southbound	17	University Avenue to I-380
GP Lane/Express Lane	Northbound	13	University Avenue to I-380
General Purpose Lane	Southbound	13	University Avenue to Millbrae Avenue
	Northbound	12	Willow Road to I-380

13 Appendix B: Collision Detail

Incident data was organized by injury severity (**Table 13-1** and **Table 13-2**), collision type (**Table 13-3** and **Table 13-4**), primary collision factor (**Table 13-5** and **Table 13-6**), and movement preceding collision (**Table 13-7** and **Table 13-8**). Compared to the Control Corridor, post-project data shows that the 101 Corridor is showing an increase in the proportion of incidents which cause property damage only. The 101 corridor is also showing an increase in rear-end and sideswipe collisions compared to the Control, due to a large increase in stopped or slowing vehicle movement. While these trends offer insight into corridor conditions, the current dataset is limited and cannot confirm a direct impact from the ELs; further evaluation over time is needed.

Table 13-1: Annual Severity of Sustained Injuries on US 101 Study Corridor

Severity	Pre-Project				Post-Project	Percentages	
	2016	2017	2018	Average	2023	2016-2018 Average	2023
No Injury, Property Damage Only	429	550	687	555	663	70.7%	70.8%
Possible Injury or Complaint of Injury	138	171	207	172	175	21.9%	18.7%
Suspected Minor or Visible Injury	24	56	69	50	86	6.3%	9.2%
Suspected Serious or Severe Injury	4	9	10	8	11	1.0%	1.2%
Fatal Injury	2	1		1.5	1	0.2%	0.1%
Grand Total	597	787	973	786	936	100%	100%

Table 13-2: Annual Severity of Sustained Injuries on US 101 Control Corridor

Severity	Pre-Project				Post-Project	Percentages	
	2016	2017	2018	Average	2023	2016-2018 Average	2023
No Injury, Property Damage Only	46	71	78	65	54	66.1%	60.0%
Possible Injury or Complaint of Injury	22	24	25	24	22	24.1%	24.4%
Suspected Minor or Visible Injury	6	10	7	8	10	7.8%	11.1%
Suspected Serious or Severe Injury	3	2	1	2	2	2.0%	2.2%
Fatal Injury					2	0.0%	2.2%
Grand Total	77	107	111	98	90	100.0%	100%

Table 13-3: Annual Collisions by Type on US 101 Study Corridor

Collsion Type	Pre-Project				Post-Project	Percentages	
	2016	2017	2018	Average	2023	2016-2018 Average	2023
Rear End	399	509	638	515	582	65.6%	62.2%
Sideswipe	120	192	227	180	248	22.9%	26.5%
Hit Object	45	60	73	59	71	7.6%	7.6%
Broadside	13	9	12	11	16	1.4%	1.7%
Overturned	7	8	9	8	11	1.0%	1.2%
Head-On	4	4	3	4	1	0.5%	0.1%
Vehicle/Pedestrian	0	2	0	1	1	0.1%	0.1%
Other	9	3	11	8	6	1.0%	0.6%
Total	597	787	973	786	936	100.0%	100.0%

Table 13-4: Annual Collisions by Type on US 101 Control Corridor

Collision Type	Pre-Project				Post-Project	Percentages	
	2016	2017	2018	Average	2023	2016-2018 Average	2023
Rear End	38	65	65	56	50	56.9%	55.6%
Sideswipe	25	25	34	28	24	28.5%	26.7%
Hit Object	12	12	7	10	9	10.5%	10.0%
Broadside	0	2	1	1	2	1.0%	2.2%
Overturned	2	0	4	2	3	2.0%	3.3%
Head-On	0	0	0	0	0	0.0%	0.0%
Vehicle/Pedestrian	0	0	0	0	2	0.0%	2.2%
Other	0	3	0	1	0	1.0%	0.0%
Total	77	107	111	98	90	100.0%	100.0%

Table 13-5: Annual Primary Collision Factors on US 101 Study Corridor

Primary Collision Factor	Pre-Project				Post-Project	Percentages	
	2016	2017	2018	Average	2023	2016-2018 Average	2023
Unsafe Speed	573	605	638	605	534	62.9%	57.1%
Unsafe Lane Change	154	161	173	163	181	16.9%	19.3%
Improper Turning	101	104	106	104	132	10.8%	14.1%
Driving Or Bicycling Under Influence Of Alcohol Or	12	16	12	13	19	1.4%	2.0%
Following Too Closely	16	3	3	7	2	0.8%	0.2%
Hazardous Parking	0	0	1	0	0	0.0%	0.0%
Impeding Traffic	0	1	0	0	1	0.0%	0.1%
Improper Passing	4	5	9	6	3	0.6%	0.3%
Other Equipment	1	0	1	1	2	0.1%	0.2%
Other Hazardous Violation	5	15	7	9	8	0.9%	0.9%
Other Improper Driving	5	4	6	5	0	0.5%	0.0%
Other Than Driver	19	17	19	18	18	1.9%	1.9%
Pedestrian Violation	0	2	0	1	1	0.1%	0.1%
Traffic Signals And Signs	0	0	1	0	0	0.0%	0.0%
Automobile Right-Of-Way	0	1	1	1		0.1%	0.0%
Unsafe Starting Or Backing	7	6	11	8	9	0.8%	1.0%
Wrong Side Of Road	1	0	0	0	0	0.0%	0.0%
Unknown	18	24	20	21	26	2.1%	2.8%
Total	916	964	1008	963	936	100.0%	100.0%

Table 13-6: Annual Primary Collision Factors on US 101 Control Corridor

Primary Collision Factor	Pre-Project				Post-Project	Percentages	
	2016	2017	2018	Average	2023	2016-2018	2023
Unsafe Speed	39	60	63	54	43	55.5%	47.8%
Unsafe Lane Change	20	21	22	21	24	21.6%	26.7%
Improper Turning	10	8	11	10	12	9.9%	13.3%
Driving Or Bicycling Under Influence Of Alcohol Or	0	3	3	2	1	2.1%	1.1%
Following Too Closely	2	1	1	1	1	1.4%	1.1%
Hazardous Parking	0	0	0	0	0	0.0%	0.0%
Impeding Traffic	0	0	0	0	0	0.0%	0.0%
Improper Passing	0	1	0	0	1	0.3%	1.1%
Other Equipment	0	0	1	0	0	0.3%	0.0%
Other Hazardous Violation	1	3	0	1	1	1.4%	1.1%
Other Improper Driving	1	0	3	1	1	1.4%	1.1%
Other Than Driver	3	5	3	4	3	3.8%	3.3%
Pedestrian Violation	0	0	0	0	2	0.0%	2.2%
Traffic Signals And Signs	0	0	0	0	0	0.0%	0.0%
Automobile Right-Of-Way	0	0	1	0	0	0.3%	0.0%
Unsafe Starting Or Backing	0	2	0	1	1	0.7%	1.1%
Wrong Side Of Road	0	1	0	0	0	0.3%	0.0%
Unknown	1	2	0	1	0	1.0%	0.0%
Total	77	107	108	97	90	100.0%	100.0%

Table 13-7: Annual Movement Preceding Collisions on US 101 Study Corridor

Movement Preceding Collision	Pre-Project				Post-Project	Percentages	
	2016	2017	2018	Average	2023	2016-2018	2023
Proceeding Straight	370	514	603	496	476	63.1%	50.9%
Slowing/Stopping	46	26	50	41	142	5.2%	15.2%
Stopped	18	17	29	21	133	2.7%	14.2%
Changing Lanes	99	120	167	129	96	16.4%	10.3%
Other Unsafe Turning	24	31	35	30	4	3.8%	0.4%
Merging	5	10	15	10	2	1.3%	0.2%
Entering Traffic	0	2	5	2	1	0.3%	0.1%
Lane Splitting	0	0	0	0	2	0.0%	0.2%
Making Left Turn	0	2	3	2	0	0.2%	0.0%
Making Right Turn	2	3	3	3	2	0.3%	0.2%
Parked	0	2	0	1	2	0.1%	0.2%
Passing Other Vehicle	3	5	9	6	2	0.7%	0.2%
Ran Off Road	5	6	12	8	2	1.0%	0.2%
Backing	2	1	3	2	0	0.3%	0.0%
Other	23	46	39	36	71	4.6%	7.6%
Not Stated	0	2	0	1	1	0.1%	0.1%
Total	597	787	973	786	936	100.0%	100.0%

Table 13-8: Annual Movement Preceding Collisions on US 101 Control Corridor

Movement Preceding Collision	Pre-Project				Post-Project	Percentages	
	2016	2017	2018	Average	2023	2016-2018	2023
Proceeding Straight	32	59	70	54	48	54.6%	53.3%
Slowing/Stopping	8	11	9	9	11	9.5%	12.2%
Stopped	11	11	4	9	9	8.8%	10.0%
Changing Lanes	17	14	16	16	14	15.9%	15.6%
Other Unsafe Turning	0	0	2	1	0	0.7%	0.0%
Merging	0	0	2	1	1	0.7%	1.1%
Entering Traffic	0	0	0	0	1	0.0%	1.1%
Lane Splitting	0	0	0	0	0	0.0%	0.0%
Making Left Turn	0	0	0	0	0	0.0%	0.0%
Making Right Turn	0	2	1	1	0	1.0%	0.0%
Parked	0	0	0	0	0	0.0%	0.0%
Passing Other Vehicle	0	1	0	0	0	0.3%	0.0%
Ran Off Road	1	1	0	1	0	0.7%	0.0%
Backing	0	2	0	1	0	0.7%	0.0%
Other	8	6	7	7	6	7.1%	6.7%
Not Stated	0	0	0	0	0	0.0%	0.0%
Total	77	107	111	98	90	100.0%	100.0%