City of Lafayette

Lafayette Downtown Congestion Study

Background Conditions Report

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1 Introduction

The City of Lafayette is conducting a Downtown Congestion Study. This study, funded by the Contra Costa Transportation Authority (CCTA), is taking a comprehensive look at how to deliver solutions that solve Lafayette's numerous transportation challenges, mainly in the downtown core. Transportation issues in Downtown Lafayette are complex with no "quick-fix" solutions. This report builds on previous studies and recommendations, and goes a step further to recommend a wide range of solutions, from additional incremental improvements to potential "moonshots" or "game changers". As the consultants on this study, Arup has worked closely with a Steering Committee of elected officials, interested parties, residents, and City staff to outline the study's objectives and approach.

This Background Conditions report summarizes the underlying root causes of existing congestion in Downtown and presents a forecast of future conditions. The forecast represents a "future baseline" scenario that indicates the expected level of congestion if there were no increases to the capacity of the transportation system or no strategies to reduce traffic demand. The Background Conditions report lays the groundwork for the remainder of the study, which will evaluate various transportation strategies and identify the most effective solutions. The evaluation of transportation strategies occurs in the next phase of the study and is not included in this report.

1.1 Downtown Congestion Study Objectives

This is a study about downtown congestion. Therefore, the analysis focuses on how the street network performs and the various causes behind what generates auto trip making and traffic to, from, and through the Downtown. But ultimately, alleviating congestion is about enhancing the quality of life. Congestion is a facet of modern life that almost everyone dislikes as it takes longer to travel places, which keeps us away from home, work, and the enjoyable things in life. It is a significant problem that has come with growth and development in Lafayette, the larger Lamorinda area, and the Bay Area overall.

Traffic congestion is a multifaceted problem with many causes and many potential solutions. Therefore, it is a challenge to capture a single guiding principle or objective for the study. The Steering Committee developed the following statement of purpose for the study:

> *"Address critical transportation concerns that affect the quality of life in the community."*

Expanding on this statement, the Steering Committee expressed several guiding principles organized around three key themes:

1. Enhance the quality of life
2. Improve existing deficiencies
3. Guide future changes

Figure 1 presents the three themes and the guiding principles that the Downtown Congestion Study is trying to balance.

Figure 1: Guiding Principles

To help identify and evaluate potential strategies, the study has also developed goals for four main focus areas that affect circulation in Downtown:

- **Downtown**: primarily commercial areas along Mount Diablo Boulevard
- **BART:** Downtown Lafayette station
- **State Route 24 (SR 24)**: the freeway segment in Lafayette and the interchanges serving Downtown, Acalanes Road, and Pleasant Hill Road
- **Schools**: the downtown school sites at Lafayette Elementary and Stanley Middle Schools

Figure 2 provides a summary of the objectives for each of the four focus areas.

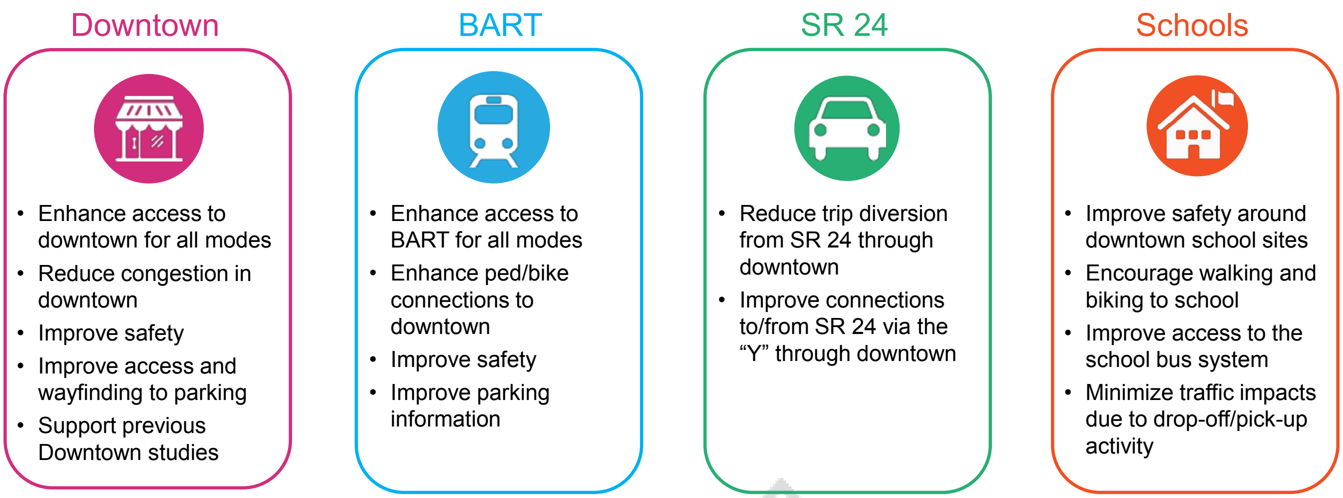

Figure 2: Project Goals

These goals highlight the range of issues that the study needs to consider.

1.2 Study Overview

The Steering Committee, City Staff and Consultant team recognize that a great deal of work has been done over the years to address congestion in Downtown. These studies have considered ways to alleviate traffic congestion and parking issues, provide better transit service, improve the pedestrian and bicycle network, and enhance safety. Figure 3 presents a timeline and lists some of the key studies. Most of these studies have focused on specific modes, "hot spots", or design recommendations.

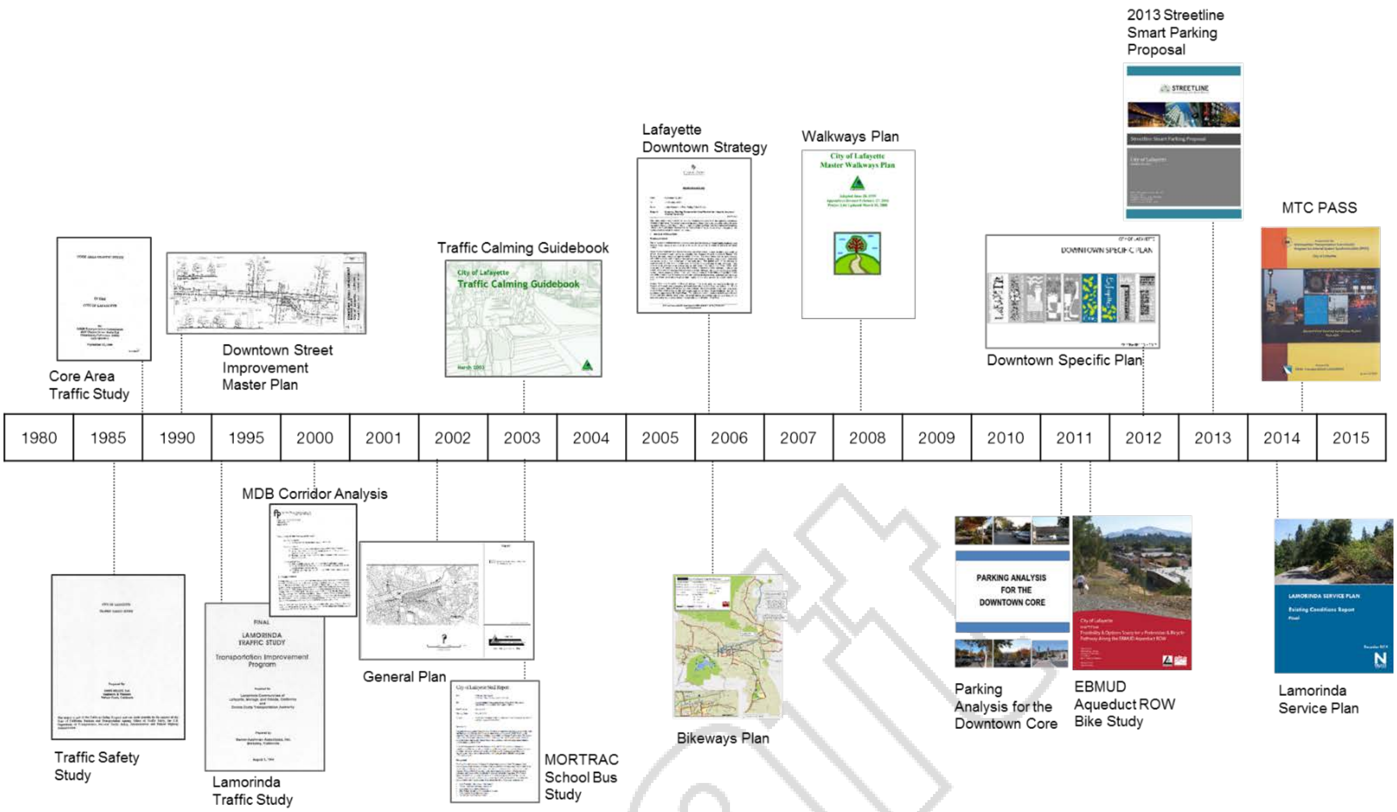

Figure 3: Previous Studies

The *Downtown Specific Plan* (2012) and the corresponding *Environmental Impact Report* (EIR) (2012) provided the most comprehensive guidance for growth and development in the Downtown. The plan identified four downtown districts and defined their unique characteristics. For each district, the plan developed policies on land use, building density and height, parking, the pedestrian experience, and other important elements.

In addition to district-specific policies, the *Downtown Specific Plan* developed a range of policies to apply to Downtown as a whole. The circulation policies were organized under these six priorities:

- Circulation: Balance downtown vehicular circulation with providing a bicycle and pedestrian system;
- Pedestrians: Ensure a continuous and accessible pedestrian network with appropriate pedestrian infrastructure;
- Bicycles: Develop a bicycle network and associated facilities to serve the Downtown;
- Transit: Support a transit network to serve the Downtown;
- Transportation Demand Management (TDM): Improve downtown circulation through TDM strategies;
- Parking: Support adequate parking in the Downtown.

Some projects have been successfully implemented, which have increased capacity and made bicycling and walking more attractive. The following lists some recently completed transportation projects:

- Downtown signal timing optimization
- New third eastbound lane on Mount Diablo Boulevard (Moraga Road to 1st Street)
- Reconfigured plaza (Moraga Road to 1st Street south of Mount Diablo Boulevard)
- Improved eastbound SR 24 on-ramp at 1st Street
- Improved bike and pedestrian facilities in Downtown
- Wider sidewalks on Mount Diablo Boulevard
- Multi-use path on Moraga Road (connecting schools)
- Crossing enhancements
- Bike sharrows
- Downtown bike bypass and route signage

However, many previously studied projects have not been implemented because of high costs, unattractive trade-offs, and/or a lack of community consensus.

This study will utilize new “Big Data” sources from GPS navigation devices and cell phones that are providing insight into travel patterns and the performance of the street network. The study will evaluate the strategies and projects holistically and use a range of performance metrics to better understand the combined costs, benefits, and trade-offs. The performance metrics will consider how well the strategies reduce congestion, improve travel times and delay, reduce auto trips, increase active modes of travel such as walking or biking, and improve safety. This comprehensive analysis will help the City to build consensus around a set of feasible strategies and projects most preferred by the community. The City of Lafayette will then find ways to fund and implement these measures.

The overall study approach has five main steps, separated into two phases. The first phase consists of understanding the problem and generating ideas. The objective of Phase 1 is to develop a “long list” of strategies and projects and to screen this down to a “short list” for more detailed analysis in Phase 2. To effectively achieve this, Phase 1 will identify and present the intricate set of interrelated transportation issues and their root causes and have the Lafayette Community (utilizing the study’s Steering Committee as a proxy) to agree to a specific set of issues that need to be solved in order to fulfill the study’s statement of purpose.

This Background Conditions Report provides the information necessary in Phase 1 to achieve these objectives and to generate the appropriate transportation strategies.

2

2.1 Project Study Area

The project study area focuses primarily on the part of the City included in the *Downtown Specific Plan* (2012). Lafayette's downtown has a wide range of land uses including residential, office, shopping, entertainment, recreation, education, and civic buildings such as the Lafayette Library and Learning Centre. The study does consider regional transportation facilities beyond the boundaries, shown in Figure 4 below, as some of the strategies could include regional initiatives or programs outside of the City.

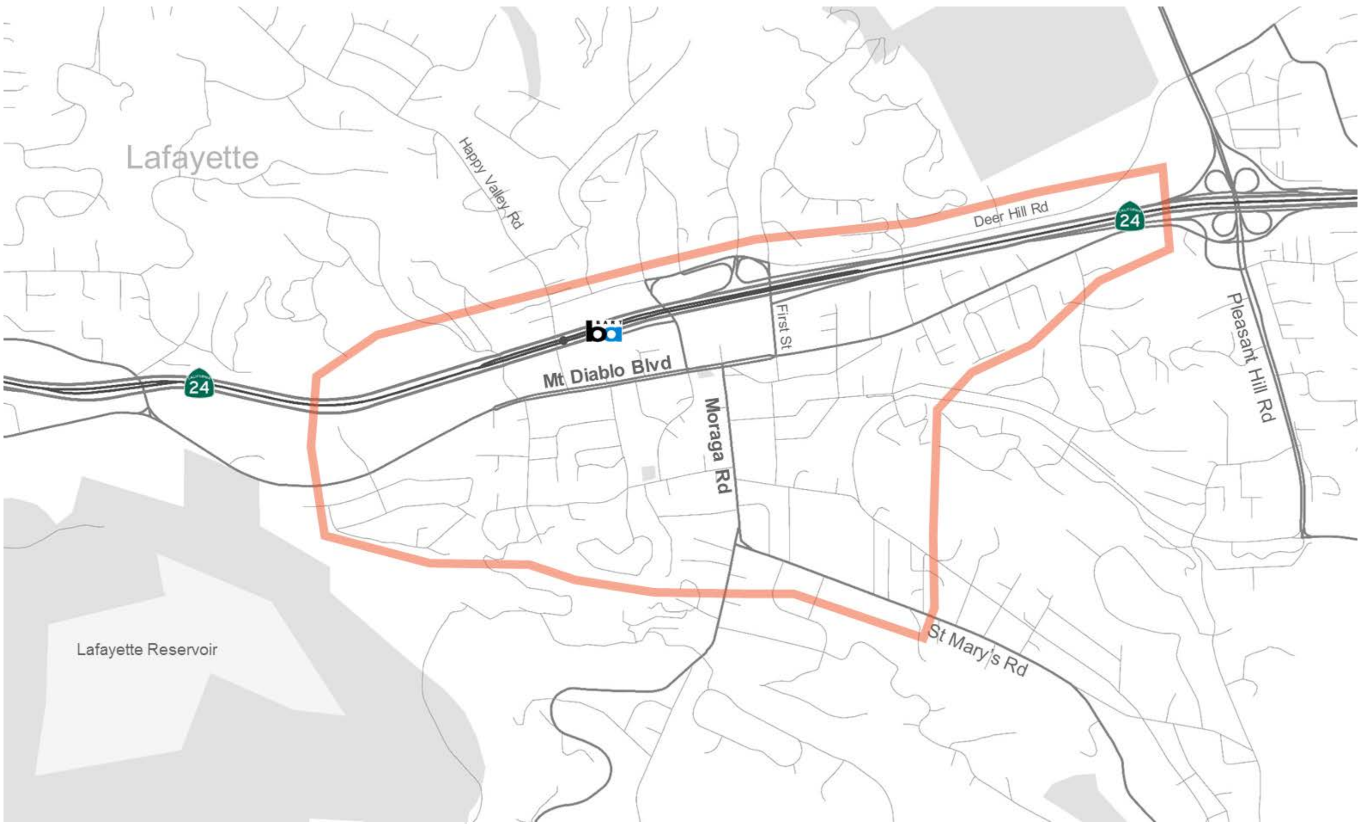

Figure 4: Project Study Area

2.2 Lafayette in the Region

2.2.1 Geography

As depicted in Figure 5, Lafayette is part of the Lamorinda sub-region, comprised of the three municipalities of Lafayette, Moraga, and Orinda. Providing a unique mix of both rural and urban characteristics, Lamorinda is situated near major urban areas yet is immediately surrounded by miles of open space. San Francisco and Oakland to the west and the I-680 corridor to the east provide jobs, housing, shopping, and other destinations to people who live and work in

Lamorinda. North and south of the sub-region, regional parks and wilderness areas free of development give the area a semi-rural environment, despite its proximity to urban areas.

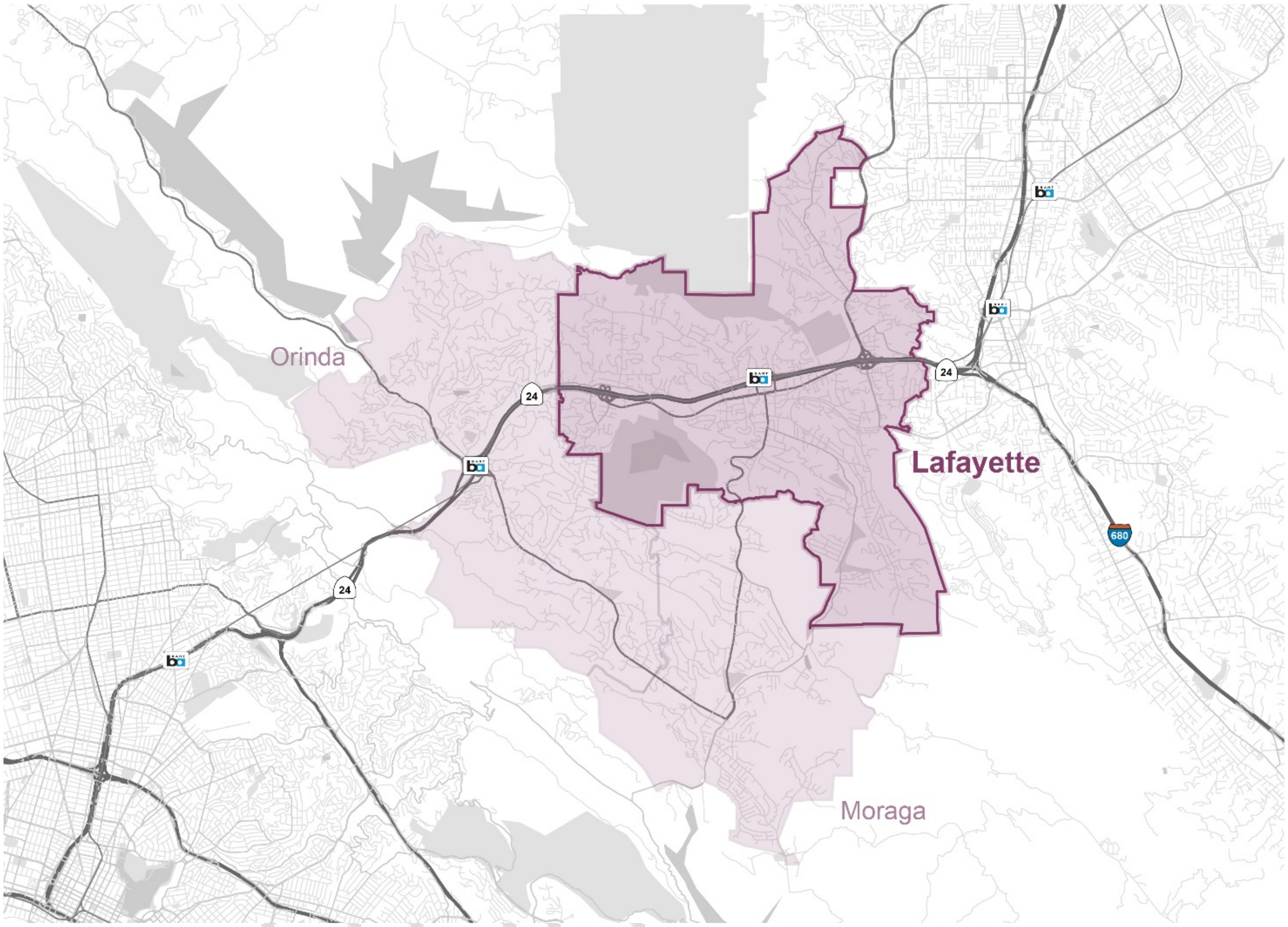

Figure 5: Lamorinda

2.2.2 Transportation

As identified in the *Lamorinda Action Plan* (2014), several Routes of Regional Significance and Interjurisdictional Routes define transportation in Lamorinda. Especially important to Downtown Lafayette, State Route 24 (SR 24) and a Bay Area Rapid Transit (BART) line together form the only prominent regional connection within Lamorinda to the wider Bay Area. SR 24, which runs through the heart of Lafayette and Orinda, connects to I-680, I-580, and I-880, all three major north-south interstates. SR 24 serves Downtown Lafayette through interchanges at Pleasant Hill Road and Acalanes Road.

BART is the primary regional transit operator in the East Bay with a network of stations throughout the Bay Area. Lamorinda has BART stations in Lafayette and Orinda. The Lafayette station (Figure 14) has served Lamorinda since 1973:

- Average daily exits in 2015: 3,900
- Parking spaces: 1,526

- County Connection bus lines servicing station: 6, 25, 250 (late evening service during the school year)

A limited number of roads access the SR 24/BART corridor through Lamorinda. Moraga Road and Moraga Way are the primary arterials serving the majority of the traffic traveling through Lafayette and Orinda respectively, to reach SR 24 and BART. Most local streets funnel traffic to these limited number of north-south roads, which is one of the root causes of congestion in Downtown Lafayette.

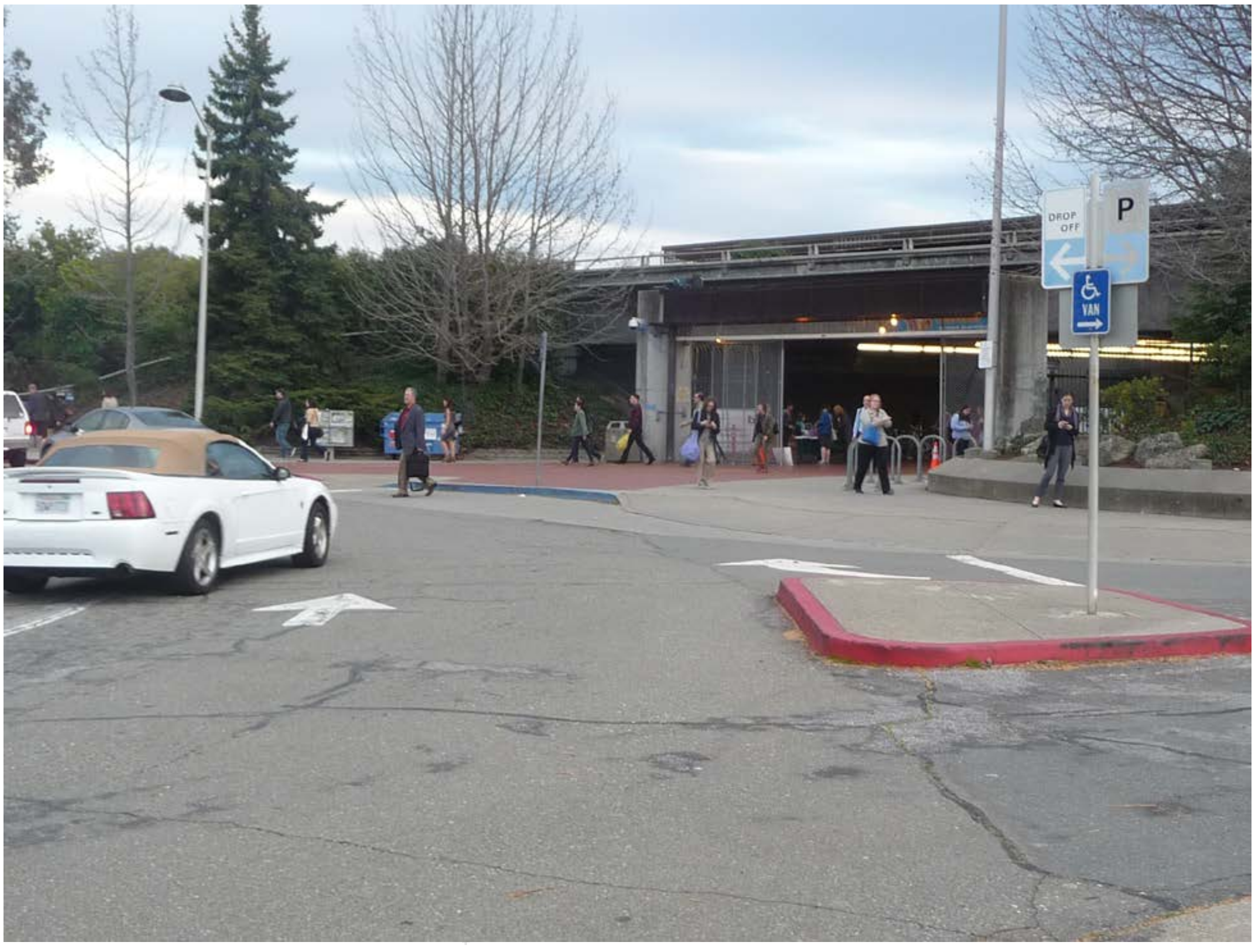

Figure 6: Lafayette BART Station, December 2015

2.3 Socioeconomics

Demographics and social indicators are critical to understanding travel behavior, vehicle trip generation, and traffic trends. The population of Lafayette has remained steady over the years with a small increase since 2000. Figure 7 shows the Census population trends from 2000 through 2015. The average growth rate over these 15 years is approximately 0.4 percent per year.

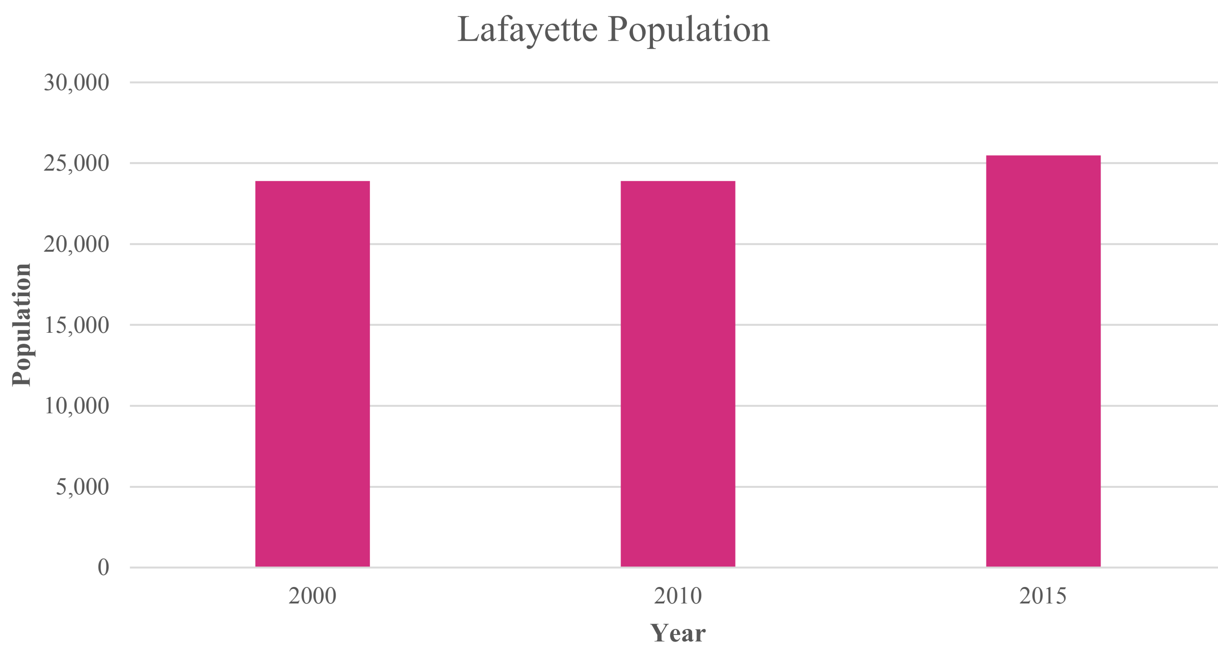

Figure 7: Lafayette Population Trends, US Census Bureau

The population over 65 years of age has grown 32 percent since 2000, while the population under 18 has declined 5 percent. Enrollment in the Lafayette School District, which includes four elementary schools and one middle school, has remained relatively steady over the decade. Overall, the median age has risen slightly from 42 in 2000 to 45 in 2013.

Although Lafayette has a high median income, the socioeconomic details of the community are complex. Lafayette's median household income has risen 9 percent since 2009, reaching $136,000 in 2013. Already a highly educated population, the percentage of residents with a Bachelor's degree increased to 75 percent of the population, an 8 percent increase from 2007 to 2013.

The number of jobs in Lafayette has recovered sine the latest recession of 2008-2011 and has slightly surpassed ten-year totals. Overall, jobs have increased 4% from 9,419 in 2002 to 9,813 in 2013. The local labor force has declined 22% from 10,234 in 2002 to 7,941 in 2013. Figure 8 shows these trends.

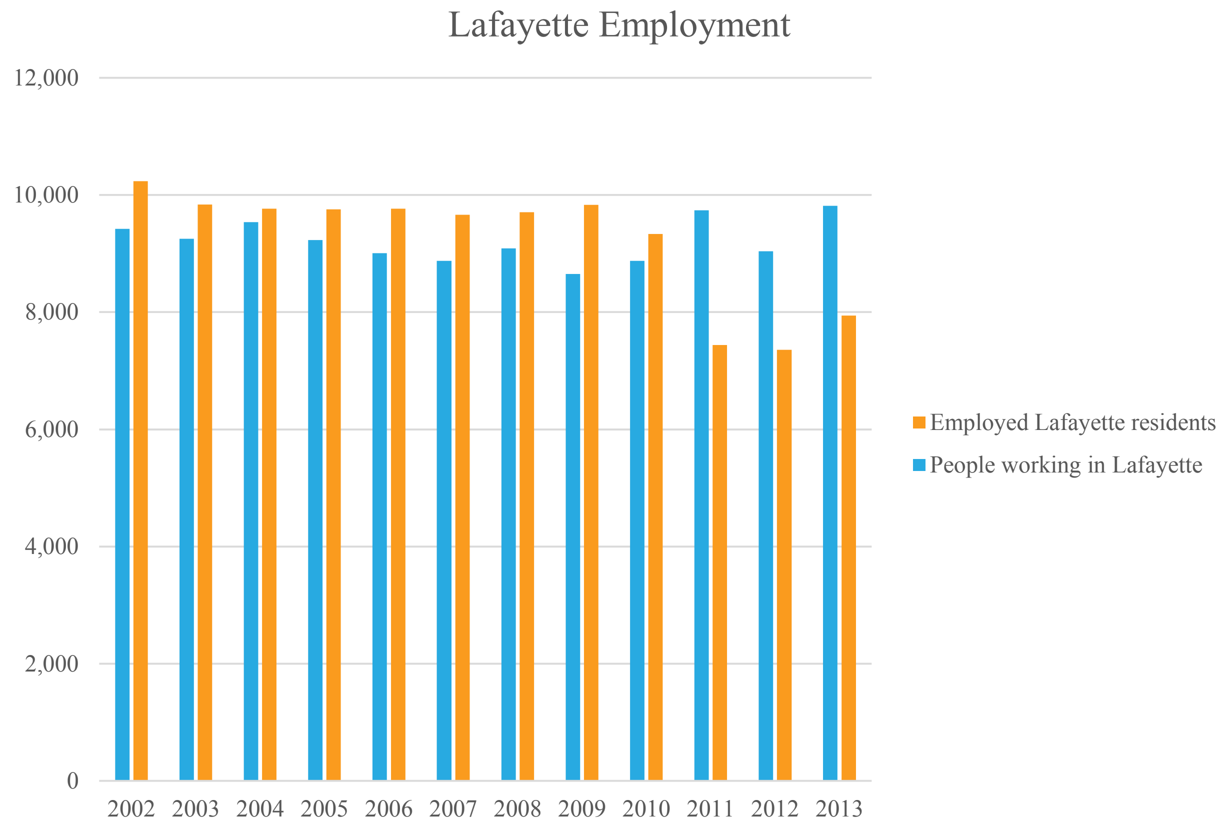

Figure 8: Data from the Longitudinal Employer-Household Survey, US Census Bureau

Lafayette residents in the workforce are employed all over the Bay Area, as shown in Figure 9. The most common cities for Lafayette residents to be employed include Oakland, Walnut Creek, San Francisco, Lafayette, Berkeley, and Concord, in that order. Approximately 50 percent of Lafayette residents travel west of Lamorinda for work (e.g., San Francisco and Oakland), 35 percent travel east of Lamorinda (e.g. Walnut Creek and Concord), and 15 percent stay within the Lamorinda area.

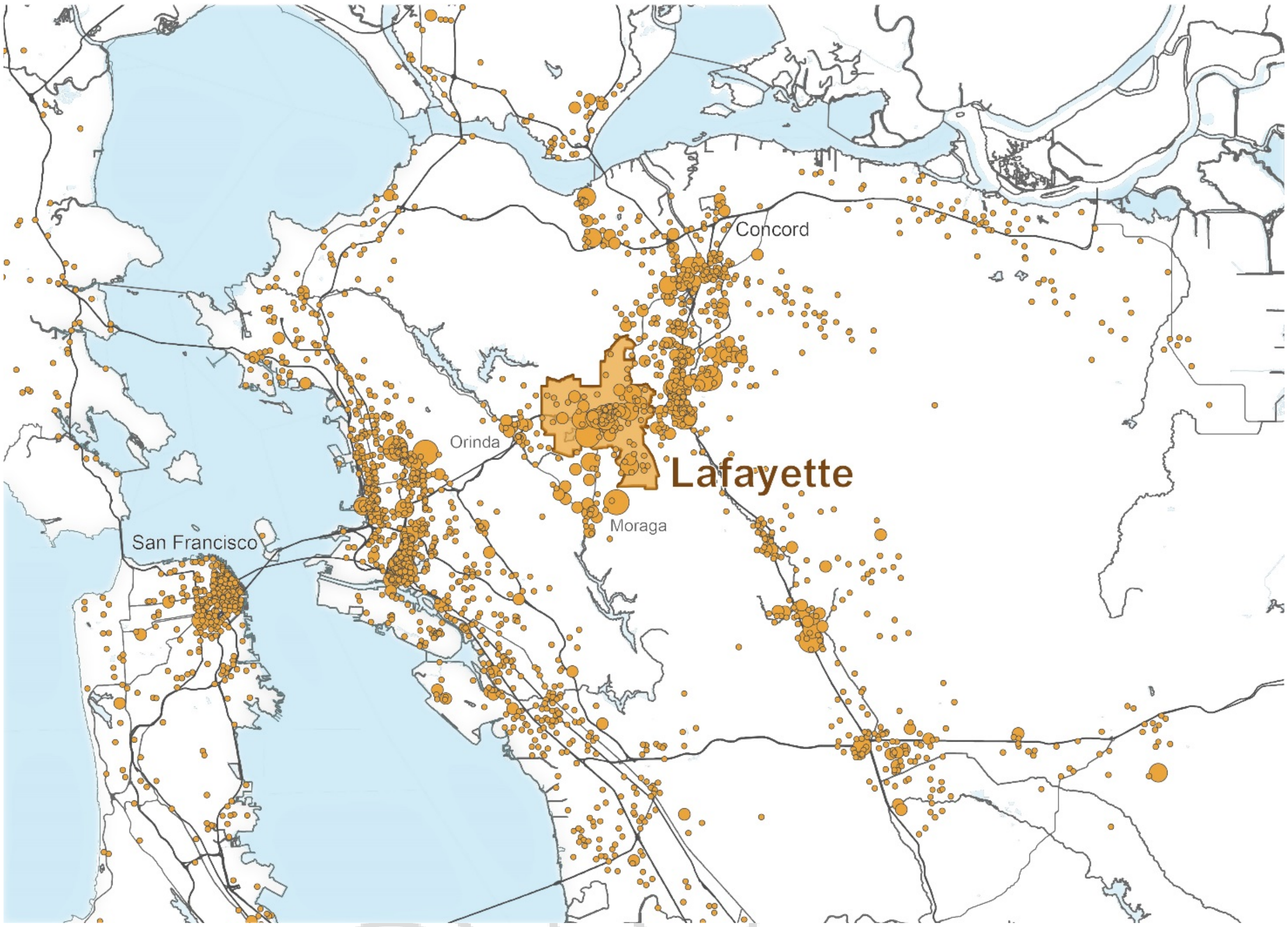

Figure 9: Data are from the Longitudinal Employer-Household Dynamics, 2013.

2.4 Transportation Mode Share

Population-wide travel to work data is available from the Census Bureau's annual *American Community Survey (ACS)*. Figure 10 shows the most recent 2013 ACS data for how Lafayette residents travel to work. Between 2009 and 2013, commuters who drove alone fell from 70 percent to 66 percent. Simultaneously, transit commuting increased 63 percent, while walking and bicycling remained steady. Across all modes, travel time to work has increased from a median 26.5 minutes in 2009 to 28.6 minutes in 2013, and the percentage of people traveling for more than 45 minutes to work has increased 26 percent.

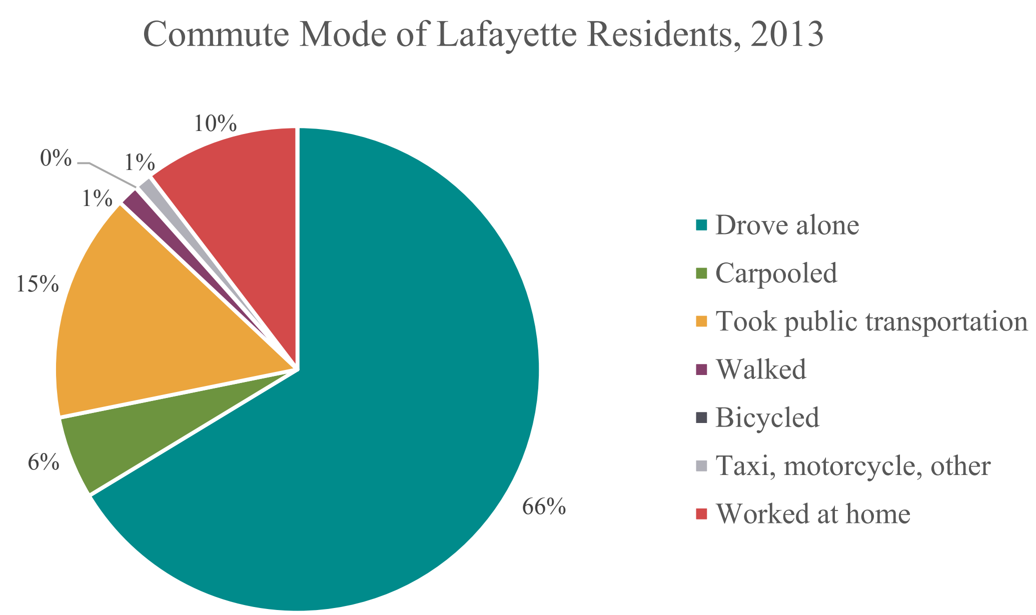

Figure 10: Data from the American Community Survey (2013)

2.5 Lafayette in the Future

Both *Plan Bay Area* (2013) and the City of Lafayette's *Downtown Specific Plan* (2012) target Downtown Lafayette as the center for much of the community's projected population growth. Plan Bay Area forecasts a 15 percent increase in housing units and households by 2040 with approximately 50 percent of that growth occurring in the Downtown. Figure 11 provides a summary of the projected growth for Lafayette and Moraga.

The *Downtown Specific Plan* and *EIR* provide detail for local growth in the study area, including:

- Downtown will increase housing units in addition to office and retail square footage. The EIR traffic study included 1,765 additional housing units and 180,000 square feet of both office and retail space. The EIR estimated an increase of an additional 1,900 peak hour vehicle trips in Downtown by 2040.
- BART will not add more parking spaces to its current 1,526.
- Traffic on SR 24 will increase as population and jobs increase in the I-680 corridor and in the San Francisco and Oakland urban areas.
- Local housing dynamics will impact enrollment in Lafayette schools.

The CCTA regional travel demand model estimates similar growth rates of 15-20 percent for areas in and around the Downtown.

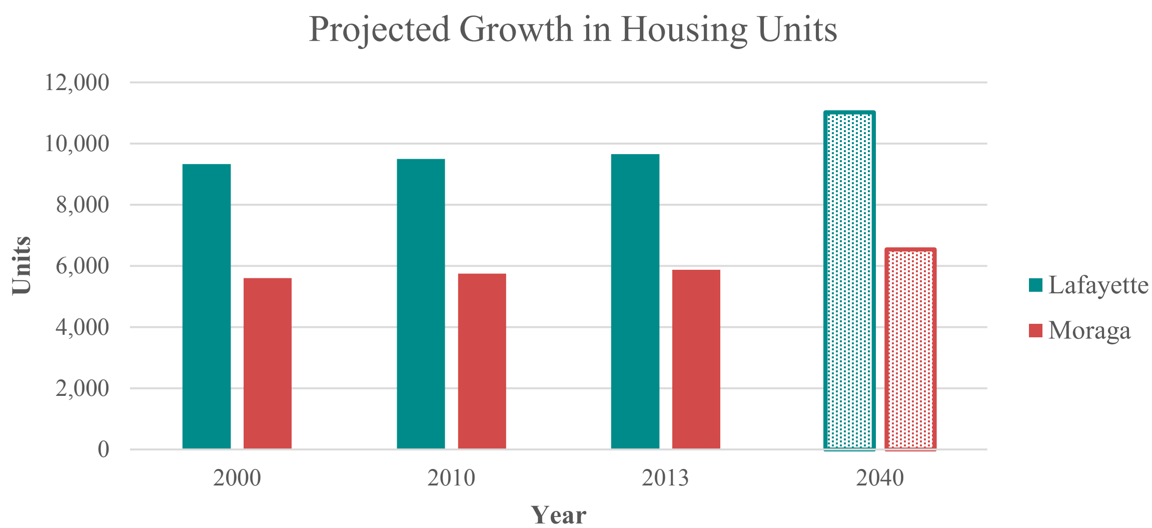

Figure 11: Plan Bay Area (2013).

In addition to ongoing demographic changes, future societal trends are likely to also impact travel behavior and auto trip-making. Recent evidence indicates that Boomers (ages 50-65) and Millennials (ages 21-34) prefer more walkable, transit-oriented communities.[2] These preferences are shaping travel behavior in communities around California. Biking, walking, and riding transit continue to rise in popularity, while driving is decreasing.[3]

Technological trends will also impact Lafayette. Vehicles, and the goods and services that support them, are likely to evolve along with the demand for more energy efficient and self-driving features. The Internet of Things (IoT) is expanding and producing smarter devices with more complex and real-time data. As data becomes more prevalent and integrated seamlessly into transportation services, travel options will increase and could begin to favor connected and shared mobility services such as those offered by technology network companies like Uber and Lyft. However, the impacts of these technology trends on travel behavior, auto trip-making, and ultimately traffic congestion in Lafayette is uncertain.

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[2] American Planning Association, *Investing in Place: Two Generations' Views on the Future of Communities*, May 2014: https://www.planning.org/policy/polls/investing/pdf/pollinvestingreport.pdf.

[3] Brian McKenzie, "Modes Less Traveled – Bicycling and Walking to Work in the United States: 2008-2012." *American Community Survey Reports*, United States Census Bureau, May 2014: http://www.census.gov/prod/2014pubs/acs-25.pdf; American Public Transportation Association, "Public Transportation Use Is Growing – Here Are the Facts," March 2014: http://www.apta.com/mediacenter/ptbenefits/Pages/Public-Transportation-Use-is-Growing-.aspx.

3 Measuring and Understanding Congestion

Congestion occurs when the traffic demand on a roadway exceeds the available capacity, which results in slower speeds, increased delays, and long queues. There are two types of congestion:

- Typical (Recurring): this is congestion that occurs on a regular basis when demand exceeds capacity;
- Incident-based (Non-Recurring): this is when an accident or another incident (e.g., downed power lines) blocks one or more lanes of traffic.

Congestion is caused by the popularity of destinations and various activities. The more people want to travel to similar locations at similar times, the more likely the roadway network that connects people with these locations will become congested. Congestion can also result from incidents, such as collisions, inclement weather, special events, and construction or other work zones. Typical congestion is something that transportation planners can address through managing demand and designing solutions that increase capacity. While incidents are impossible to predict, there can be policies in place to clear accidents more efficiently and communicate information to travelers faster if they do occur.

3.1 Congestion Data Sources

To measure travel and congestion for this study, we drew from a variety of traditional count sources as well as new probe data from GPS and navigations systems. These are summarized below:

- **Program for Arterial System Synchronization (PASS):** The study utilized peak period vehicle, pedestrian, and bicycle counts collected by TJKM in 2013 for the ongoing Program for Arterial System Synchronization (PASS) traffic signal project in Downtown. These counts included: weekday AM, mid-day, afternoon, PM and weekend mid-day periods for 13 of the highest volume intersections on Mount Diablo Boulevard and Moraga Road. This study also collected hourly traffic counts for seven days using machine “tube” counters at five locations. Machine counts provided an indication of the daily and hourly traffic variation on local streets.
- **Downtown Specific Plan (2012):** The Downtown Specific Plan analysis utilized counts collected in 2009 for the *Downtown Specific Plan EIR*. The EIR was also a source of intersection “level-of-service” (LOS) calculations, which provided an indication of vehicular traffic operations across the City.
- **New traffic counts**: For this study, updated traffic counts were collected in May 2015 for three locations on Mount Diablo Boulevard at the intersections of Moraga Road, 1st Street, and Oak Hill Road-Lafayette Circle East. These counts were used as a check on the previous data sources.
- **Caltrans PeMS:** To understand conditions on SR 24, the study utilized freeway volume and speed data from Caltrans’ Freeway Performance Management System (PeMS). The data were downloaded for several years to understand the variability in traffic conditions

and how long congestion persists on SR 24. The Caltrans Count Book was used to check and supplement the data.

- **Incident data:** Traffic incident data was compiled from the California Statewide Integrated Traffic Records System (SWITRS) and accessed through the University of California at Berkeley's Transportation Injury Mapping System (TIMS).
- **Parking data:** The City provided parking data from 2011 and 2014 that were analyzed to understand parking utilization and turnover.
- **Field observations:** The consultant team collected queuing information, identified pedestrian and bicycle conditions, and reported on the general condition of the transportation system during routine field work.
- **GPS, cell phone, navigation systems data:** The consultant team utilized mobility data provided by the data vendors Inrix and StreetLight. This data offers a tremendous opportunity to better understand how people travel through a study area. Traditional traffic data does not provide insight into where trips are coming from and going to. Autonomous GPS and mobile phone data is an emerging data source that can provide this level of detail and help us to identify local travel markets.
    - **Inrix:** Metropolitan Transportation Commission (MTC) provides free access to Inrix data for public agencies throughout the Bay Area. Inrix data covers freeways and arterial segments and is based on GPS traces collected from mobile phones and navigation systems. Inrix provides these data to MTC to help supplement toll tag and Caltrans data used for 511. For our analysis, the 511 and Inrix data provided a more detailed picture of real-time congested travel times and their variability throughout the day and year. The City collected the available data from these sources, which go back to 2010, and visualized it. These data help communicate the significance of congestion and to help calibrate the traffic model described below.
    - **StreetLight:** The consultant team also obtained data from the data vendor StreetLight, which provides data collected from GPS devices, navigation systems, and mobile phones. These data provide origin-destination (O-D) and street routing metrics, which allow for more insight into local travel behavior.

These data sources were used to understand existing congestion in Downtown and to develop the traffic model, which is described later in the report.

3.2 The Where and When of Congestion

Congestion in Downtown occurs at various places and throughout the day. Figure 12 presents the location of typical congestion using Inrix GPS/navigation system data during the morning and evening peak periods. The shading of segments indicates the relative level of congestion on that particular link, and is defined as the ratio of actual speed to the typical "uncongested" or "free flow" travel speeds. For example, green segments show links where travel speeds are over 85% of what they would be with no other vehicle traffic; whereas dark red segments indicate heavily congested links during gridlock conditions.

Sections on Moraga Road, Mount Diablo Boulevard, and SR 24 are the most congested segments, which reflects field observations. The severity and causes of congestion are detailed in the following sections.

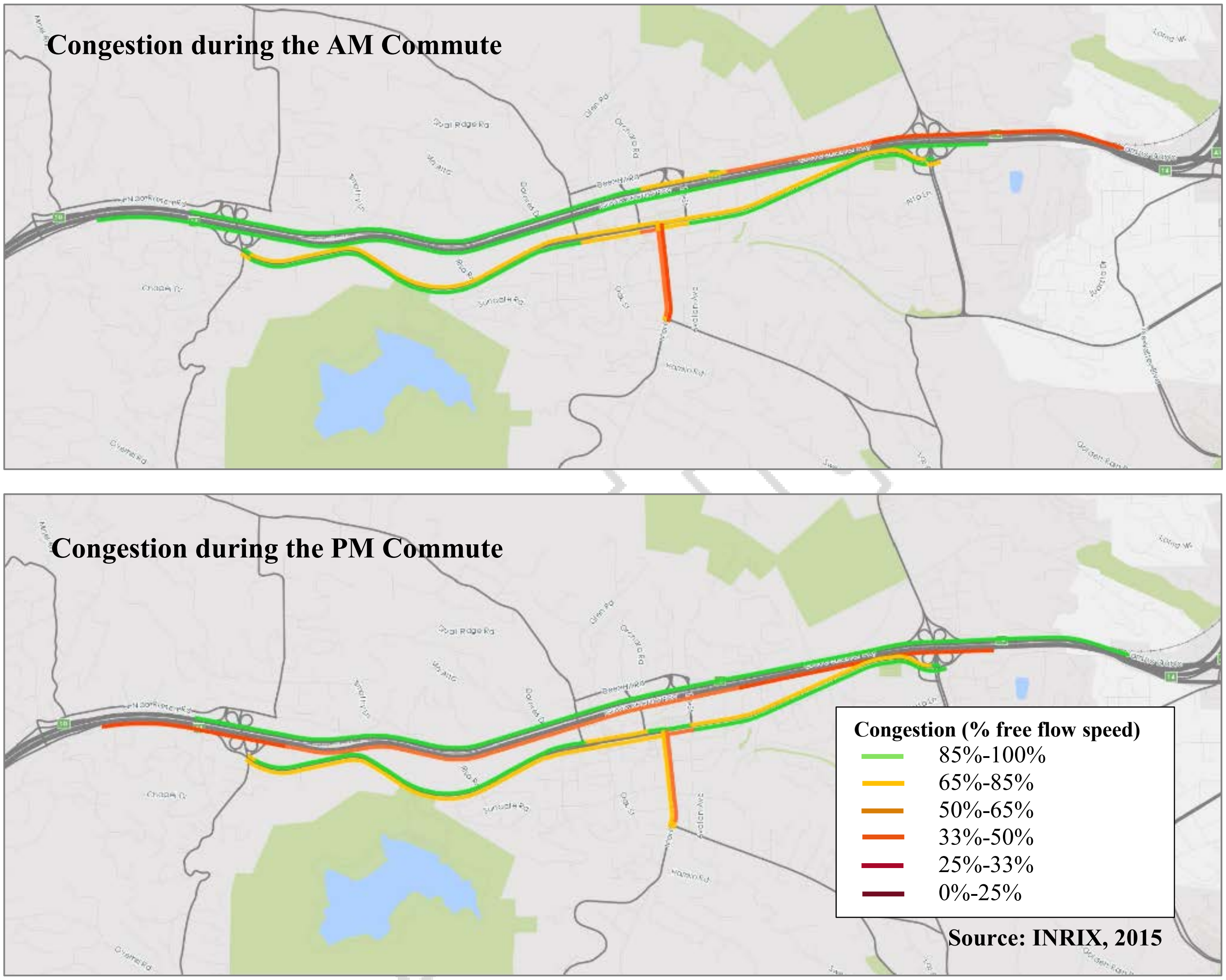


Figure 12: Typical Congestion at 8 AM and 5 PM (2015)

The temporal distribution of congestion in Downtown is somewhat unique. Figure 13 presents hourly traffic count data collected over several days on Moraga Road at School Street. Figure 14 shows total intersection traffic volumes at Mount Diablo Boulevard / Moraga Road for four different hours of the day. These two figures indicate that traffic volumes in Downtown begin peaking earlier in the afternoon – around 2:30 to 3:00 PM – and volumes remain at a sustained level for a longer period – from three to four hours – compared to most roadways in the Bay Area. Most streets experience a peak hour between 4:00 and 5:00 PM with a peak period lasting two hours. The earlier peak and longer peak period is a unique phenomenon. This reflects the numerous activities that are focused along these two main arteries and the strong influence of school and shopping trips, which typically peak at this time of the day.

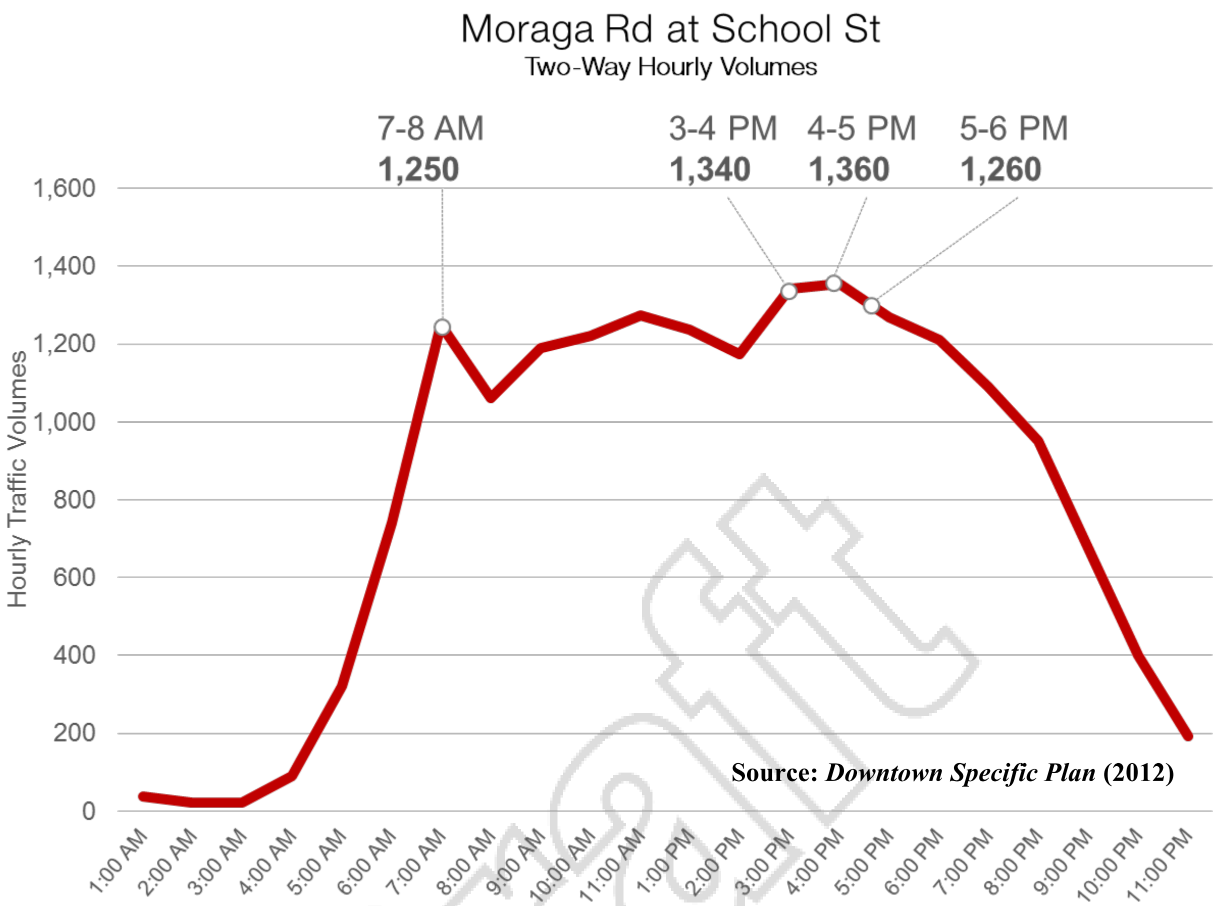


Figure 13: Hourly traffic volumes on Moraga Rd at School St

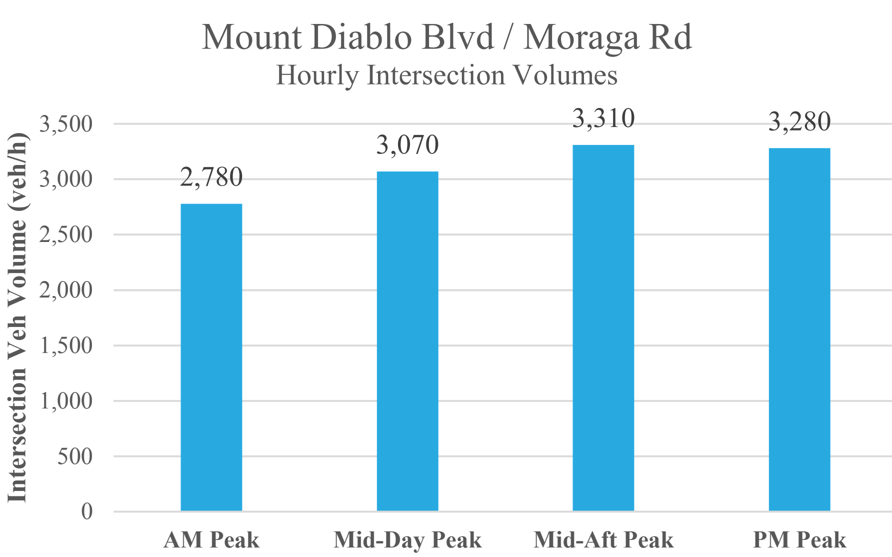


Figure 14: Hourly intersection volumes at Mount Diablo Blvd/Moraga Rd (MTC Pass Study, 2013)

3.3 Congestion across the Four Study Focus Areas

The following figures summarize the underlying sources of downtown congestion by focus area. Figure 15 illustrates the major issues around the Downtown. These issues are summarized below:

- The *Downtown Specific Plan* EIR reported LOS D conditions at Mount Diablo Boulevard / Moraga Road and Mount Diablo Boulevard / 1st Street.
- Localized delay (LOS F conditions) reported in the *Downtown Specific Plan* EIR at the Moraga Road / School Street / Brook Street intersection during the school peak.
- Downtown has several significant core destinations that are major traffic generators: the Whole Foods and Safeway block between Oak Hill Road and 1st Street, La Fiesta Square, and the Trader Joes block between Mountain View Drive and Dewing Avenue.
- The “Downtown Y” forces traffic from Moraga Road and heading to/from SR 24 or the BART station to use a circuitous path that includes various turning movements on Mount Diablo Boulevard, 1st Street, and Oak Hill Road to reach the freeway. This causes congestion at multiple intersections.
- Eight traffic signals in 0.8 miles on Mount Diablo Boulevard between Mountain View Drive and 2nd Street. This close spacing of signals makes coordination between intersections challenging.
- Driveways and on-street parking along Mount Diablo Boulevard create additional friction as vehicles decelerate to access these parking lots or to parallel park at on-street spaces.
- Close signal spacing and lack of dedicated left-turn lanes on Moraga Road contribute to queuing and congestion.

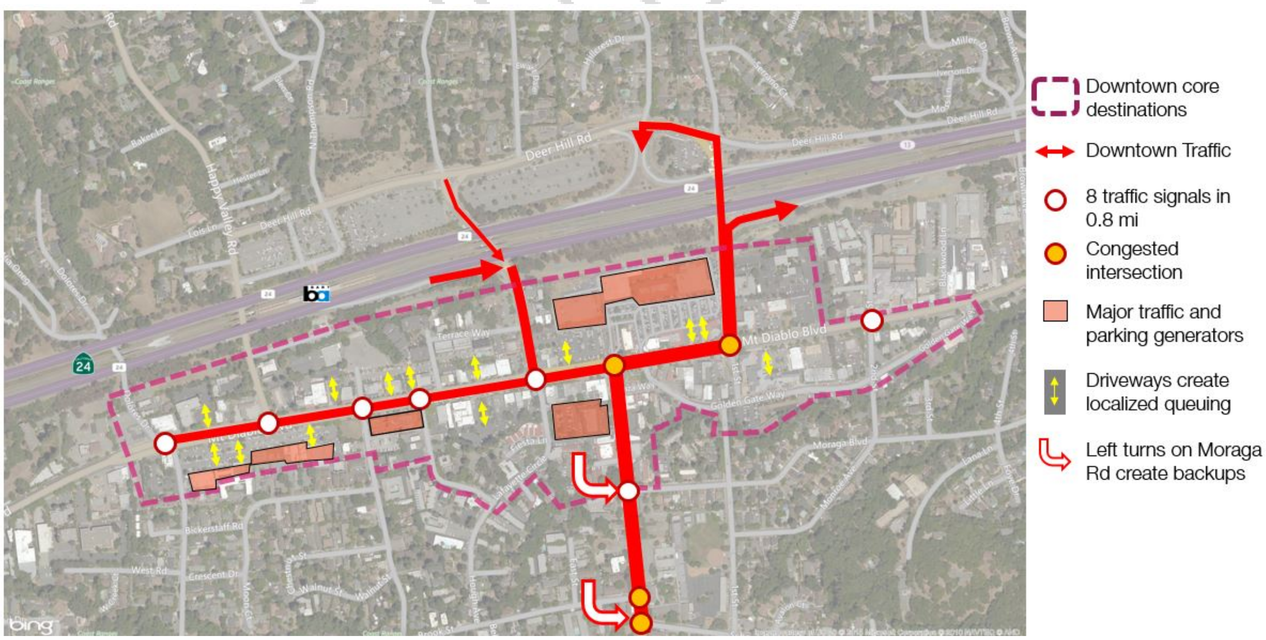


Figure 15: Downtown Issues

The BART station is a valuable transportation asset as it provides high-speed commuter rail service across the core of the Bay Area. However, the station precinct has access and parking issues similar to those of the Downtown. Figure 16 illustrates the issues summarized below:

- A primary route to the BART station, 1st Street, requires drivers to use segments of the congested Downtown "Y".
- Parking fills up fast in the morning (around 8 AM), which then results in drivers circulating looking for other options or leaving Lafayette altogether.
- BART patrons parking west of Oak Hill Road have to cross the Deer Hill Road / Oak Hill Road intersection (all way stop) to access the BART station.
- Wayfinding does not clearly highlight pedestrian pathways between BART and Mount Diablo Boulevard.

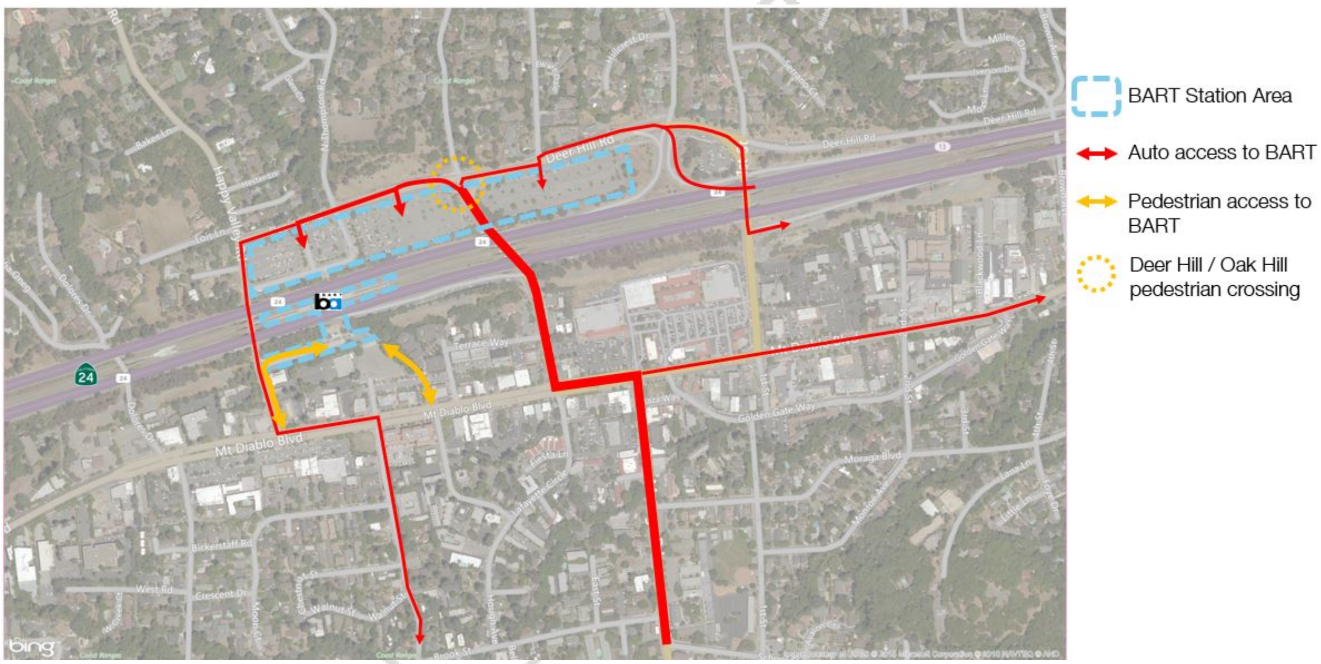


Figure 16: BART Issues

Traffic congestion on SR 24 and the access to and from the ramps at Deer Hill Road, 1st Street, and Oak Hill Road also affect downtown conditions. Figure 17 illustrates these issues, which are summarized below:

- SR 24 is congested during the AM and PM peak travel periods. The afternoon congestion can sometimes result in traffic exiting the freeway at Acalanes Road to use Mount Diablo Boulevard to bypass the traffic.
- For downtown traffic, the "Y" is the primary route to access the SR 24 on- and off-ramps.

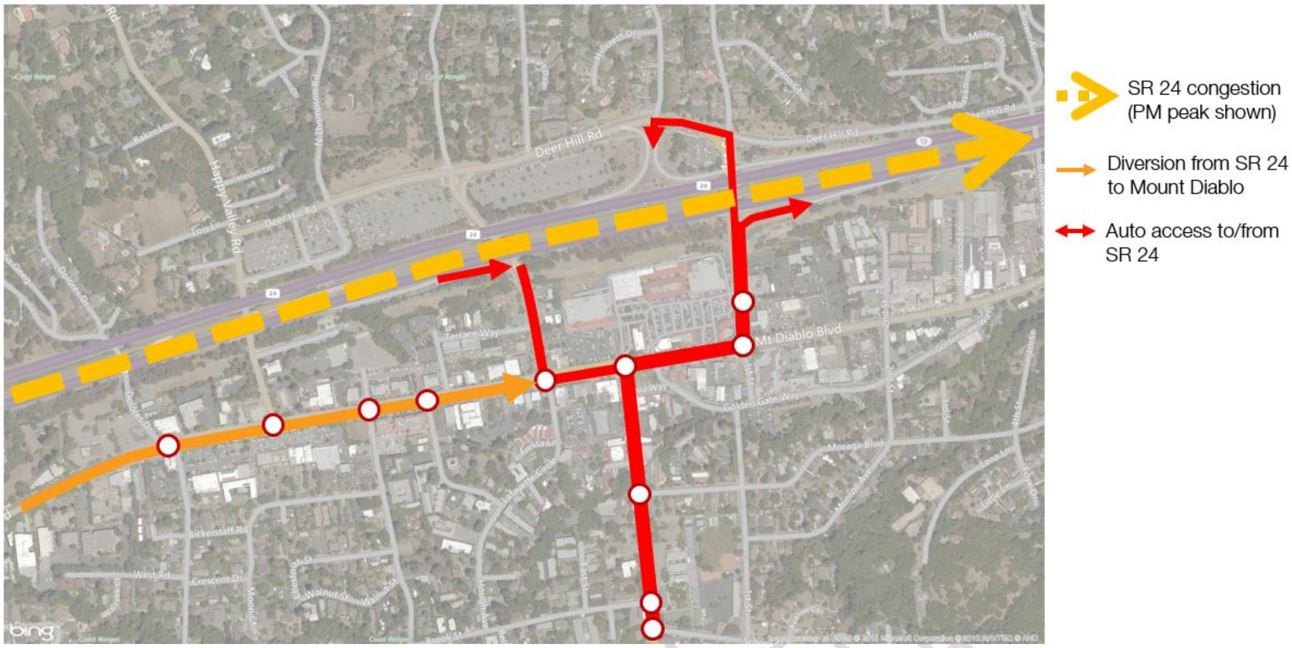


Figure 17: SR 24 Issues

Traffic congestion around the downtown school locations (Lafayette Elementary and Stanley Middle School) is caused by pick-up and drop-off activities around the schools combined with other traffic using Moraga Road during the mid-afternoon. Figure 18 illustrates the issues around the downtown school locations. These issues are summarized below:

- Pick-up and drop-off activities around the schools contribute to congestion on Moraga Road and St Mary's Road
- School Street has issues related to narrow sidewalks, drop-off/pick-up activity, and residential on-street parking
- There are safety concerns for pedestrians at crossings around the schools, particularly at Moraga Road and St Mary's Road
- The pedestrian crossing times contribute to traffic delay on Moraga Road

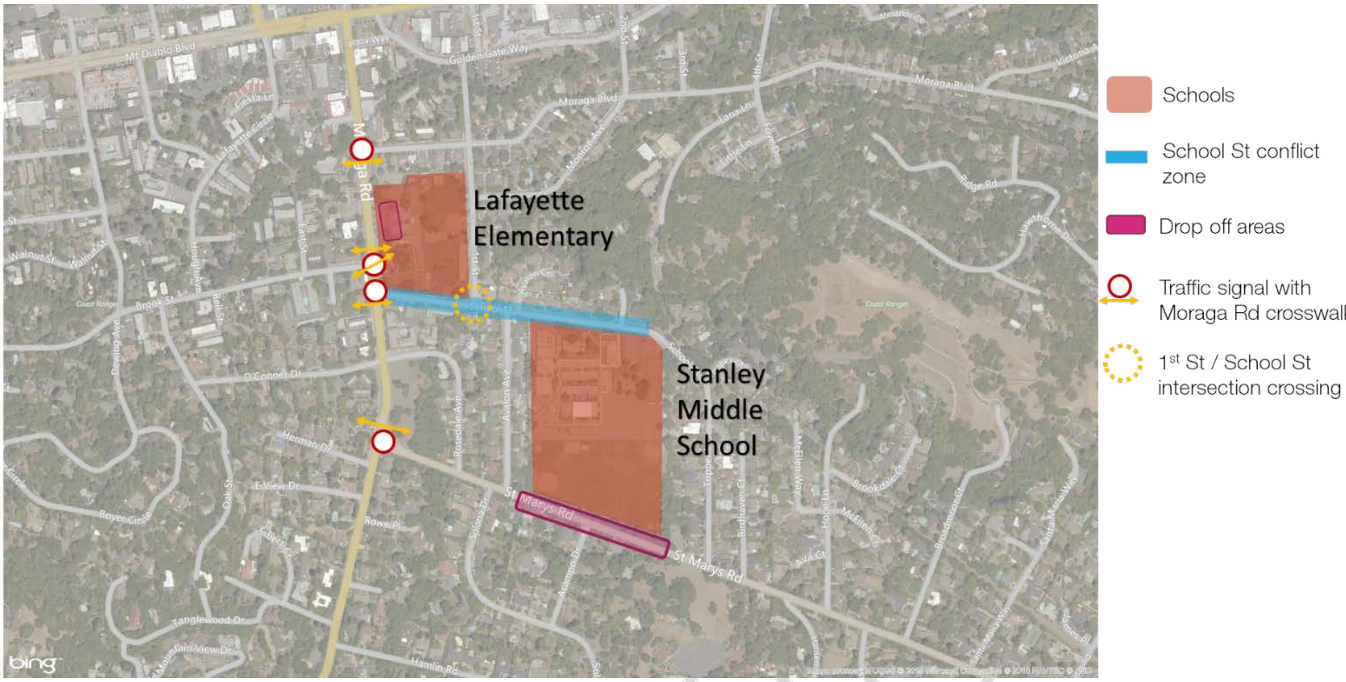


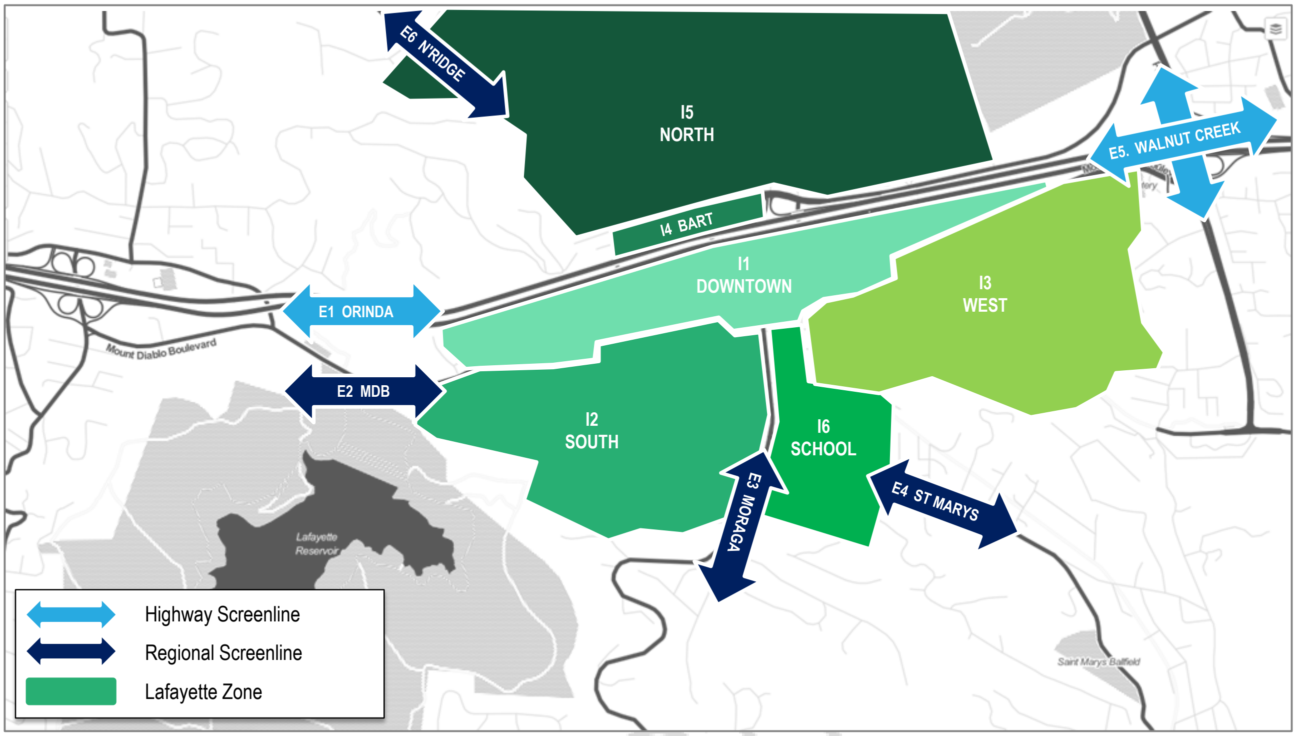
Figure 18: School Issues

3.4 Origin and Destination Travel Patterns

Data from in-vehicle GPS navigation systems and cell phones has been provided by the mobility data vendor StreetLight. The data:

- Spans a four month period and is aggregated for four different time periods for zones around the study area
- Represents relative trips which can be compared to determine relative flows between given points. Individual trips between given points cannot be sourced.
- Captures a sample of auto trips through the study area, but does not reflect travel patterns on other modes
- Provides insight into the origin and destination (O-D) travel patterns for drivers through and around Lafayette and was used to help calibrate the traffic model.

Figure 19 shows the zone system used to analyze the StreetLight data. The O-D data were organized for "internal" zones within the study area and "external" gateway zones at the edge of the study area. The large arrows at the edges of the study area indicate the primary gateways or "screenlines".



Internal Zones		External Zones (Screenlines)	
Label	**Location**	**Label**	**Location**
I1	Downtown Lafayette	**E1**	SR 24 West (Orinda)
I2	South Lafayette	**E2**	Mount Diablo Blvd (West)
I3	West Lafayette	**E3**	Moraga Road
I4	Lafayette BART (Parking)	**E4**	St Marys Road
I5	North Lafayette	**E5**	SR 24 East / Pleasant Hill Interchange (Walnut Creek)
I6	Lafayette School Precinct	**E6**	Happy Valley Road (Northbridge)

Figure 19: Zone System for Lafayette

The number of trips between these external and internal zones can be organized into four main trip types:

- **External to external trips or "Through" trips:** Can be defined as through trips, as they only pass through the Lafayette zones. It is noted that these do not include highway to highway trips as these trips are unlikely to impact on the local road network.
- **External to internal trips or "Incoming" trips:** Defined as incoming trips, as they terminate within the Lafayette zones.
- **Internal to external trips or "Outgoing" trips:** Defined as outgoing trips, as they originate within the Lafayette zones.
- **Internal to internal trips or "Local" trips:** As local trips, these vehicle movements originate and terminate within the Lafayette internal zones. Trips with an origin and destination within the same zone ("intrazonal" trips) are not included in this trip type.

Figure 20 below shows the proportion of each trip type through the Lafayette zones on an average weekday between 6 AM and 7 PM. The analysis indicates there are a significant number of through trips (29%) traveling through Lafayette in comparison to local trips (7%). There are a high level of incoming and outgoing trips (64% of all trips), which could be attributable to commute and regional shopping trips.

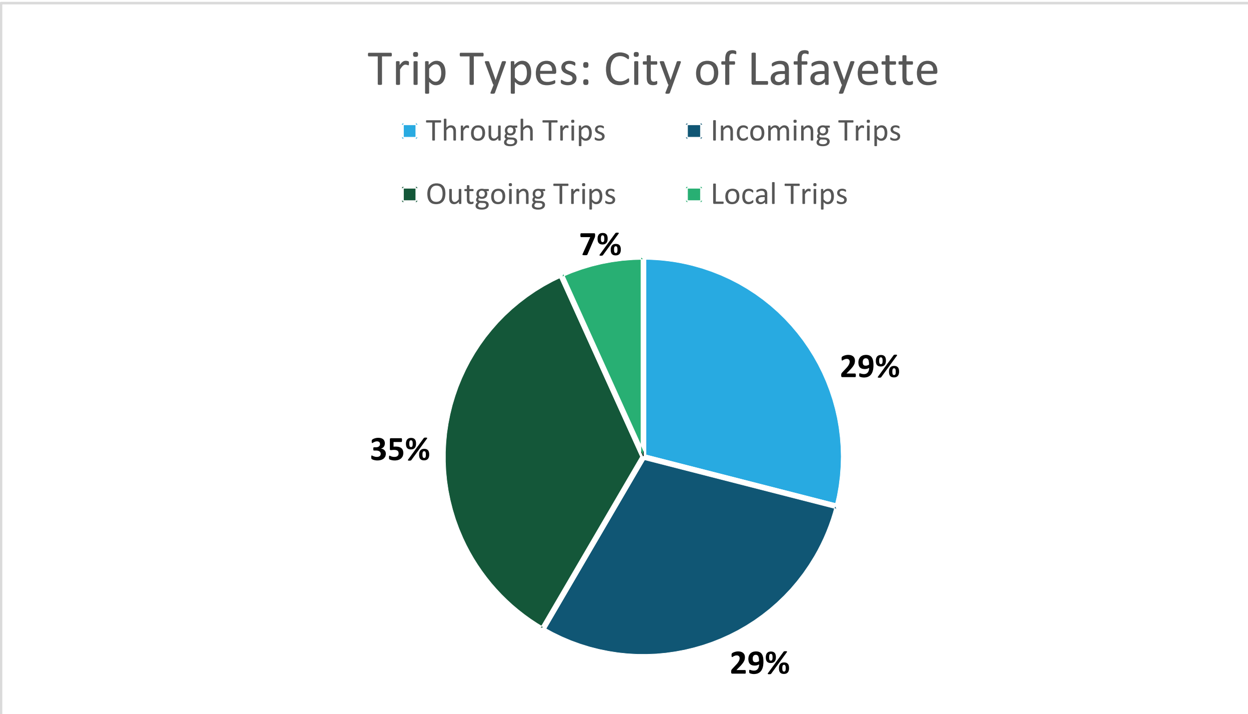
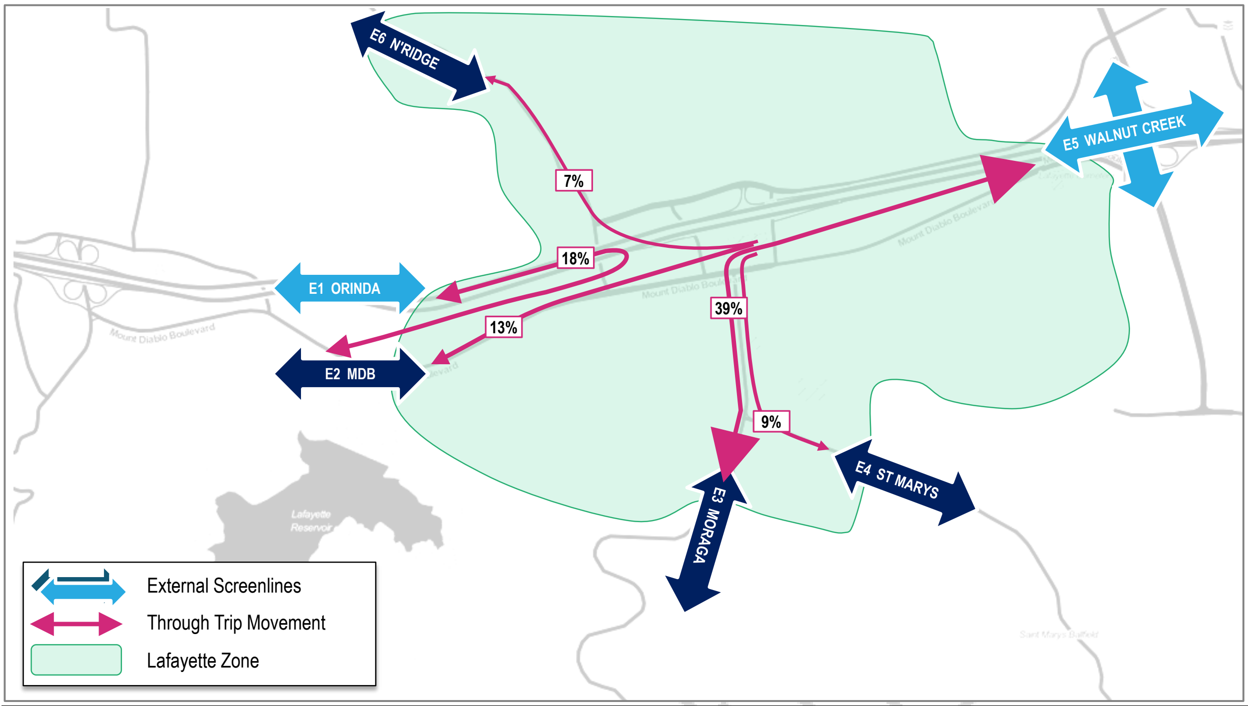


Figure 20: Lafayette Trip Types

The through trips were analyzed further to identify the primary routes that drivers use to travel through Downtown to reach destinations outside of Lafayette. Figure 21 shows a bandwidth diagram that illustrates the relative weight of trips through Downtown. The table below summarizes the totals. This table indicates that the largest share (39%) of through trips involves traffic from Moraga Road south of St Mary's traveling east on SR 24. All of these trips would use Moraga Road and parts of the Downtown "Y" to reach Mount Diablo Boulevard and the freeway.



Through Trips		
Label	**Route**	**Through Trip Proportion**
E3↔ E5	Moraga Road↔ SR24 / Pleasant Hill East Interchange	39%
E1↔ E2	SR24 West↔ Mount Diablo Blvd (West)	18%
E2↔ E5	Mount Diablo Blvd (West)↔ SR24 / Pleasant Hill East Interchange	13%
E4↔ E5	St Marys Road↔ SR24 / Pleasant Hill East Interchange	9%
E5↔ E6	SR24 / Pleasant Hill East Interchange↔ Happy Valley Road (Northbridge)	7%
Others	All other through trips	14%

Figure 21: Analysis of Through Trips

To better understand the specific destinations for traffic using Moraga Road, a detailed analysis of the segment between Brook Street and Moraga Boulevard was conducted using the StreetLight data. Figure 22 shows the O-D flows on Moraga Road traveling in both directions. This figure indicates that the majority of trips on Moraga Road are traveling between SR 24 and Moraga Road south of St. Mary's Road. Figure 23 summarizes the total trip flows across this segment. Approximately 60 percent of vehicles on Moraga Road are through trips headed to SR 24 or Mount Diablo Boulevard. These findings provide support that a large share of the vehicles causing the localized congestion on Moraga Road and the Downtown "Y" are trips leaving the Lamorinda area.

These percentages were combined with the existing traffic volumes to quantify the number of peak hour vehicle trips that take this route. Approximately 2,200 vehicles (two-way total) travel through Moraga Road, between Brook Street and Moraga Boulevard in the PM peak hour. The estimates indicate that approximately 1,200 vehicles (two-way total) during the PM peak hour are traveling between Moraga Road south at St. Mary's Road and SR 24. Figure 24 illustrates this trip flow through Downtown. The majority of these trips are traveling to/from the east.

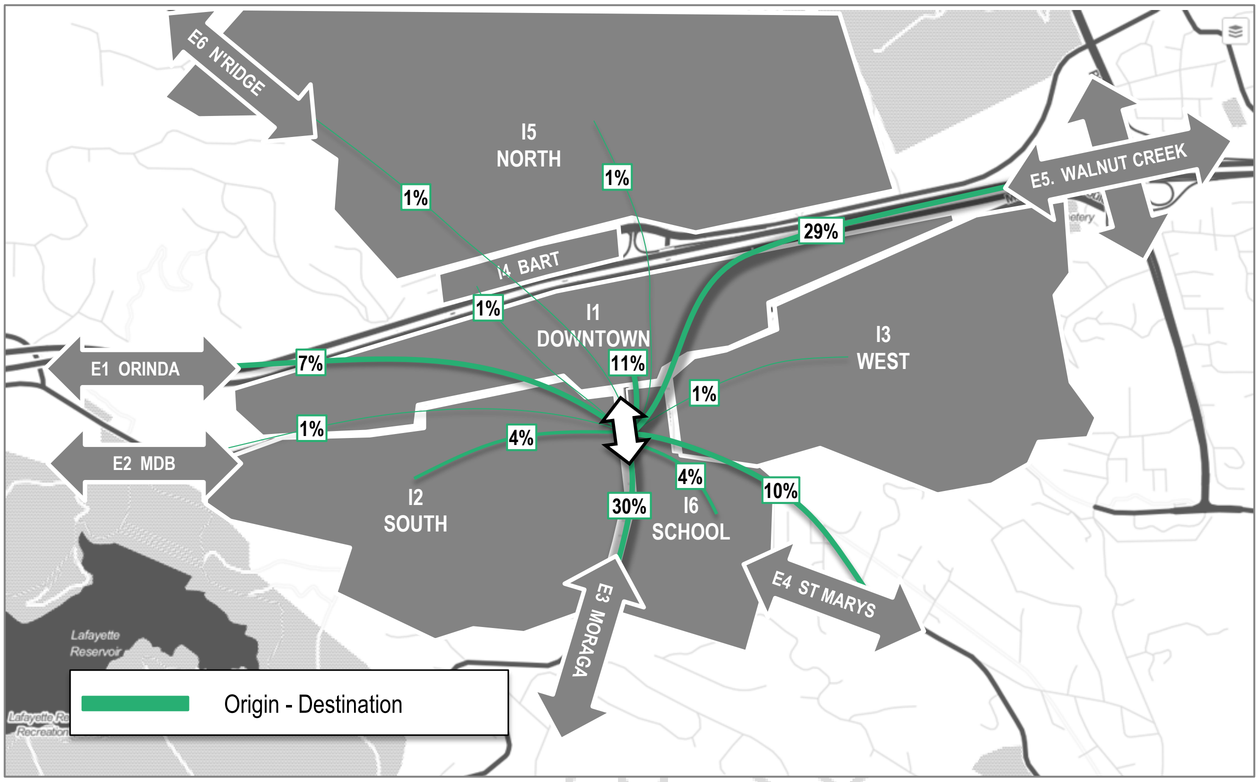


Figure 22: Moraga Road Traffic Origin-Destination Flows

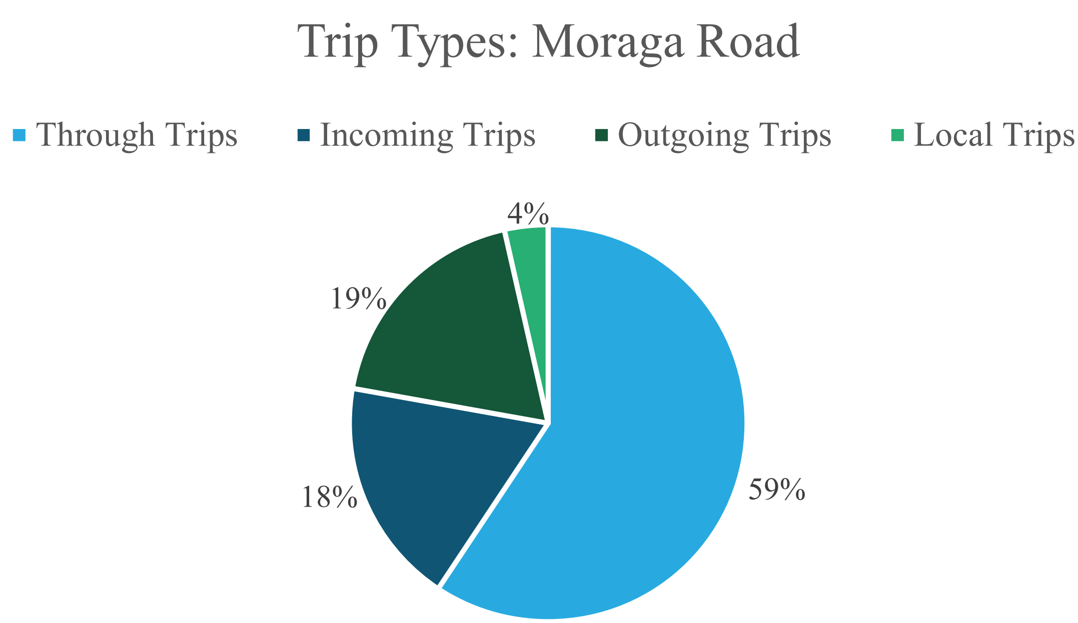


Figure 23: Trip Types Using Moraga Road

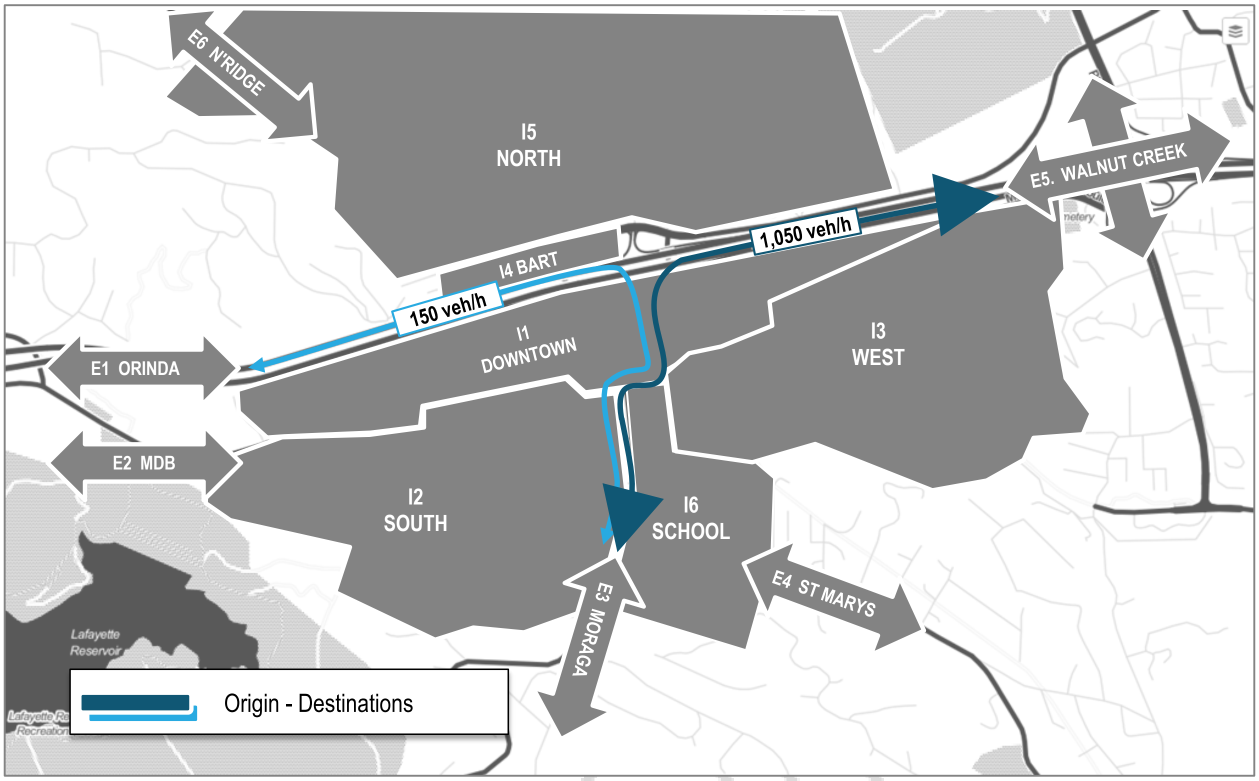


Figure 24: Existing Trip Volumes between Moraga Road and SR 24

This finding is consistent with our understanding of local travel patterns:

- The majority of trips from Moraga travelling to/from SR24 west are using Moraga Road to access the freeway.
- The figure above shows that a relatively small number of trips from Moraga are travelling to/from SR 24 east compared to SR24 west. This suggests that Moraga Way is the faster way to access SR 24 when traveling to Oakland and San Francisco.

The StreetLight data was analyzed to focus on retail trips traveling to/from Downtown around Mount Diablo Boulevard. Figure 25 shows how the downtown zones were organized to quantify the trip types to/from the core downtown retail area. Figure 26 shows the percentages by trip type. The results show that over 70 percent of trips accessing the downtown retail are traveling from SR 24. Only 30 percent of trips are from local zones within Lafayette or Moraga.

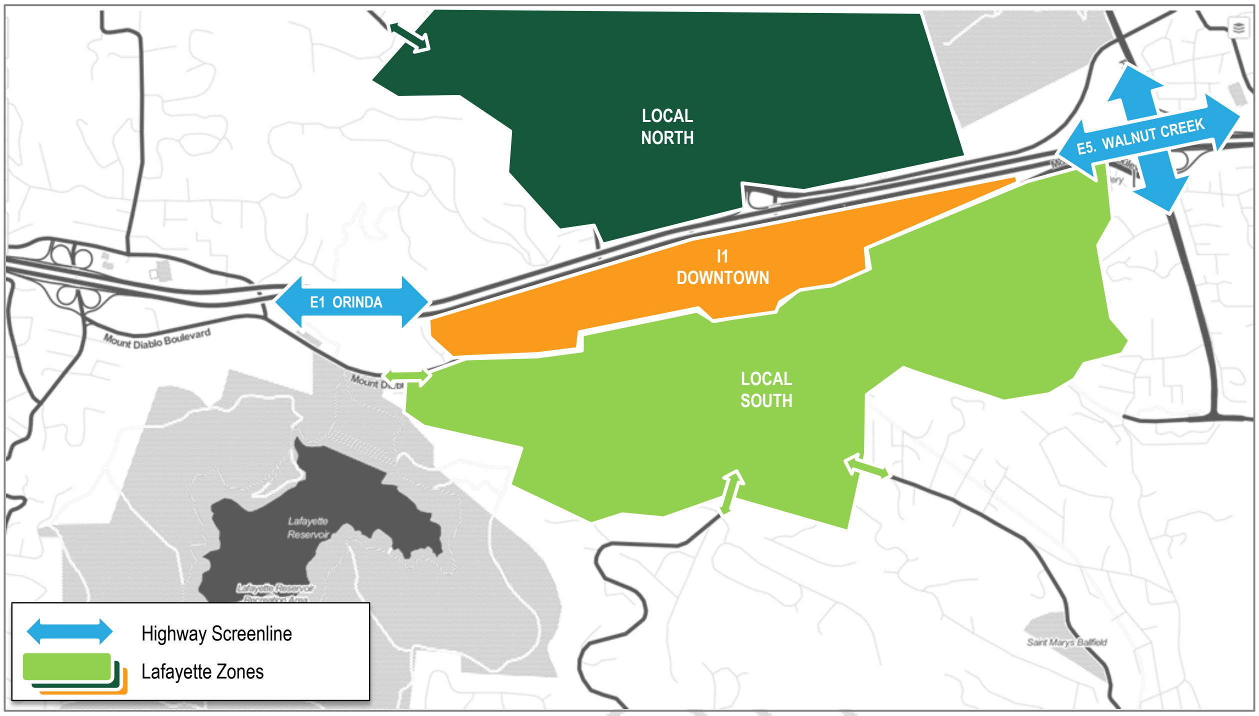


Figure 25: Downtown Retail Zone Structure

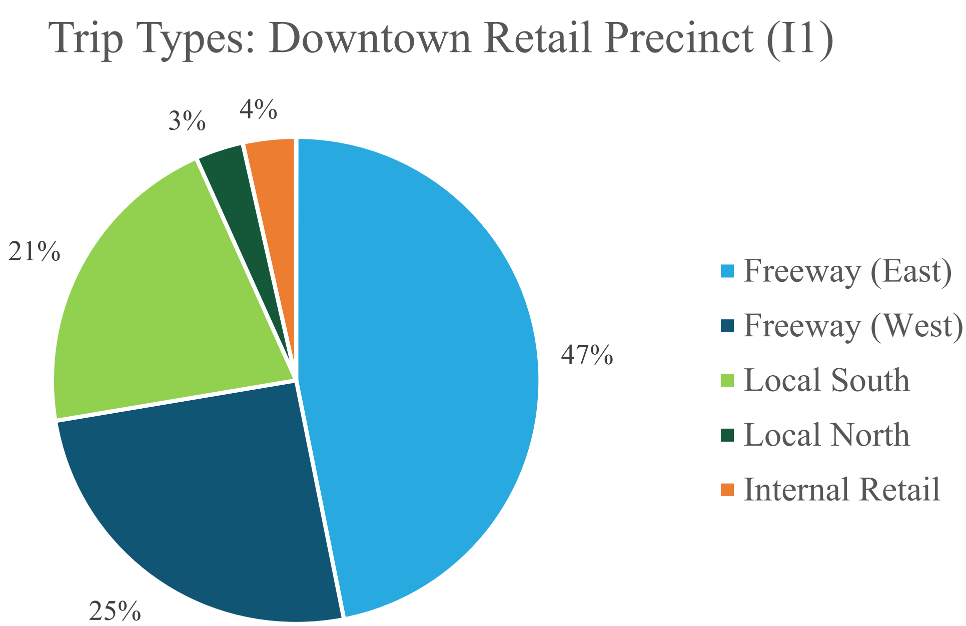


Figure 26: Downtown Retail Trip Types

3.5 Congestion Trends

It is important to reflect on recent historical trends in traffic volumes to understand how conditions have changed over time. Figure 27 and Figure 28 compare the AM and PM peak hour traffic volumes for the Mount Diablo Boulevard / Moraga Road and Mount Diablo Boulevard / 1st Street intersections since the year 2000.

Overall, traffic volumes are lower at both intersections in 2015 compared with 2000. Comparing 2015 to 2000, peak hour volumes at Mount Diablo / Moraga Road are 14% lower in the AM and 10% lower in the PM. The recent 2015 counts are slightly higher than 2013, which reflects the ongoing economic recovery, but have remained largely steady or slightly lower compared with 2007 levels.

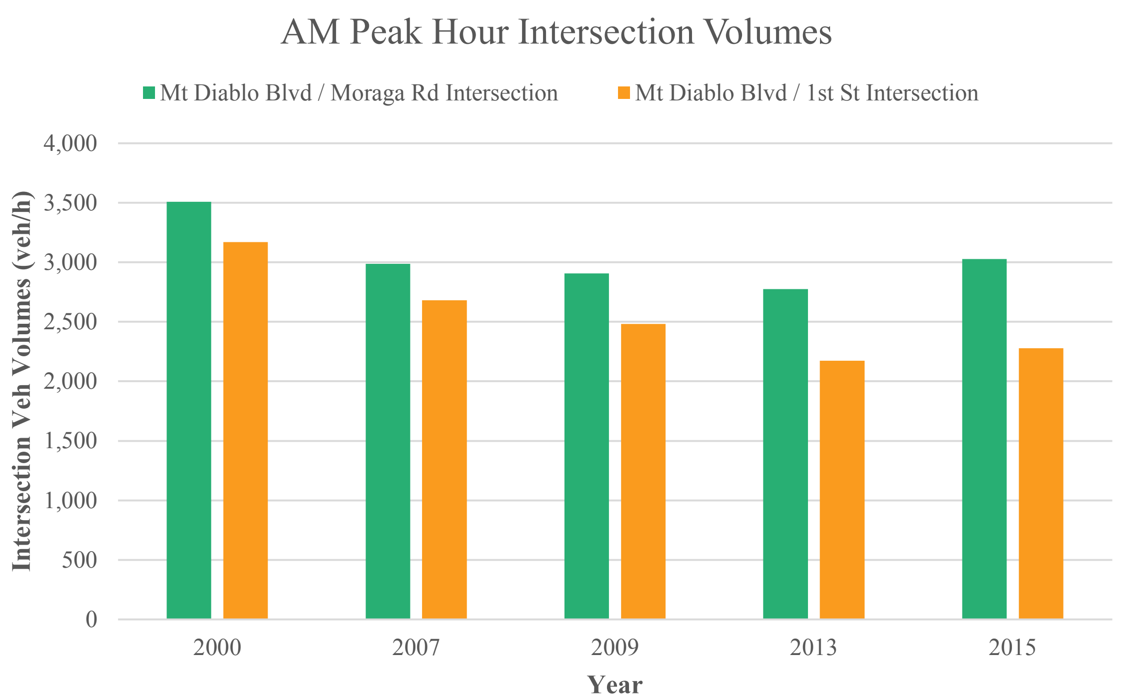


Figure 27: AM Peak Hour Traffic on Mount Diablo Blvd at Moraga Rd and 1st St

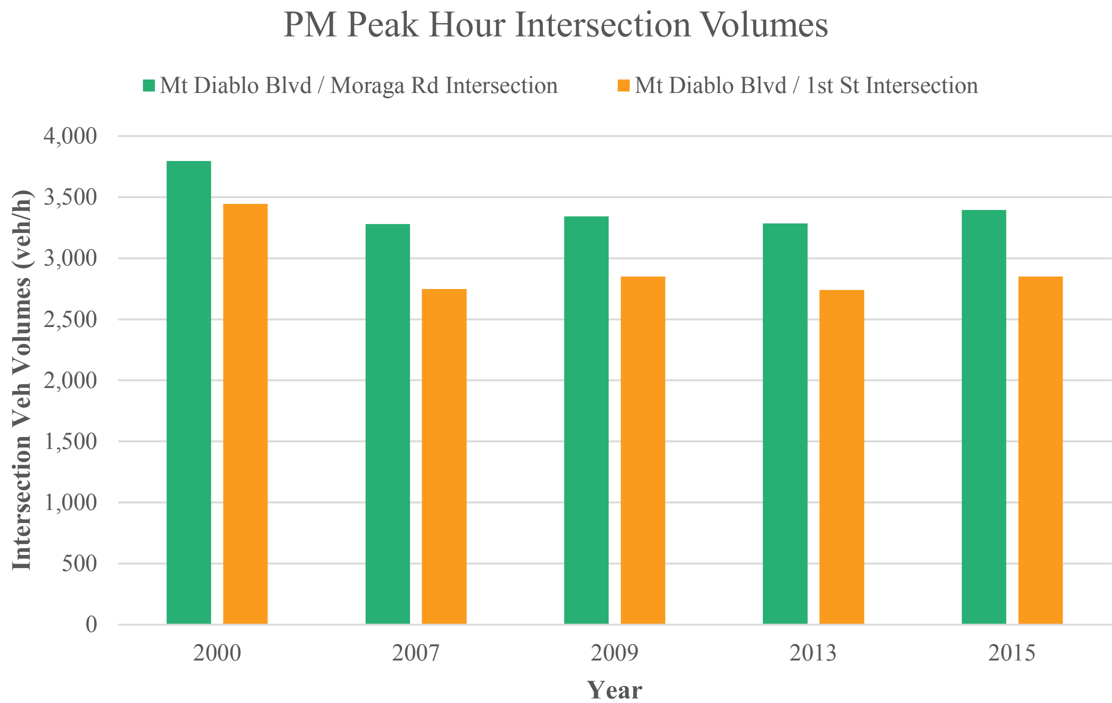


Figure 28: PM Peak Hour Traffic on Mount Diablo Blvd at Moraga Rd and 1st St

Traffic on SR 24 has remained consistently congested. In its 2015 report on congestion in the Bay Area, the Metropolitan Transportation Commission listed the evening commute on SR 24 from Oakland to Orinda as the ninth most congested route in the Bay Area.[4] A bit farther east towards Lafayette, total traffic and peak period traffic has remained relatively consistent over the past decade. After a dip in 2008, daily traffic on SR 24 has returned to pre-recession levels with traffic east of Downtown remaining heavier overall than traffic west of Downtown, as shown in Figure 29. An evaluation of peak period traffic volumes on SR 24 show similar patterns.

[4] Metropolitan Transportation Commission, "Fresh Data on Bay Area's Vital Signs Include New Top 10 List for Freeway Congestion," Vital Signs, December 17, 2015. http://www.mtc.ca.gov/whats-happening/news/fresh-data-bay-areas-vital-signs-include-new-top-10-list-freeway-congestion.

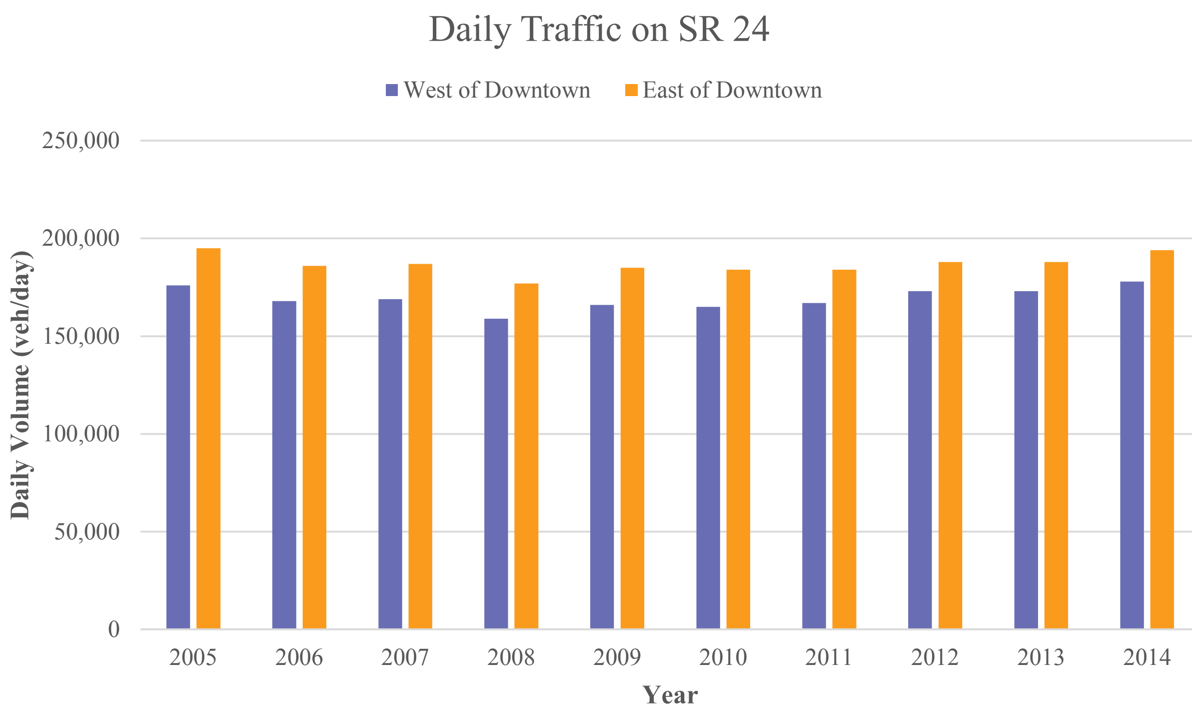


Figure 29: Average Daily Traffic on SR 24 in Lafayette, Caltrans Count Book

4 Other Transportation Conditions

4.1 Transit Ridership

Transit ridership has grown significantly and in a relatively short span of time. BART ridership at Lafayette BART Station has increased 37% from 2,900 daily riders in 1999 to 3,900 in 2015, as shown in Figure 30. System-wide growth over this period was 54%.

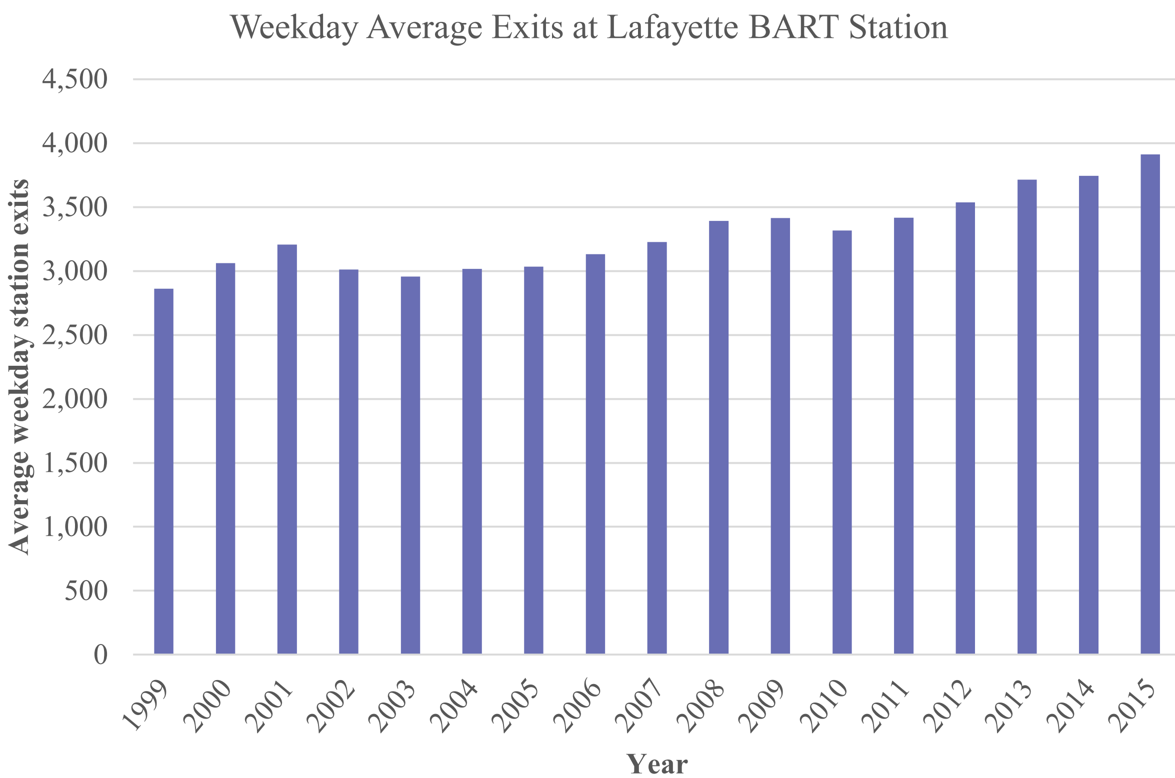


Figure 30: Data from BART Ridership Reports for April 1999-2015

Two County Connection routes, the 6 and 25, serve Downtown Lafayette and the BART station. Route 6 (Figure 31) serves both the Lafayette and Orinda BART stations, running along Moraga Road in Lafayette and Moraga Way in Orinda. Route 25 (Figure 32) similarly serves both the Lafayette and Walnut Creek BART stations along Mount Diablo Boulevard and Olympic Boulevard.

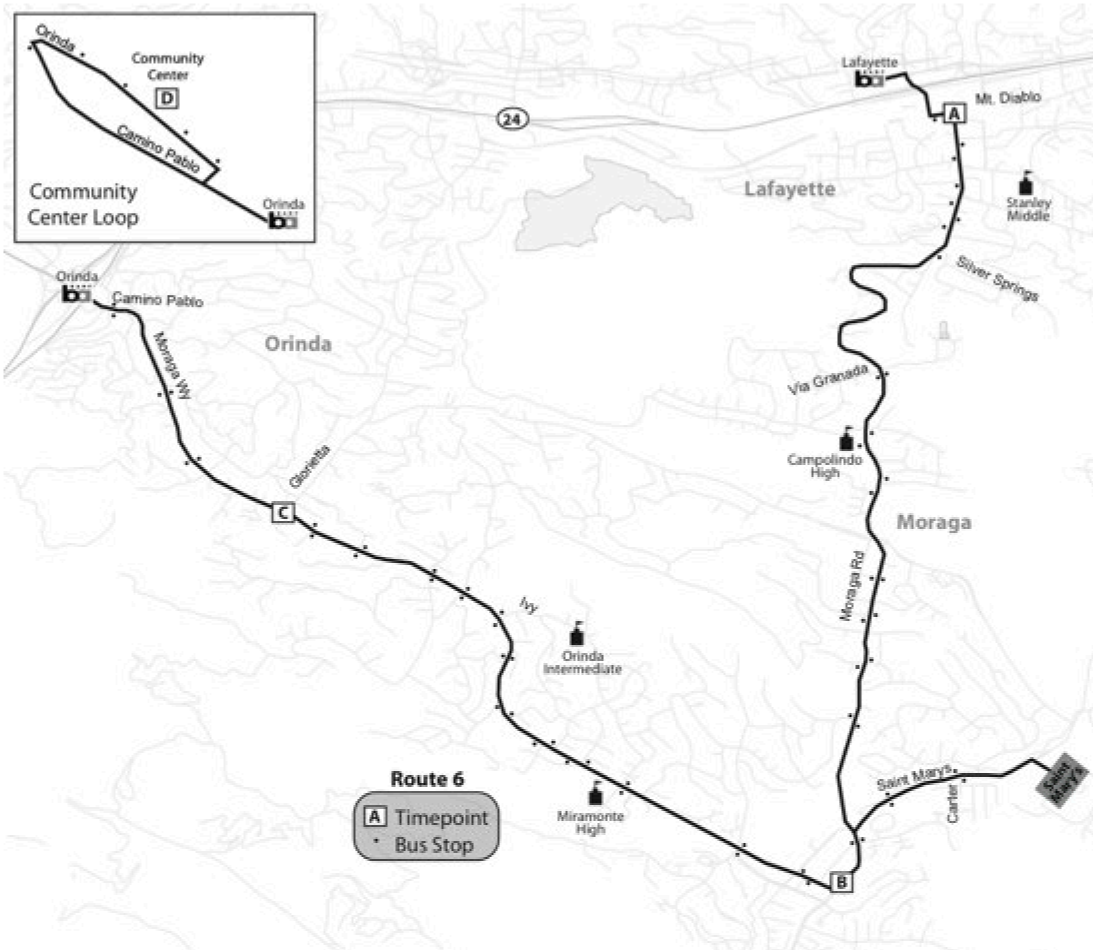


Figure 31: County Connection Route 6 map, source: countyconnection.com

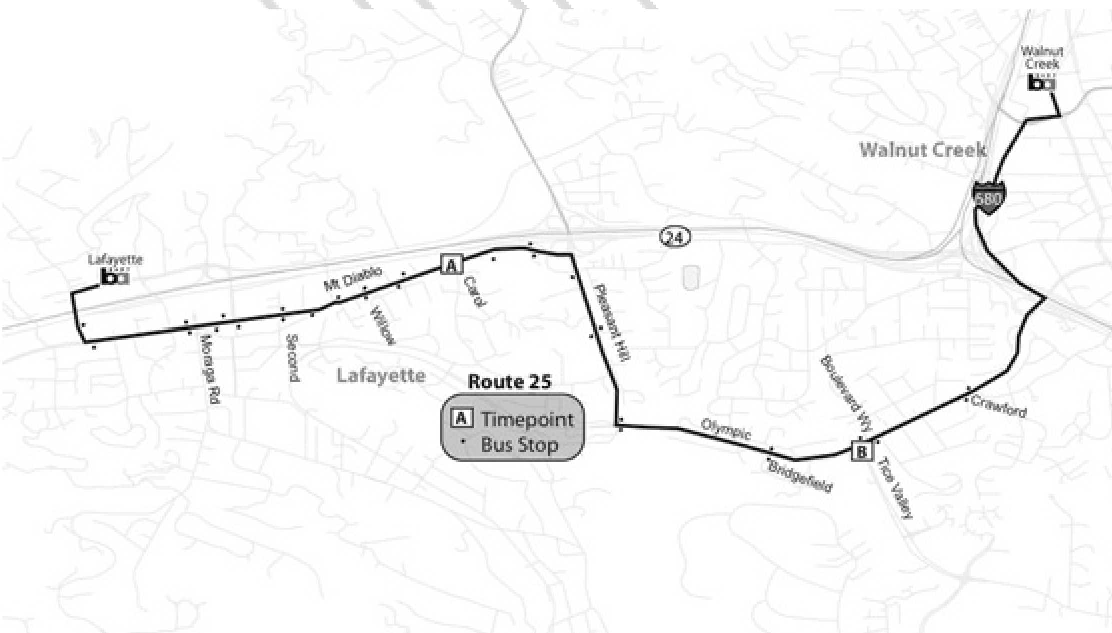


Figure 32: County Connection Route 25 map, source: countyconnection.com

According to the Central Contra Costa Transit Authority's *Mini Short Range Transit Plan (FY 2013-14 through FY 2022-23)*, both of these routes are underperforming compared to other County Connection routes. Route 6 is 43rd of 63 of County Connection's routes with 13.7 passengers per revenue hour. Route 25 ranks even lower with 5.3 passengers per revenue hour, putting it at 62nd of 63 routes.

The cost per passenger is high for each route. Route 6 again performs better than Route 25, but worse than most County Connection routes. Route 6 costs $4.65 per passenger, 46th of the 63 County Connection Routes, while Route 25 is second to last at $12.79 per passenger.

Lamorinda is the least densely populated incorporated area in County Connection's service area, according to the Central Contra Costa Transit Authority's *Short Range Transit Plan 2016-2025*. In large part because of this low density pattern, Route 25 does not meet County Connection's performance standards of 15 passengers per revenue hour and $8.50 per passenger. Route 6 is just shy of the passengers per revenue hour standard and surpasses the cost per passenger standard.

Despite low ridership trends overall, both routes have grown ridership to downtown destinations in the last five years (Figure 33).

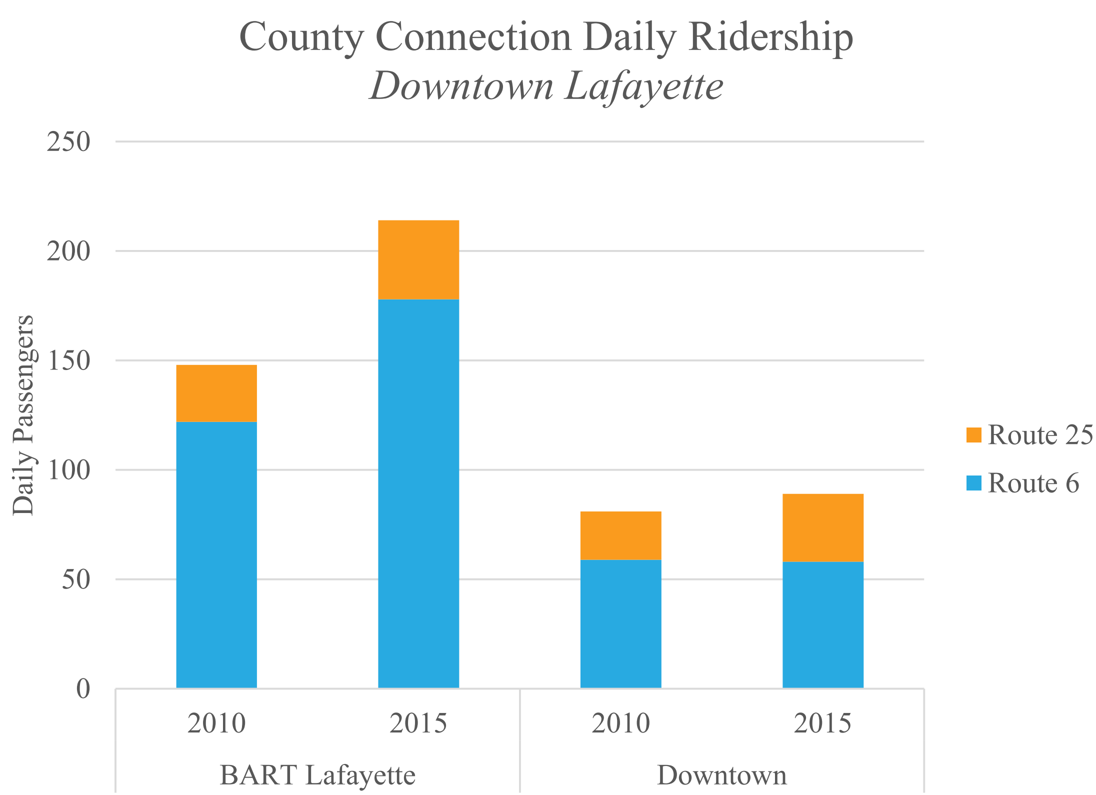


Figure 33: County Connection Ridecheck Plus, Ridership by Route and Stop for Routes 6 and 25 provided by County Connection

4.2 Parking

There are approximately 5,445 parking spaces in off-street parking lots (4,390 spaces) and on-street spaces (1,055 spaces) in the downtown study area. This total encompasses all on-street and off-street parking, including spaces and lots owned by both private businesses and public entities, such as the City, the Lafayette School District, or BART. The majority of the off-street parking spaces are private (4,062 spaces, 93%), with only a small percentage available to the public with no parking fees or time restrictions (328, 7%). There are 308 short-term metered spaces (less than two hours) located on Mount Diablo Boulevard, Moraga Road, Oak Hill Road, Plaza Way, and Golden Gate Way. Long-term metered spaces (12 hours) typically for BART patrons are located under SR 24 on Oak Hill Road, Happy Valley Road, and 1st Street. 50 percent of the timed on-street spaces have a two-hour time limit.

There are two primary sources of parking data:

- The City of Lafayette's *Parking Analysis for the Downtown Core* (2011). This parking study included a count of the parking supply, an occupancy survey of short-term on-street metered and non-metered parking spaces, and a parking demand assessment of off-street parking lots to identify if the parking supply meets the City's parking standards. An occupancy survey of off-street parking lots was not conducted in this parking study. The on-street occupancy survey included three time periods: 10:30 AM, 2:30 PM, and 6:30 PM.

  A parking occupancy survey for a sub-set of off-street parking lots and on-street spaces was conducted in August and September 2014. The occupancy survey included five time periods: 5 AM, 9 AM, 12 PM, 4 PM, and 8 PM. The on-street inventory totaled 1,357 spaces. The off-street lots total 1,982 spaces and included the following:

  1. BART parking lots (three) = 1,566 spaces (south = 120 spaces, main = 872 spaces, lot east of Oak Hill = 574 spaces)
  2. Gazebo lot (Mount Diablo Boulevard) = 32 spaces
  3. City owned Moraga Road lots = 37 spaces
  4. Mercantile Capital lot (Mount Diablo Boulevard) = 188 spaces
  5. Corner of Oak Hill Road and Mount Diablo Boulevard = 9 spaces
  6. Town Center lot = 105 spaces
  7. Pac Bell (permit) = 45 spaces

The below maps from the 2011 study show on-street parking during the most congested peaks (Figure 34, Figure 35, and Figure 36) and show the estimated demand based on the City's parking standards for off-street parking (Figure 37).

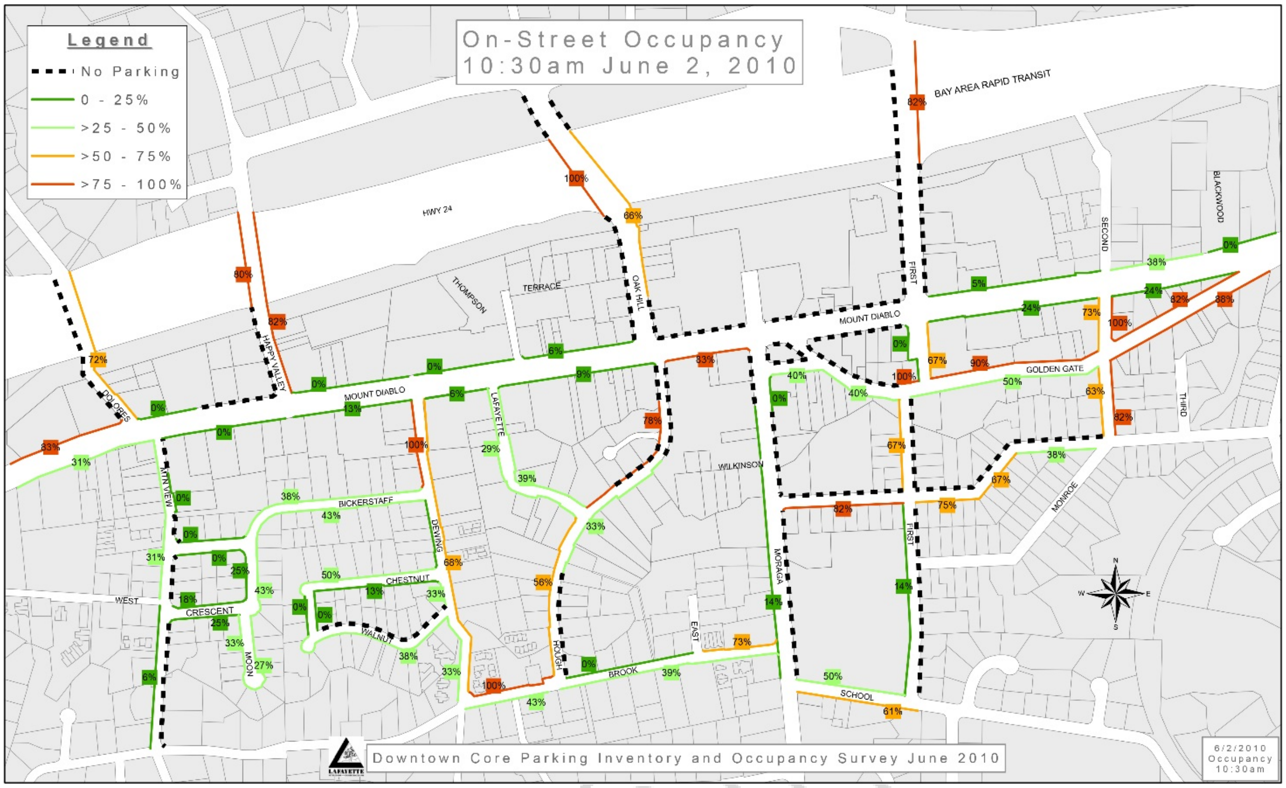


Figure 34: Morning On-Street Occupancy, Parking Analysis for the Downtown Core *(2011)*

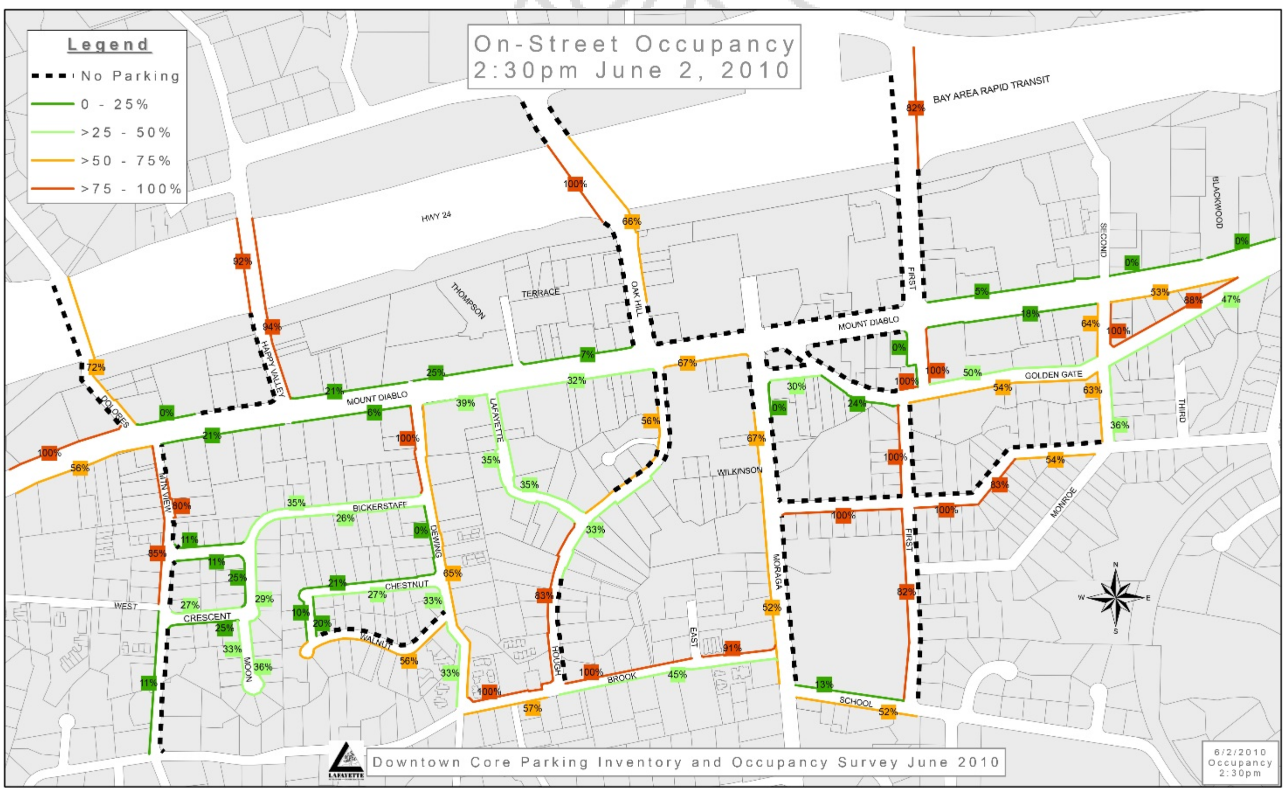


Figure 35: Mid-Afternoon On-Street Occupancy, Parking Analysis for the Downtown Core *(2011)*

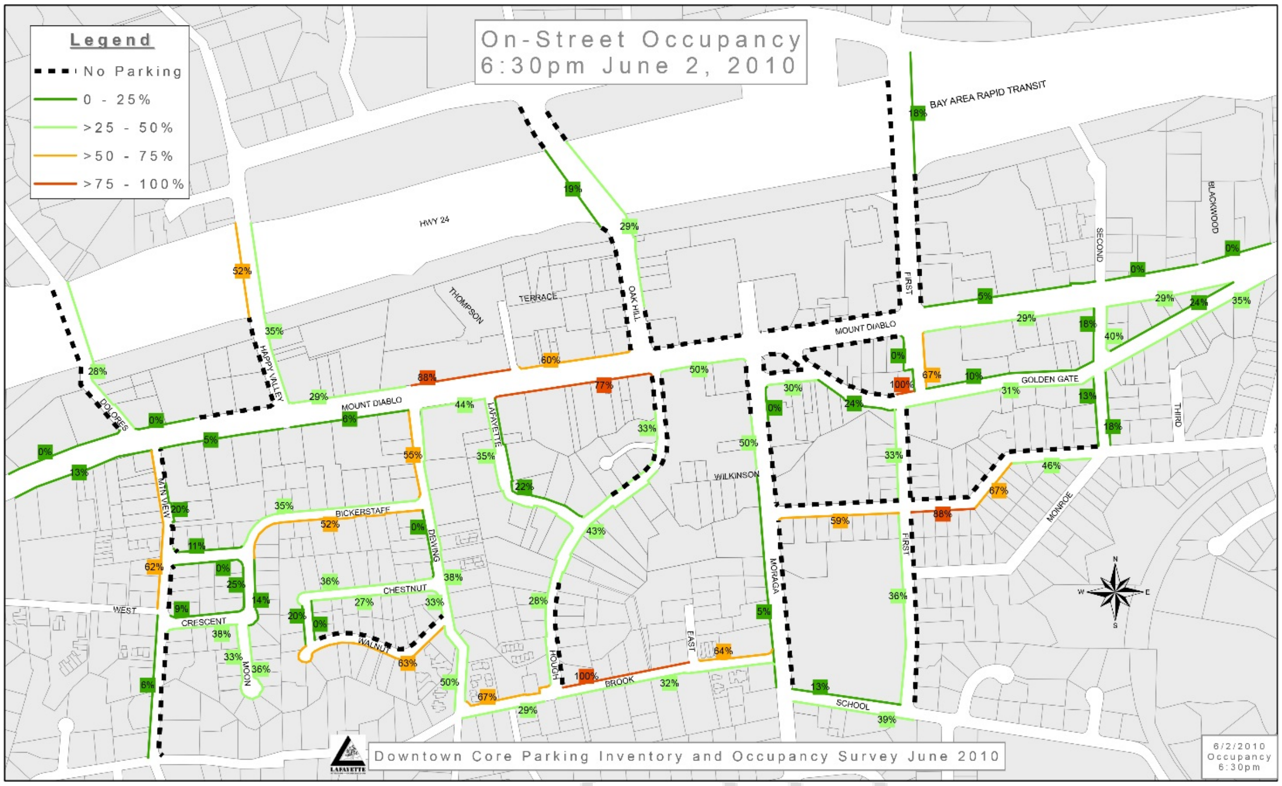


Figure 36: Evening On-Street Parking Occupancy, Parking Analysis for the Downtown Core *(2011)*

Figure 37: Off-Street Parking Survey, Parking Analysis for the Downtown Core *(2011)*

Averaging occupancy for all on-street parking spaces, Figure 38 shows that peak parking never exceeds a 50 percent average occupancy across Downtown. While some on-street parking locations may be heavily occupied, others experience a lower occupancy that causes an average occupancy of under 50 percent. The occupancy rates for the major off-street parking areas along Mount Diablo Boulevard were not collected in these studies. However, field observations indicate that the parking lots are heavily utilized. Without additional data, off-street occupancy rates cannot be determined with confidence.

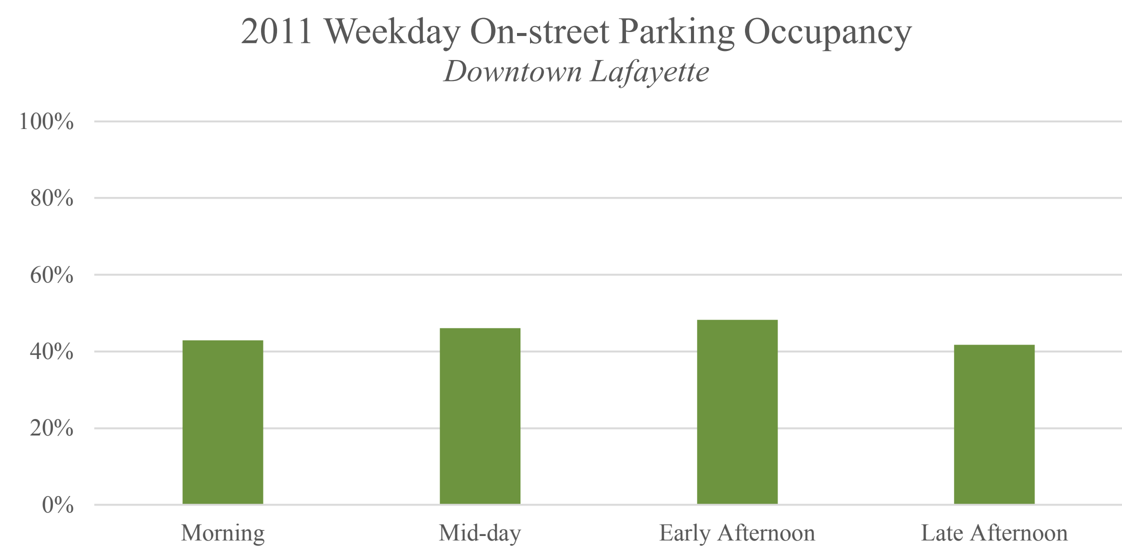


Figure 38: Compiled data from the Parking Analysis for the Downtown Core (2011)

The 2014 study revealed similar parking occupancy trends. Figure 39 shows the on- and off-street parking occupancy for a typical weekday. The on-street occupancy mirrors the 2011 study. The off-street parking shows occupancy around 85 percent during the mid-day. However, these numbers include the BART parking lots, which typically operate at close to 100 percent occupancy.

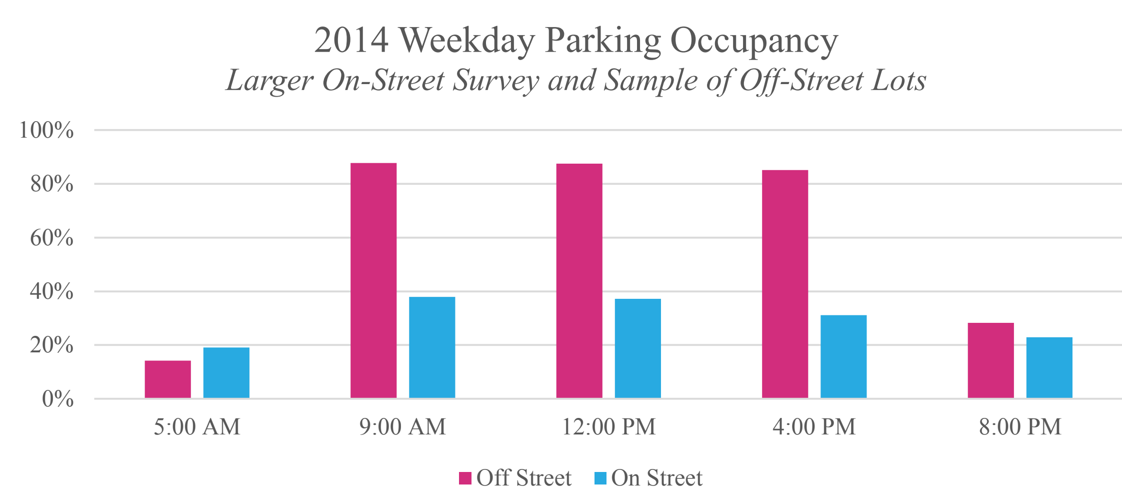


Figure 39: 2014 Weekday Parking Occupancy

Figure 40 removes the BART parking. This shows off-street parking demand in the non-BART parking lots as closer to 60 percent occupancy in the mid-day.

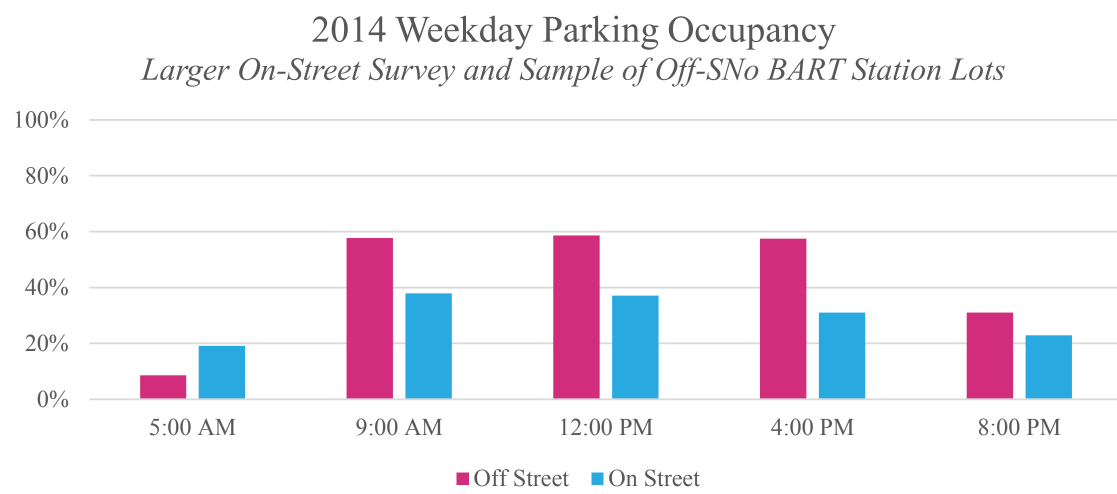


Figure 40: Weekday Parking Occupancy (No BART parking lots)

The major parking findings include:

- Parking in Downtown is unevenly distributed. Some of the private parking lots near the major retail generators are heavily utilized between 85-100%, but some off-street parking lots have capacity and most of the on-street parking is underutilized.
- These results indicate the attractiveness of free off-street parking. The StreetLight origin-destination data indicates that a high percentage of vehicle trips, approximately 50 percent, have an origin and a destination within the downtown retail area along Mount Diablo Boulevard. This finding suggests that drivers are making a large number of short vehicle trips along the corridor to access various parking lots.

However, the following caveats must be considered for both the older study and for the more recent inventory.

- The 2011 study area includes parking just west of Dolores Drive to parking just east of 2nd Street and parking on Oak Hill Road south to parking on School Street. This study area is more geographically concentrated than the 2014 study area.
- The 2011 off-street parking demand was estimated per the City's Parking Code and not empirically measured whereas the on-street parking is comprehensive within the bounds of the study area.
- The 2014 study area is broader than the 2011 study area, extending all the way from Risa Road to Viela Court, east of Pleasant Hill Road.
- The off-street parking inventory includes a sample of only nine lots, excluding some of the most highly congested lots, such as those in front of popular grocery stores.

- The on-street parking inventory includes most but not all parking within the study area, most prominently excluding Mount Diablo Boulevard.

Despite these caveats, it can be concluded that off-street parking is heavily utilized but on-street parking is largely underutilized.

4.3 Safety

According to SWITRS data, over a ten-year period from early 2004 to late 2013, 204 traffic injury collisions were reported within Lafayette city boundaries, excluding collisions on SR 24.[5] While most of these injury collisions involved no severe injuries or fatalities, seventeen were severe injury collisions and seven involved traffic fatalities. Figure 41 shows the severity of injury collisions in Lafayette.

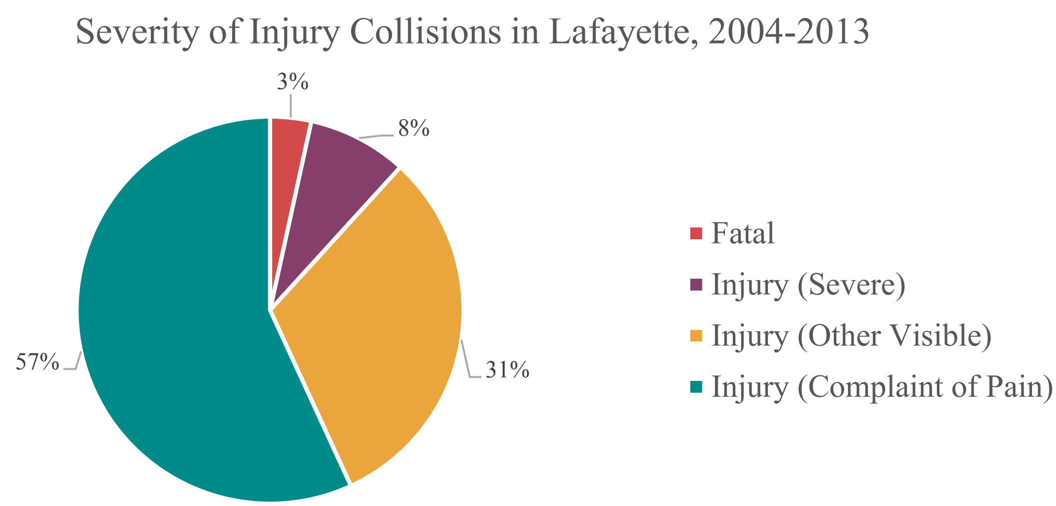


Figure 41: Severity of Collisions, SWITRS

All the collisions that involved fatalities or severe injuries in the Downtown area involved a vulnerable road user. Of the seven traffic fatalities in Lafayette during this ten-year period, two were in the Downtown area. The first fatality occurred in 2007 when a speeding driver hit a pedestrian at Brown Street and Hall Lane. In the other traffic fatality, a motorcyclist died just north of the BART station parking lots at the intersection of Deer Hill Road and North Thompson Road. The citation issued was "Automobile Right of Way."

Seventeen collisions resulted in severe injuries in Lafayette with four of these incidents located in the Downtown area. Two pedestrians were injured in 2005 due to unsafe backing up on 2nd Street and in 2007 due to improper passing at Mount Diablo Boulevard and Dewing Avenue. The other two severe injuries involved bicyclists. Figure 42 plots the fatal/severe and non-severe accidents across Downtown.

[5] Collisions involving property damage only and no injuries are not reported in the SWITRS database.

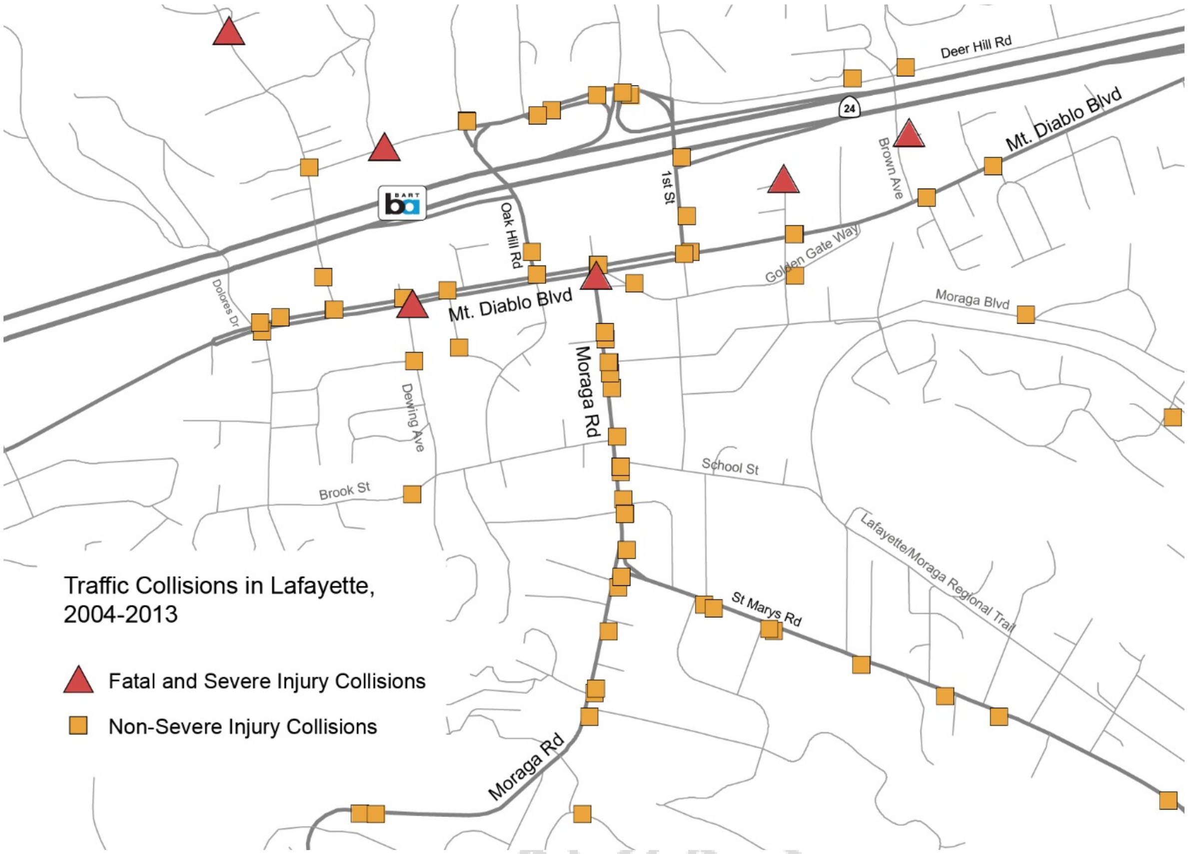


Figure 42: Traffic Collisions in Lafayette, 2004-2013 (SWITRS)

Vulnerable road users (pedestrians and bicyclists) are significantly overrepresented in injury collision statistics. First, SWITRS data show that vulnerable road users involved in an injury collision tend to be located in the Downtown area. Citywide, there were 46 injury collisions involving bicyclists or pedestrians during the ten-year timeframe. Two-thirds, or 29, of these collisions occurred in the Downtown area, as shown in Figure 43. Just over half of the collisions were pedestrians, and the rest were bicyclists.

Second, within the Downtown area, vulnerable road users are overrepresented in injury collision data. Of all injury collisions in the ten-year period, 32 percent of all incidents involving bicyclists or pedestrians. By comparison, traffic counts at the Mount Diablo Boulevard and Moraga Road intersection show 89 bicyclists and pedestrians and 3,394 vehicles in the evening peak period. In other words, 97 percent of traffic are vehicles and only 3 percent are bicyclists or pedestrians, yet bicyclists and pedestrians are involved in a large portion of injury collisions.

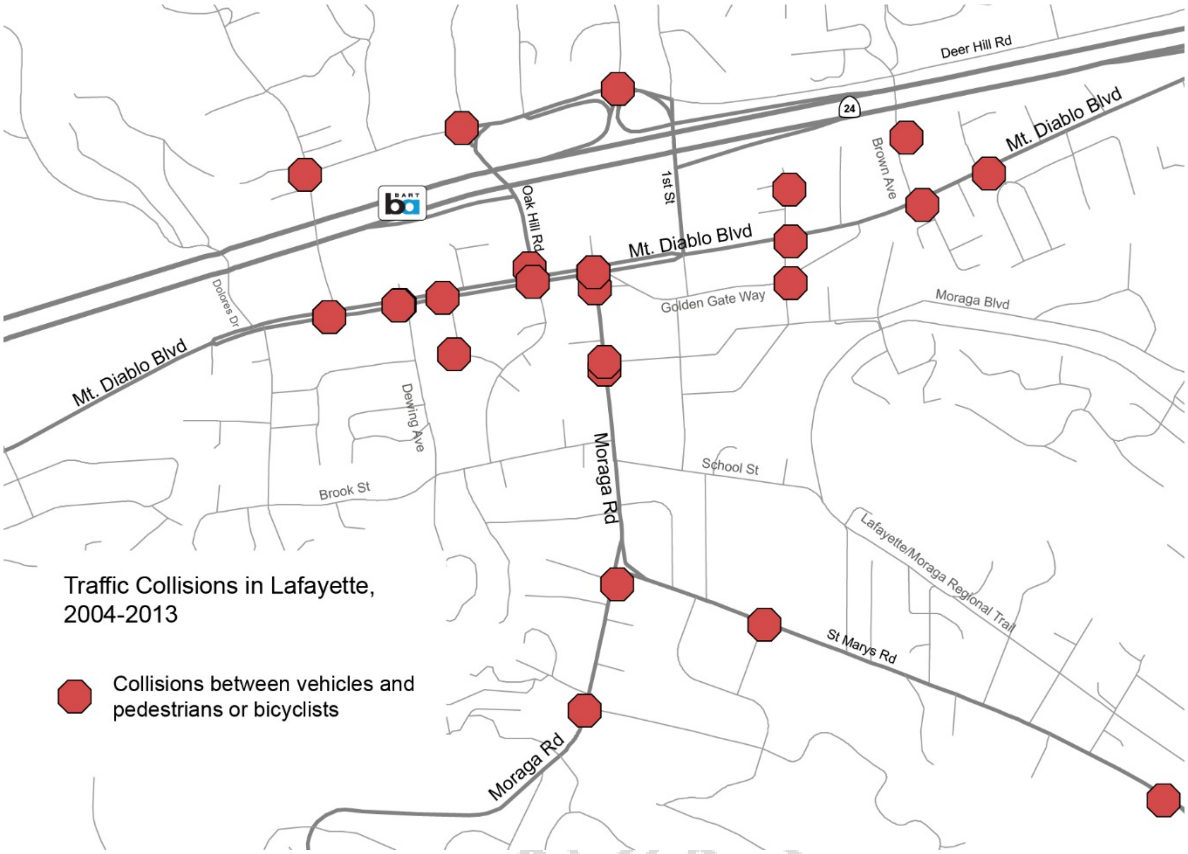


Figure 43: Collisions between Vehicles with Pedestrian/Bicyclists (SWITRS)

In a third of the injury collisions in Lafayette over the ten-year period, a violation for driving at an unsafe speed was issued. Following this violation, three other violations were common. Drivers who violated the right of way were involved in 12 percent of the collisions, drivers who turned improperly made up 10 percent of the collisions, and violations at traffic signals or traffic signs were also 10 percent of the incidents. A more complete list of violation categories in detailed in Figure 44.

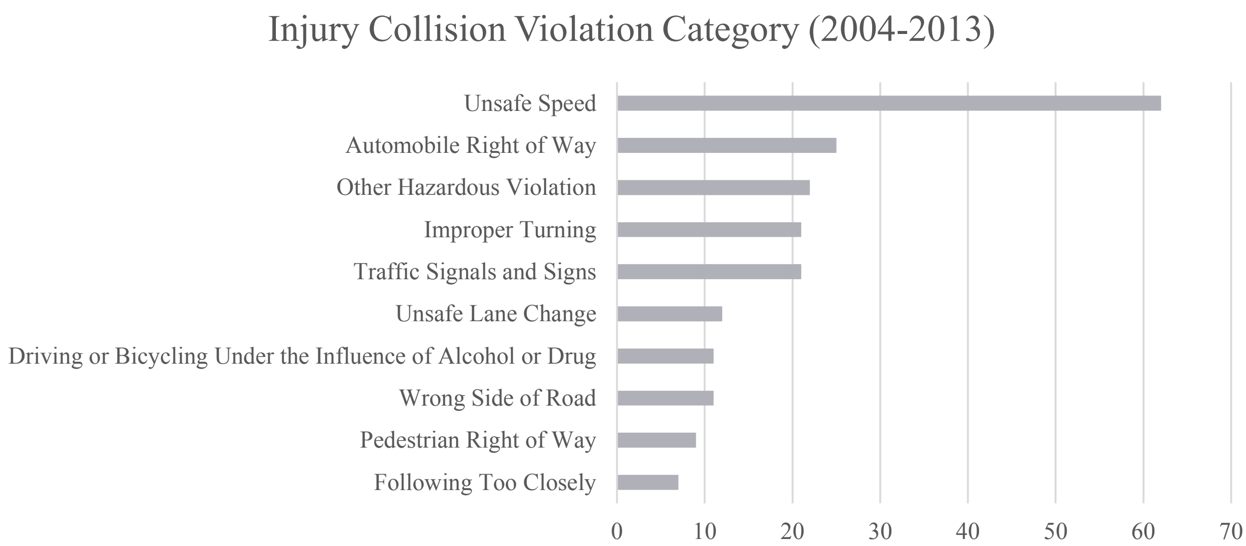


Figure 44: Collision Violation by Category, SWITRS

Figure 45 shows injury collisions by time-of-day. The largest share of injury collisions, 27 percent, occurred in the evening peak period. By contrast, relatively few collisions occurred in the morning peak period.

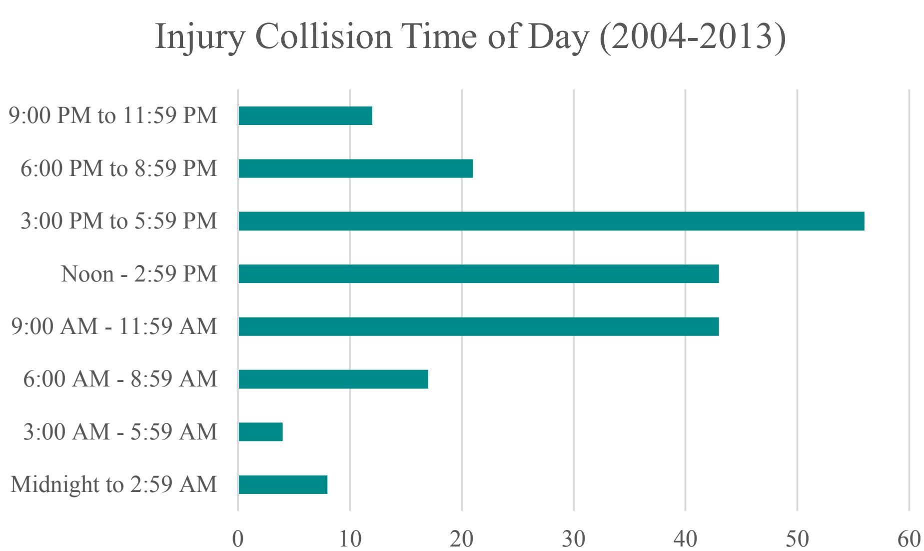


Figure 45: Collision by Time of Day, SWITRS

Citywide, most pedestrians who are involved in a collision were in a crosswalk. Only three of the nineteen collisions involved a pedestrian who was crossing the street not in a crosswalk. Full information is shown in Figure 46. These data show the need for safer conditions for pedestrians.

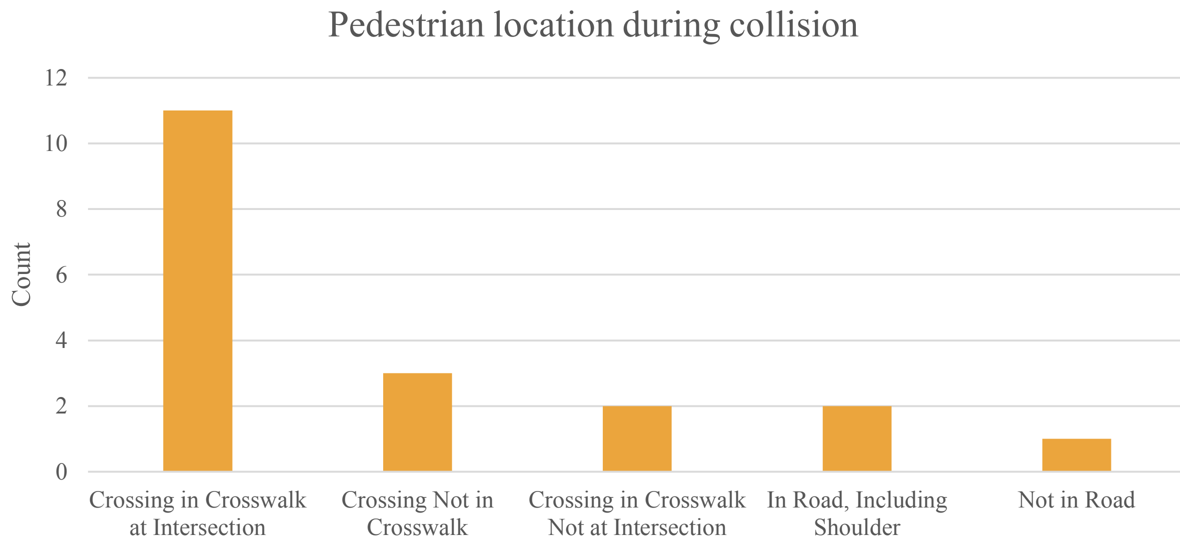


Figure 46: Pedestrian Location During Collision (SWITRS)

5 Traffic Analysis

The traffic analysis for this study incorporates a series of tools and methods to evaluate traffic capacity, intersection performance, travel time, and queuing within Downtown. A traffic microsimulation model of the project study area, the Downtown Lafayette Traffic Model (DLTM), was developed using the software program VISSIM. The DLTM allowed for detailed testing of demand management strategies, traffic signal and coordination changes, and projects to increase the capacity of the roadway network. Traffic microsimulation models analyze how individual users (e.g., drivers, pedestrians, and buses) interact on the transportation system. In addition to the microsimulation model, a Synchro traffic model was also adapted to test signal optimization strategies and to develop traffic “level-of-service” (LOS) results.

The *Downtown Specific Plan* EIR conducted a comprehensive traffic analysis that identified the potential impacts of future development in Downtown. The EIR traffic analysis provides a strong basis for understanding existing and future traffic conditions. The DLTM and the traffic analysis presented in this report builds on this earlier work and is largely consistent with the previous findings. However, some differences between these studies do exist and are the result of differences in the analysis approach. A comparison between the studies is provided and explained later in this chapter.

This section summarizes the model development and calibration, the existing conditions analysis, and the development and analysis of the "future baseline” scenario. The future baseline scenario assumes the future growth within the *Downtown Specific Plan* study area and background growth from *Plan Bay Area* and CCTA travel demand model for areas in Moraga, Orinda, and Pleasant Hill. The future baseline scenario does not assume any additional changes to the local roadway network. The details on the model development are provided in the Appendix.

5.1 Existing Conditions Model Results

The existing conditions DLTM was calibrated to existing traffic volumes and travel times from INRIX. Details on this are provided in the Appendix. Table 1 provides a summary of the range of observed travel times from INRIX and the average from the DLTM. All of the segments are within 10 percent, except for Moraga Road northbound. The INRIX travel times show a lot of travel time variability on this segment, which matches field observations. The DLTM estimates travel times on this segment higher than the average, but within the 95th percentile observed speeds. It is standard practice to have conservative assumptions such as this in modeling to have a higher level of confidence in the analysis of alternatives.

Table 1: Travel time calibration summary

Road	**Section**		**Travel Time (seconds) (3:00–4:00 p.m.)**				**Travel Time (seconds) (4:00–5:00 p.m.)**			
	From	**To**	**INRIX**			**DLTM**	**INRIX**			**DLTM**
			Avg	***5th %ile***	***95th %ile***	**Avg**	**Avg**	***5th %ile***	***95th %ile***	**Avg**
Moraga Rd (NB)	St Marys	Mount Diablo Blvd	112	*58*	*207*	204	97	*69*	*161*	140
Moraga Rd (SB)	Mount Diablo Blvd	St Mary's Rd	69	*53*	*161*	87	68	*47*	*161*	83
Mount Diablo (EB)	Happy Valley Rd	1st St	125	*71*	*207*	129	125	*74*	*221*	124
Mount Diablo (WB)	1st St	Happy Valley Rd	109	*65*	*198*	116	103	*71*	*190*	112

A comparison between the modeled intersection delay from the DLTM and the delay and LOS results in the *Downtown Specific Plan* EIR was undertaken to check the reasonableness of the analysis. LOS (LOS A to F) is a qualitative grade assigned to an intersection based on the estimated delay experienced by drivers. LOS criteria and methodologies are published in the *2000 Highway Capacity Manual* (HCM). Table 2 defines the criteria for each LOS grade.

Table 2: Intersection LOS Criteria

LOS	Signalized Intersections
A	Delay of 0 to 10 seconds. Most vehicles arrive during the green phase and do not stop at all.
B	Delay of 10 to 20 seconds. More vehicles stop than with LOS A, but many drivers still do not have to stop.
C	Delay of 20 to 35 seconds. The number of vehicles stopping is significant, although many still pass through without stopping.
D	Delay of 35 to 55 seconds. The influence of congestion is noticeable, and most vehicles have to stop.
E	Delay of 55 to 80 seconds. Most, if not all, vehicles must stop and drivers consider the delay excessive.
F	Delay of more than 80 seconds. Vehicles may wait through more than one cycle to clear the intersection.

Table 3 presents a comparison of the DLTM results and the HCM LOS results from the *Downtown Specific Plan*. A few observations:

- The DLTM used a microsimulation model, while the *Downtown Specific Plan* used HCM LOS methodologies. These generate different results.
- Microsimulation models are random simulations of vehicle movements throughout a network, which does a better job of estimating queuing between intersections. HCM methods utilize deterministic equations based on observed data. These methods often generate different results.
- The majority of intersections showed similar LOS results between the DLTM and *Downtown Specific Plan* EIR.
- The Moraga Road / Brook Street and Moraga Road / School Street locations were combined in the DLTM because the proximity of intersections are so close.
- The *Downtown Specific Plan* mid-day peak, which captures the peak school activity on Moraga Road, is slightly earlier than the first hour of the DLTM (3:00 – 4:00 PM). Therefore, the LOS results differ.
- The one LOS comparison that stands out is the School Street intersection during the mid-day peak hour. The school pick-up period generates a short, yet intensive travel peak on School Street as part of student pick-up activity. HCM intersection analyses incorporate the delay for the peak 15-minute period, while the DLTM incorporates the average delay over the entire hour. The HCM results reflect the very “peaked” condition associated with school activities, while the DLTM reflects average conditions experienced over the entire hour and during periods when school drop-off has ended.

Table 3: Comparison of LOS Results

Intersection	**DLTM (3:00–4:00 p.m.)**		**DSP EIR (Mid-Day Peak)**		**DLTM (4:00–5:00 p.m.)**		**DSP EIR (PM Peak)**	
	Delay (s)	**LOS**	**Delay (s)**	**LOS**	**Delay (s)**	**LOS**	**Delay (s)**	**LOS**
Mount Diablo / Risa	17.6	**B**	11.3	**A**	19.3	**B**	9.8	**A**
Mount Diablo / Dolores	18.4	**B**	13.7	**B**	20.3	**C**	17.1	**B**
Mount Diablo / Happy Valley	24.3	**C**	29.3	**C**	25.5	**C**	32.5	**C**
Mount Diablo / Dewing	15.8	**B**	17.2	**B**	15.4	**B**	15.5	**B**
Mount Diablo / Lafayette Circle	11.1	**B**	11.6	**A**	10.6	**B**	7.9	**A**
Mount Diablo / Oak Hill	28.5	**C**	34.0	**C**	27.1	**C**	31.7	**C**
Mount Diablo / Moraga	49.3	**D**	44.4	**D**	40.2	**D**	35.1	**D**
Moraga / Moraga Blvd	34.1	**C**	5.3	**A**	14.3	**B**	4.6	**A**
Moraga / Brook	26.5	**C**	47.1	**D**	19.9	**B**	10.1	**B**
Moraga / School			124.1	**F**			13.1	**B**
Moraga / St Mary's	16.1	**B**	13.9	**B**	8.8	**A**	13.3	**B**
Mount Diablo / 1st	29.2	**C**	35.2	**D**	27.4	**C**	33.7	**C**
Mount Diablo / 2nd	10.0	**A**	8.0	**A**	8.1	**A**	8.2	**A**
Mount Diablo / Brown	11.1	**B**	16.5	**B**	11.4	**B**	11.2	**B**
Deer Hill / 1st	18.4	**B**	11.2	**B**	18.1	**B**	16.4	**B**
Deer Hill / SR24 WB ramps	28.2	**C**	34.7	**C**	26.9	**C**	46.8	**D**

Notes:

The DLTM reports total delay for all vehicles at the intersection. The Downtown Specific Plan utilized methodologies published in the 2000 *Highway Capacity Manual* (Transportation Research Board, 2000).

Source: Arup, 2016; *Downtown Specific Plan* (2012)

Observations from the traffic model were also compared to the vehicular traffic comments provided as part of the Collaborative Maps survey to ensure that the model represents actual traffic conditions. A review of the comments showed that over 50% of all vehicular traffic comments in the downtown study area were within the "Y" which matches the location of the congested areas within the traffic model.

Based on the calibration process and comparisons of traffic volumes, travel times, intersection delay, and resident comments, the DLTM is fit for testing various future demand scenarios and roadway configurations.

5.2 Future Baseline Scenario Development

A future baseline scenario was developed to understand future traffic conditions within the study area. The future baseline scenario assumes future traffic growth within Downtown and in the areas surrounding the City. This scenario does not assume any changes to the transportation network. Therefore, it provides an indication of how conditions could deteriorate without any changes to capacity.

Year 2040 population and employment projections were obtained from the *CCTA Development Forecasts*, *Plan Bay Area*, and the *Downtown Specific Plan*. Table 4 below shows the proposed population and employment growth forecasts from the *CCTA Development Forecasts* for areas in Downtown Lafayette and for other areas of Lamorinda (2010-2040), along with the combined total growth rate proposed to develop the future baseline volume scenario.

Table 4: Population and employment forecasts (2010-2040)

Area	Population Growth	Employment Growth	Total Growth
Downtown Lafayette	32%	15%	24%
Lamorinda	14%	14%	14%
Source: CCTA, City of Lafayette, MTC			

These year 2040 growth rates were applied to the existing traffic zones in the DLTM based on the location of the zone (downtown/internal or external) and the type of trip. For example, through trips that do not stop within Downtown are assumed to increase based on the wider Lamorinda area estimates (14%). Trips with an origin or destination in Downtown or local trips internal to Downtown (both an origin and destination) increase at the downtown rate. The overall weighted average traffic forecast for year 2040 conditions is approximately 18 percent. This is in-line with traffic forecasts for SR 24: daily freeway traffic is expected to increase 20 percent by 2040. This increase could divert additional trips to Mount Diablo Boulevard.

The increment of new additional peak hour traffic in the Year 2040 model is approximately 1,750 vehicle trips within the Downtown area. This is very close to the Cumulative With Specific Plan vehicle trip generation estimate of 1,900 peak hour trips presented in the EIR.

These growth rates were used to develop two future baseline scenarios for testing in the DLTM.

- Near-Term (Existing + 5%): this is a near-term scenario that assumes 5 percent growth.
- Year 2040: this assumes the full 18 percent growth. The analysis indicates that the existing configuration of Moraga Road cannot support this level of traffic growth.

Figure 47 shows the increment of trips in both of the DLTM scenarios.

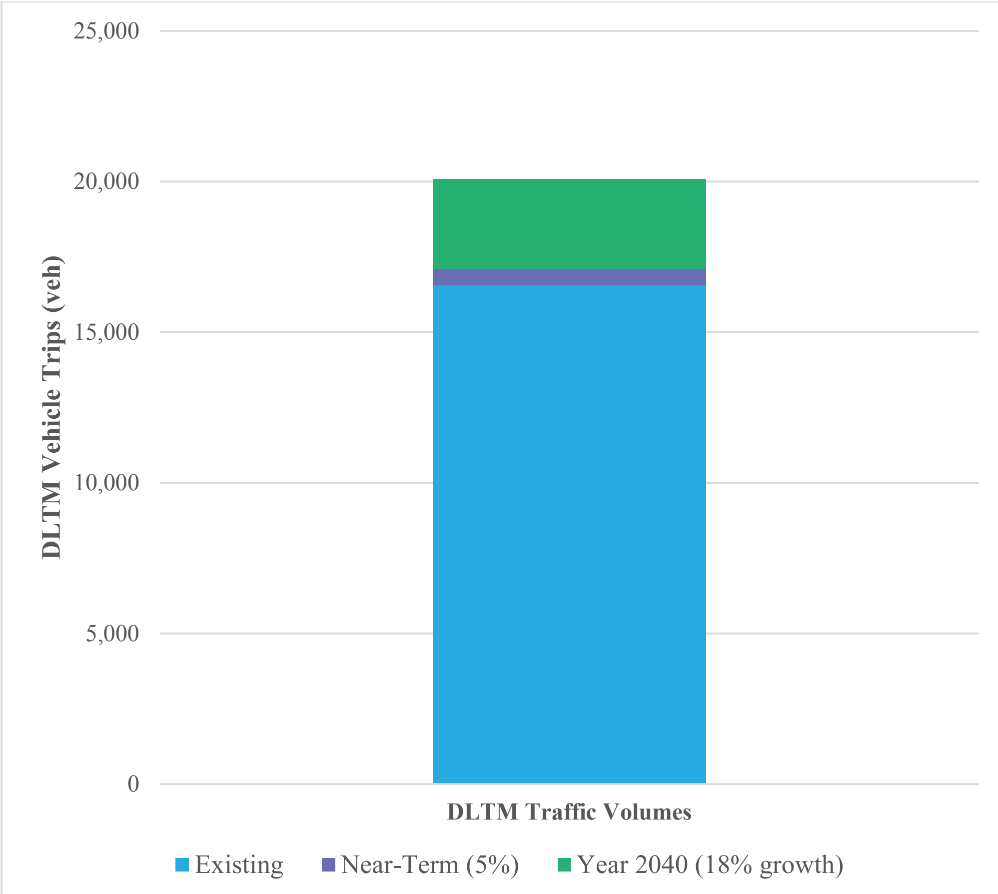


Figure 47: DLTM Traffic Volumes, source: Arup

The future baseline scenarios were modeled using the calibrated existing conditions model and adding in the future traffic forecasts. These scenarios will be used to evaluate the range of projects and strategies in the next phase of the project. Comparing the performance measures between the scenarios will provide an indication of their effectiveness at reducing vehicle delay.

Table 5 compares the DLTM results for the existing and the two future baseline scenarios. The results show the expected decreases in average speed, average travel time, and average delay in the Year 2040 model scenario.

Table 5: Comparison of DLTM Results

Model Scenario	**Speed (mph)**	**Travel Time (seconds/veh)**	**Vehicle Delay (seconds/veh)**	**Vehicles Served (vehicles in 2 hour PM peak)**
Existing	13.27	217	119	16,562
Near-Term (Existing + 5%)	12.60	218	119	17,106
Year 2040	11.16	244	147	18,283
Source: Arup, 2016				

Table 6 compares the future baseline LOS results for a key set of study intersections. These results largely match the LOS results presented in *Downtown Specific Plan* EIR.

Table 6: Comparison of Future Baseline Intersection LOS

Intersection	Existing		Existing +5%		Baseline (2040)	
	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
MDB / Happy Valley	25.5	C	25.3	C	28.2	C
MDB / Oak Hill	28.5	C	28.4	C	31.2	C
MDB / Moraga	49.3	D	49.1	D	51.3	D
Moraga / School	26.5	C	58.6	E	94.0	F
MDB / First	29.2	C	30.0	C	31.7	C
Deer Hill / SR24	28.2	C	29.0	C	25.2	C
Source: Arup, 2016						

The future baseline analysis indicates the following:

- The future traffic increases will cause delay to worsen. In Year 2040, the 18 percent increase in traffic will result in a 36 percent increase in vehicle hours of delay.
- Moraga Road, including the intersections at Mount Diablo Boulevard, Brook Street, and School Street, remains the most critical segment, followed by the 1st Street side of the "Y".
- Other intersections of Mount Diablo Boulevard outside of the "Y" appear to have sufficient capacity and should continue to operate acceptably in the future. However, projected growth of 20 percent on SR 24 could lead to greater diversion to Mount Diablo Boulevard if freeway conditions worsen.
- The Deer Hill Road intersections with the westbound SR 24 ramps and 1st Street will experience considerable congestion and generate queues on the off-ramp that begin to back up to the SR 24 mainline.

The traffic modeling indicates that significant changes to the roadway network and intersection capacity are needed to support future traffic volumes.

6 Transportation and Collaborative Map Surveys

To augment data based analysis and assessment, feedback was sought from local residents through a range of survey tools aimed at gathering community input on transportation issues and to identify priorities for the study. Two survey tools were developed and have been made available along with a project website (www.lafayettecongestion.com):

1. Transportation Survey of issues and priorities (857 responses)
2. Collaborative Map of specific transportation issues (420 responses)

The primary findings from these survey tools are summarized below:

- Congestion is felt to be a major problem in Lafayette with downtown, highway, and school congestion among the most pressing transportation issues.
- The availability and price of parking in Downtown and at the BART station are major concerns.
- Bicycle and pedestrian safety conditions are an impediment to access for non-driving travelers, especially school children.
- Frustrations about growth in the downtown and from Moraga infuse concerns about current and future traffic conditions.

6.1 Transportation Survey

The Transportation Survey was open for two months from November 2015 to January 2016. In total, 961 participants took the survey. Access to the survey was not restricted by email, IP address, or other mechanism, but when the survey was closed, the data was culled to ensure unique responses from duplicate IP addresses. After removing duplicate and unfinished surveys, the responses totaled 857.

The survey was generally representative of Lafayette residents and other groups interested in Lafayette transportation. The majority (82%) of respondents were Lafayette residents, followed by Moraga residents at 9 percent of respondents, Orinda residents at 1 percent, and 8 percent of respondents were from other Bay Area locations. Employment status and percentage of respondents with children in school was generally comparable to the American Community Survey (ACS) numbers for Lafayette. Commuting modal share was also comparable to ACS percentages. The share of school children who walked or biked to school was lower for this survey than the rates for Lafayette Elementary School listed in the *Safe Routes to School Report* (2013), which may suggest lower walking and biking rates for other schools in Lafayette since this survey was not restricted to Lafayette Elementary families.

While respondents indicated that they use a range of modes for commuting purposes, they rely almost exclusively on driving to get to downtown destinations for non-work trips. Most survey respondents (91%) visit Downtown Lafayette frequently (at least a few times per week) for non-work purposes. For such trips, 89 percent of respondents drive alone or with others. No respondents listed County Connection buses as a mode for downtown trips. The remaining travelers visited Downtown by walking (6%) or bicycling (3%).

While an overwhelming 98 percent of respondents rated the quality of life in Lafayette as “excellent” or “good” (Figure 48), over half of residents rated congestion as “severe” or worse (Figure 49).

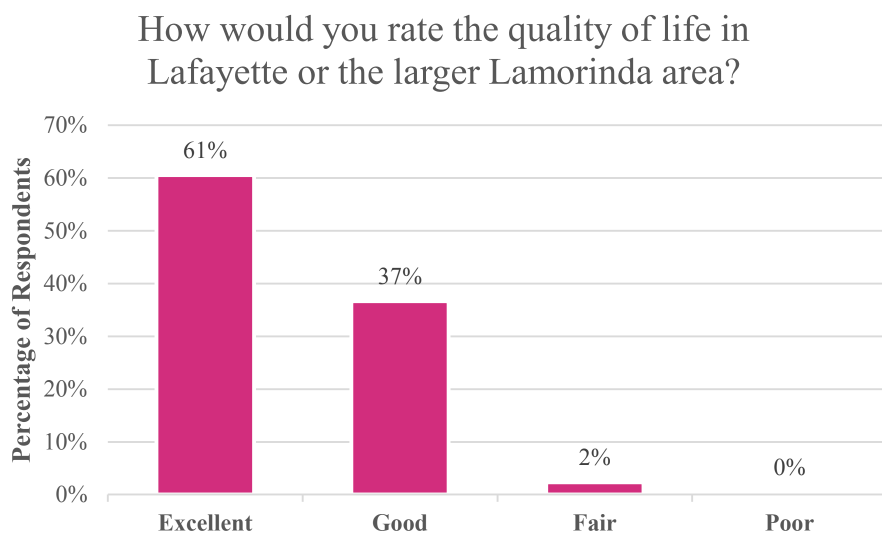


Figure 48: Transportation Survey from lafayettecongestion.com, active November 2015 - January 2016.

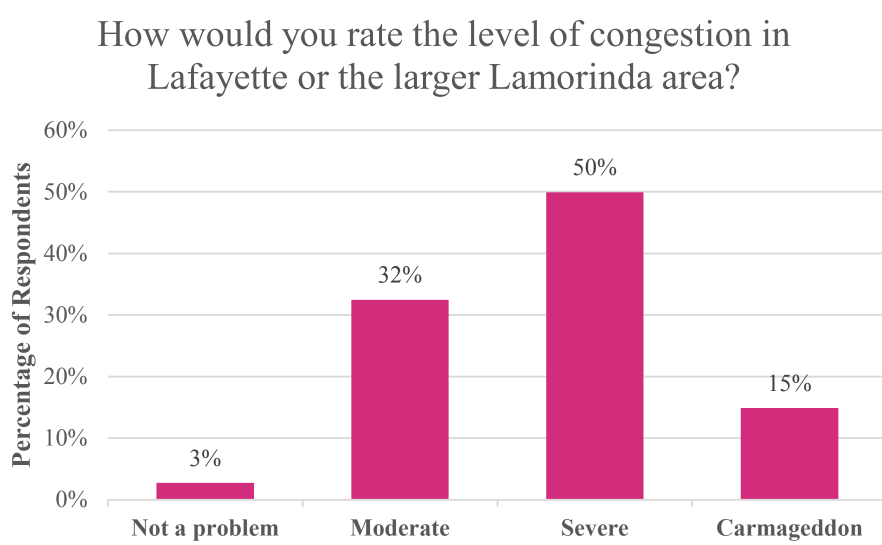


Figure 49: Transportation Survey from lafayettecongestion.com, active November 2015 - January 2016.

For the final multiple choice questions, respondents were asked to choose their highest and lowest three priorities from a list of fourteen options. Respondents did not have the ability to rank among their priorities. Reducing downtown congestion was the clear top priority. Downtown parking, highway ramp access, and school congestion were fairly even second priorities. See Figure 50 below for a full list.

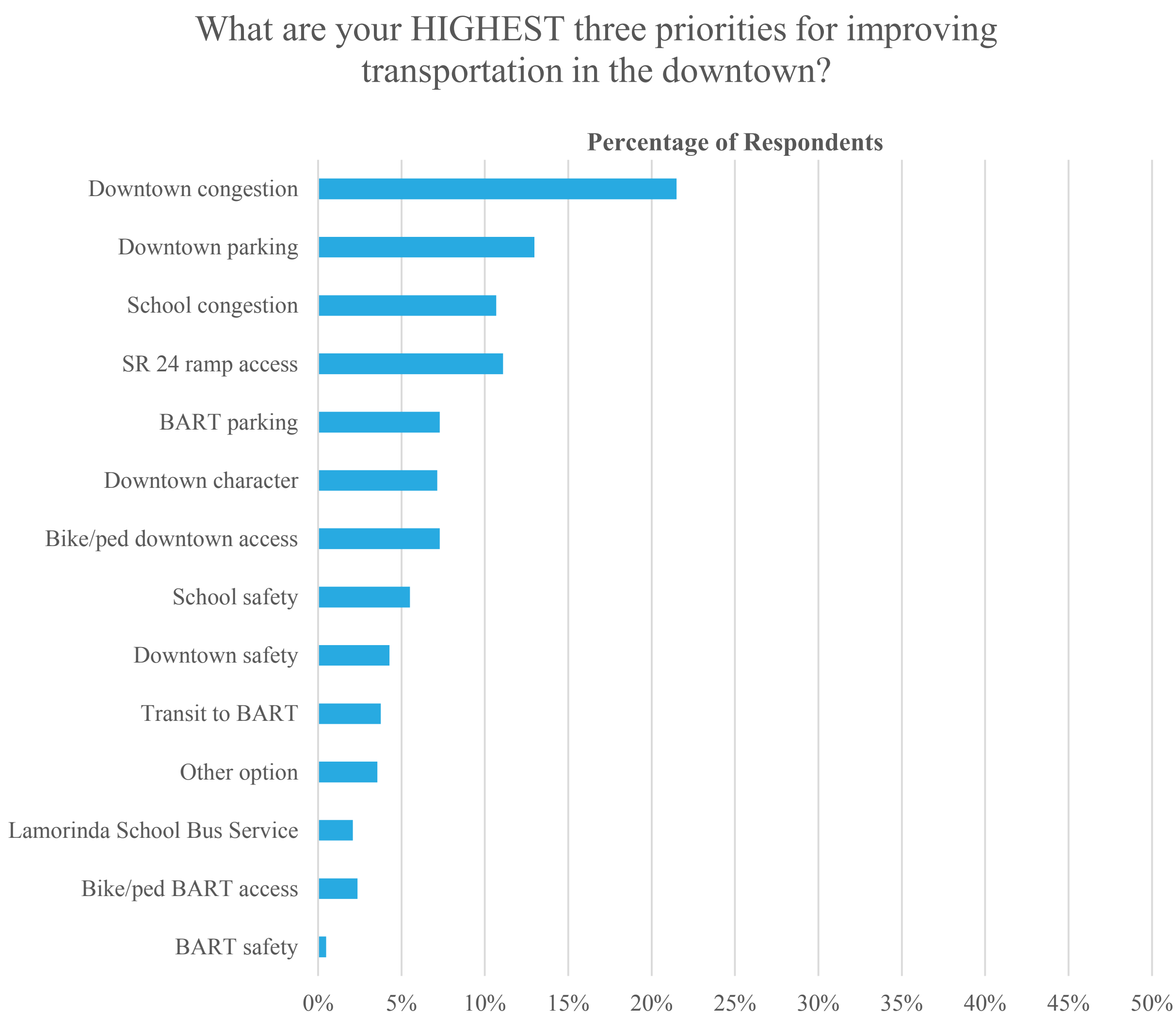


Figure 50: Transportation Survey from lafayettecongestion.com, active November 2015 - January 2016.

While most issues selected as low priorities were not selected as high priorities, school safety was twice as likely to be selected as a high priority than as a low priority (Figure 51).

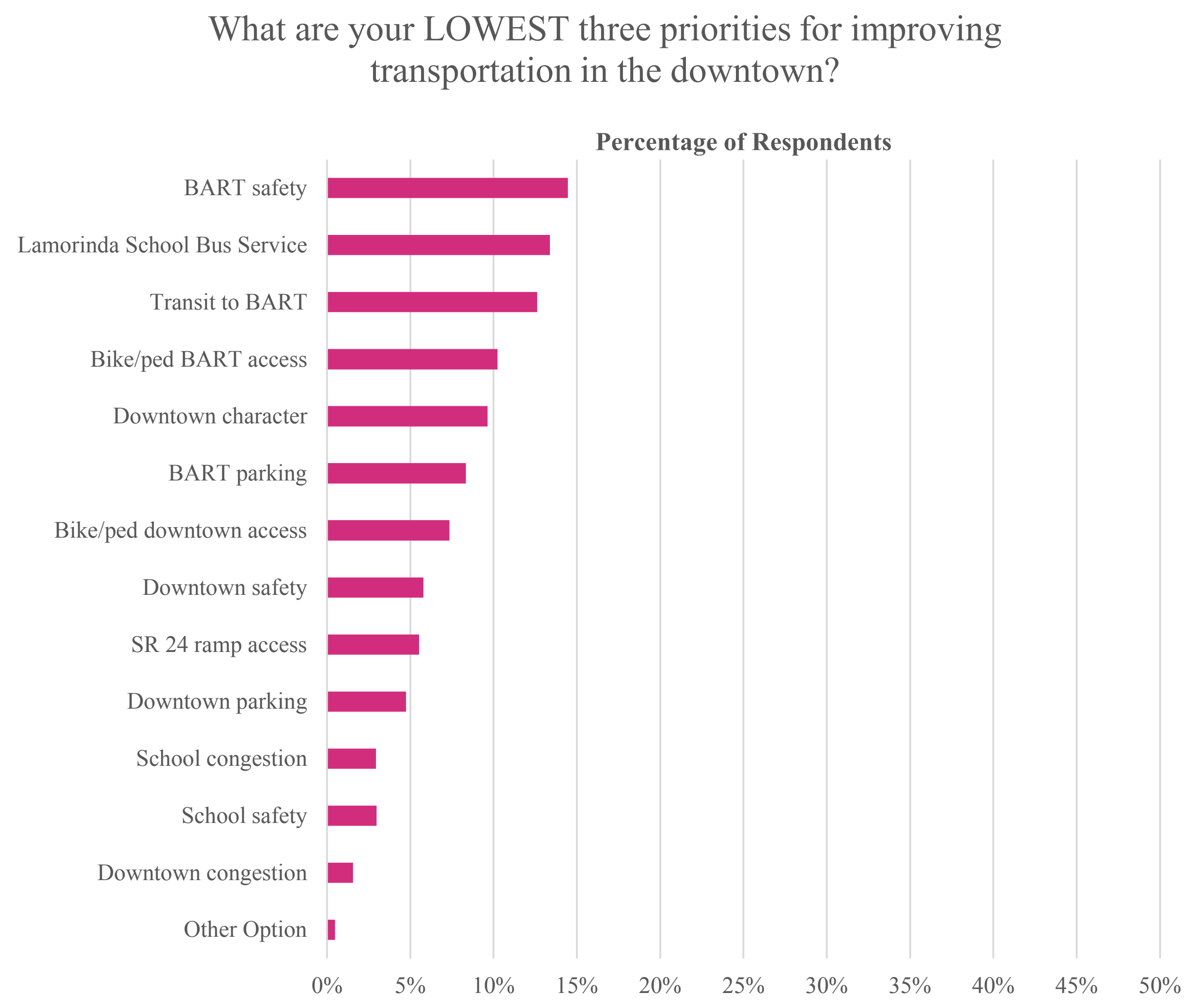


Figure 51: Transportation Survey from lafayettecongestion.com, active November 2015 - January 2016.

Of the 857 survey participants, 45 percent responded to the open-ended question. The responses were coded the responses into eight general categories: parking, growth, biking, safety, walking, transit, school options, and intersections (Figure 52).

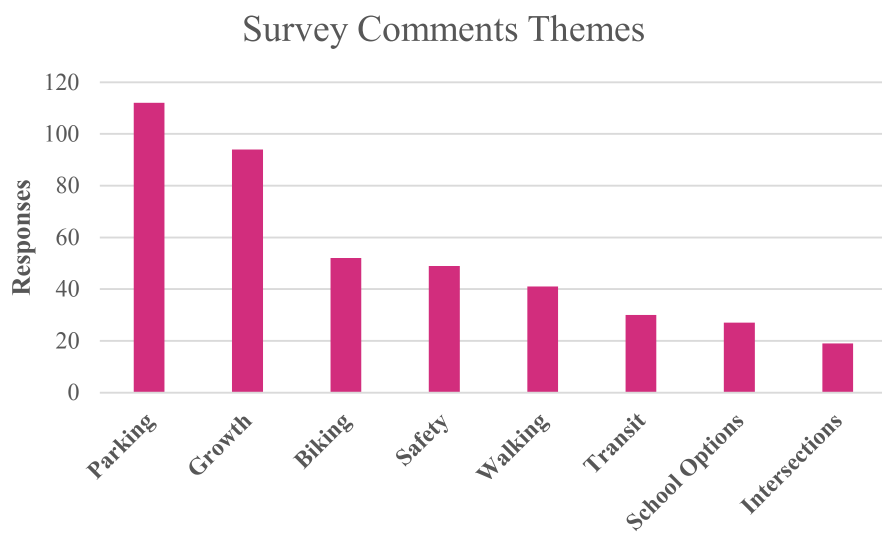


Figure 52: Transportation Survey from lafayettecongestion.com, active November 2015 - January 2016.

Under these themes, these discussions were most common:

1. Parking was the most commonly discussed item. Respondents had negative opinions regarding downtown parking meters and discussed availability problems in specific parking lots. Calls for parking garages were common.
2. Growth was discussed almost as much as parking. Commenters expressed fear that growth will transform Lafayette in part by exacerbating existing traffic issues.
3. Respondents expressed a desire to bicycle, but safety was a prominent concern. There were calls for more bike parking and more direct connections between BART and the Lafayette/Moraga Regional Trail.
4. Safety was a concern in general, especially regarding speeding drivers. Respondents highlighted the area around the schools for needing more safety measures.
5. Respondents expressed an interest in walking, but in safer conditions.
6. The idea of a downtown circulator was frequently mentioned, as was improving County Connection headways.
7. Parents mentioned safer walking and biking routes for their children, and respondents generally mentioned improving bus service.
8. Some respondents commented on intersections, either general operations (such as signal timing) or the design of specific intersections (such as lane striping).

6.2 Collaborative Map Survey

As of January 11, 2016, 131 people provided 420 comments to the Collaborative Maps survey. [6] Most people contributed a few comments, but sixteen people contributed more than five comments each, with one person providing 41 comments and three people providing 25 to 29 comments each. There was no maximum contribution per unique email address set. See Figure 53 below.

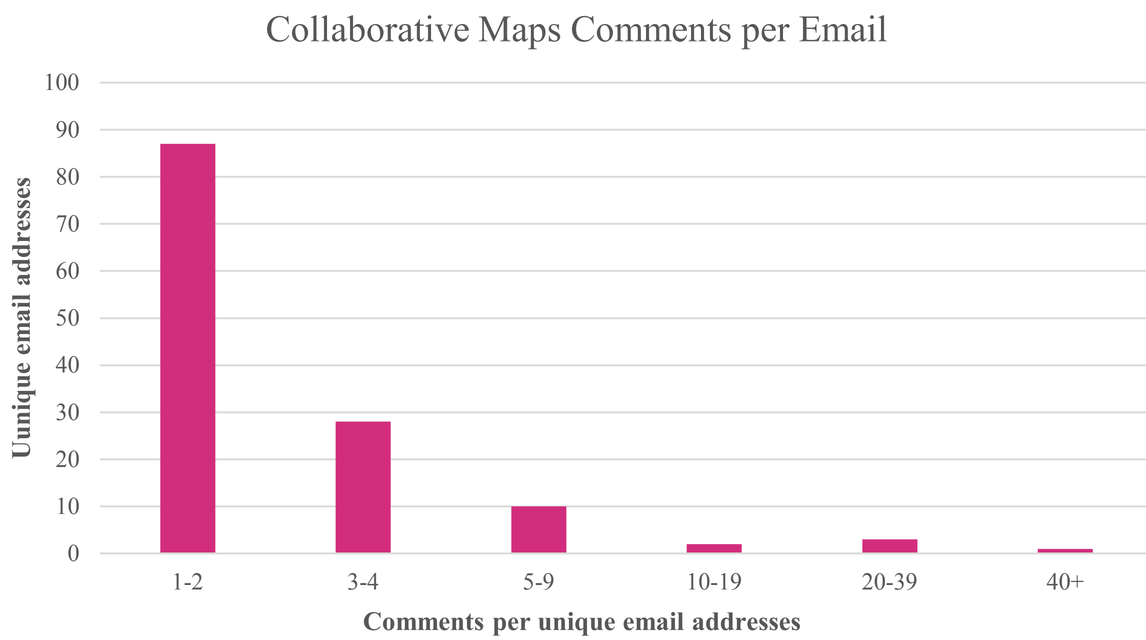


Figure 53: Collaborative Maps Survey from lafayettecongestion.com, active November 2015 - January 2016.

About half of the comments focused on general traffic conditions with pedestrian and bicycling comments falling into second and third, respectively (Figure 54). Comments spanned the spectrum of ideas and observations from the specific ("Need a pedestrian overcrossing here.") to the general ("Put up signage to remind drivers that texting while operating a vehicle is illegal and causes traffic."). Traffic comments focused on Mount Diablo Boulevard and especially Moraga Road. Given that Mount Diablo Boulevard has a higher average daily traffic volume than Moraga Road, the greater density of comments along Moraga Road shows the intensity of the conflicts along that roadway. Emphasizing the importance of Moraga Road, bicycling comments also converged on the stretch of Moraga Road from School Street to Mount Diablo Boulevard. Pedestrian comments, however, spanned the Downtown, showing the need for better walking conditions throughout the study area.

The Collaborative Map comments will be utilized in Phase 2 of the study as the "long list" of projects is screened down to a "short list". The comments will help in this screening process.

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[6] A unique person is actually a unique email address. While one person could use different email addresses to submit repeating comments, the incentive for doing this was low, since we did not limit the number of comments per email address.

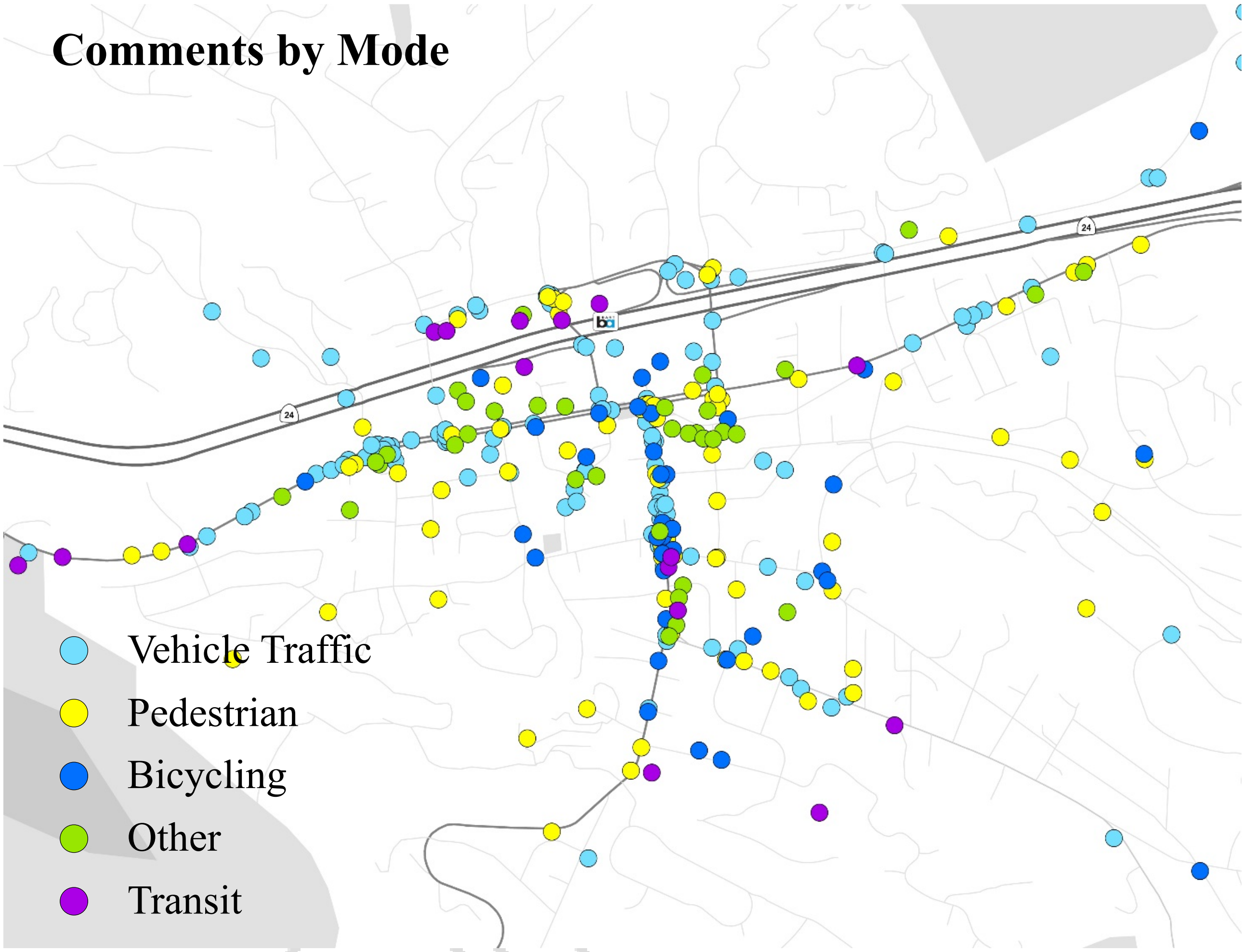

Figure 54: Collaborative Maps Survey from lafayettecongestion.com, active November 2015 - January 2016.

In addition to creating their own comments, participants could engage with other commenters through "agree" and "disagree" buttons. Of the 420 comments submitted to the Collaborative Map, 306 or 73% received "agree" or "disagree" votes. With many of these comments receiving multiple or even dozens of votes, the total vote tally came to 1,421. While most comments had only a small handful of votes, some comments received a large number. The density of votes per comment is shown in Figure 55.

More information on the surveys can be found in the Appendix of this report.

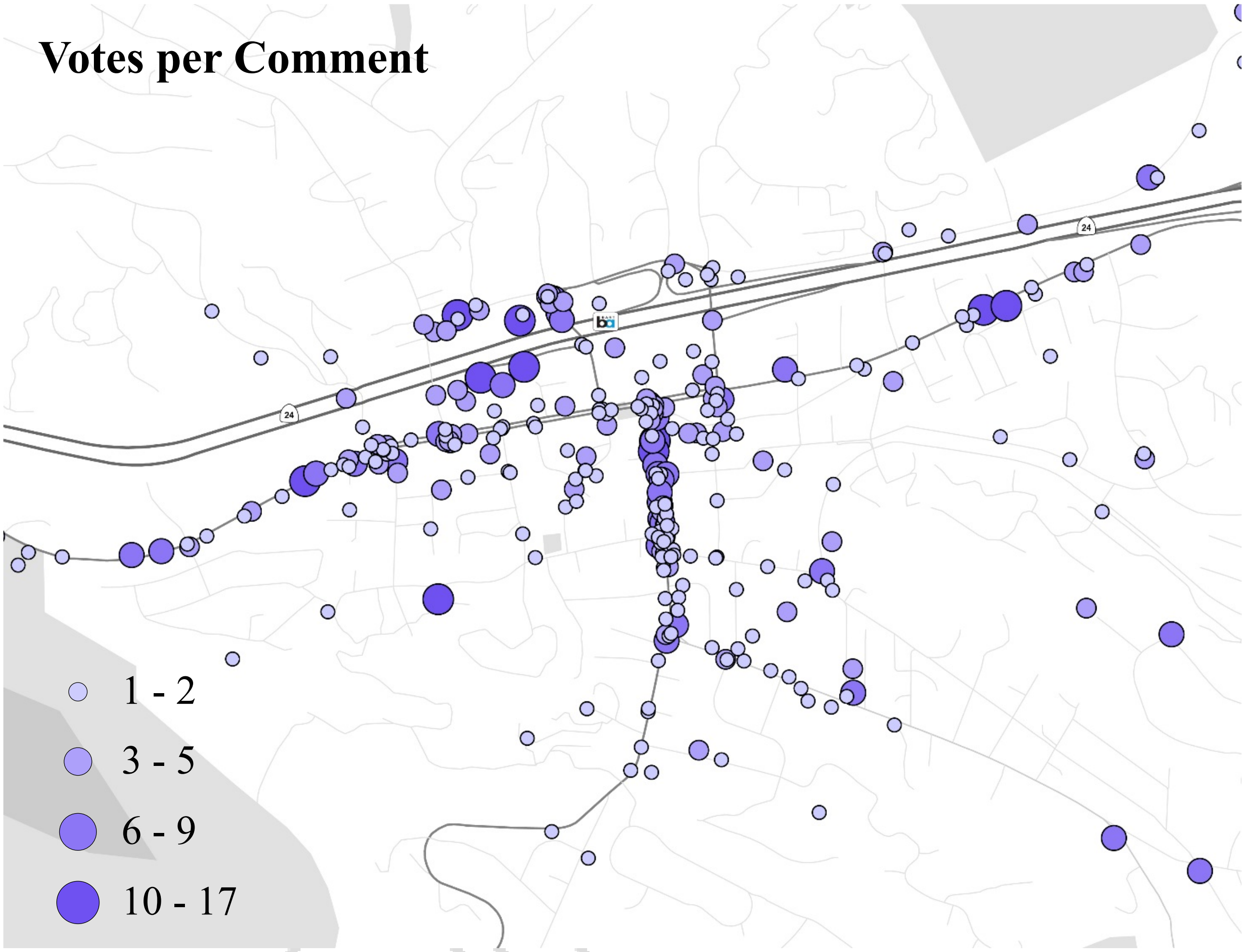

Figure 55: Collaborative Maps Survey from lafayettecongestion.com, active November 2015 - January 2016.

7 Major Conclusions

The survey and background conditions traffic analysis have yielded a number of key findings that will help focus the strategy and project development process. The key findings are summarized below:

- **Congestion, parking, and access to SR 24 are the top issues for residents**. The survey and traffic analysis indicate that the Downtown “Y”, Moraga Road, Mount Diablo Boulevard, and the SR 24 interchange are the top issues. The various analysis sources identify LOS D through F at several intersections during the morning, afternoon, and evening peak hours. However, the congestion bottlenecks are not spread across the entire study area, but are mostly concentrated along Moraga Road between School Street and Mount Diablo Boulevard. Parking availability was also raised in the surveys as a top issue. However, the parking occupancy results provide
- **Residents support better walking and biking conditions.** The Transportation Survey and Collaborative Map Survey revealed a diversity of observations and ideas. In addition to the major issues of congestion, parking and SR 24 access highlighted as priorities, survey respondents discussed the need for friendlier walking environments and more designated bicycle facilities. While the comments spanned the Downtown area, a particularly high number of respondents highlighted walking conditions around the schools as important priorities.
- **The “Y” is a circuitous and inefficient route to SR 24 and BART**. The Downtown “Y” provides the only significant north-south connection between Moraga Rd and SR 24 and the BART station. Vehicles on Moraga Road heading to the freeway must navigate several turn movements to reach the freeway. The “Y” has several closely spaced signalized intersections along both streets, which makes signal coordination and progression challenging for trips trying to access the freeway.
- **Existing congestion levels are moderate but highly variable.** The traffic analysis presented in this study and in previous reports indicates that current congestion levels are moderate (LOS C and D) for most of the day. However, congestion is highly variable and tied to left turns on Moraga Road, peak school activity, the amount of traffic funneled through the “Y”, and the effectiveness of the traffic signal coordination. Traffic signal coordination can be influenced by pedestrian actuation at crosswalks, fluctuations in vehicle demand at minor side-street approaches, and deceleration and acceleration around the high number of driveways serving the commercial areas along Mount Diablo Boulevard.
- **Congestion will worsen in the future given the current growth projections**. The traffic analysis indicates that operations on Moraga Road will degrade and approach LOS F conditions if capacity enhancements and demand reduction strategies are not implemented.
- **Traffic volumes and most of the underlying socioeconomic drivers of traffic demand have stayed relatively constant over the last ten years.** Traffic volumes are actually lower compared to 2000 and have stayed relatively flat for the last decade. Slow population and employment growth, an aging population (lower automobile trip generation rates), flat school enrollments, and higher transit usage (for commute trips) have all played a role. Over the same period, some downtown projects have provided minor capacity improvements and

delivered some pedestrian enhancements. These factors would suggest that traffic congestion has also stayed largely unchanged over this period. However, several factors are offsetting this downward pressure on automobile trip generation, including: additional retail space in Downtown (more retail trips), higher incomes (which drive higher trip rates), and fewer children walking to school (more school trips).

- **BART ridership is up, but local bus transit still underperforms.** BART ridership at the Downtown Lafayette station is up considerably, which has translated into a decrease in the drive alone mode share for work-related travel (BART mostly serves peak period commute trips). The supply of parking spaces has not increased around the station; therefore, the majority of this ridership growth is accessing the station by means other than driving alone (walk, bike, carpool, or local bus transit). The recent increase in County Connection ridership is related to this increase in overall transit ridership. However, the operating performance on the two County Connection routes serving Downtown still lags behind.
- **Parking is an issue in the free off-street lots, but is largely available in the metered on-street spaces.** Parking will remain a significant challenge. Parking concerns rank highly in the survey and the parking data indicate that the free off-street parking lots are largely full during peak times. However, the data and field observations indicate that there are sufficient metered on-street spaces available.
- **Fixing operations for Moraga Road and the section of the "Y" connecting to SR 24 (1st Street side) is key.** The public feedback and the analysis indicates that traffic operations on Moraga Road and sections of Mount Diablo Boulevard and 1st Street that connect to the SR 24 ramps are the biggest issue to solve. The traffic volume using this section of the Downtown "Y" is approximately 800 to 1,000 peak hour vehicles in both directions.

8 "Long List" to "Short List" Preview

This report provides the information necessary to begin the process of screening the "long list" of strategies down to a "short list" for more detailed analysis in Phase 2. Phase 2 will consist of organizing the strategies into three scenarios. The structure and framing of these scenarios and the projects included in each will be determined by the Steering Committee.

The scenarios could be structured to represent a cost continuum (low to high) or could be structured around specific "big ticket" capital projects in key corridors. Many of the smaller capital projects, the demand management strategies and programs, and future technology considerations could be incorporated into one or all of the scenarios.

To help provide a preview of the "long list" to "short list" process, a range of capital projects from low to high cost for Moraga Road and The Downtown "Y" are presented below. These projects provide a continuum of ideas for addressing capacity issues along the two most critical sections of the transportation network. These projects represent only a very small subset of the full range of projects currently under consideration. Projects related to school pick-up/drop-off, and pedestrian, bicycle, and demand management strategies will play a key role in the alternatives analysis. The full list of proposed projects and strategies will be presented to the Steering Committee for consideration during the alternatives analysis phase of the project.

8.1 Initial Project Ideas for Moraga Road and the Downtown "Y"

- **Moraga Road Improvements:** Improvements to Moraga Road are critical for addressing the most concentrated area of congestion in the network. These improvements could include: dedicated southbound left-turn lanes on Moraga Road at Moraga Boulevard and School Street with protected left-turn phasing. The left-turn lane at Moraga Boulevard is likely feasible with the removal of on-street parking. The left-turn at School Street would require some roadway widening and the acquisition of right-of-way. These improvements should increase traffic capacity and improve the operation of existing pick-up and drop-off at the school locations.
- **A more direct "Y" connection between Moraga Road and SR 24 would divert some traffic, simplify circulation, and improve traffic operations.** Several options are under consideration, including (in order of cost and constructability):

  Option 1: One-way Couplet on 1st and Oak Hill. This option would create a one-way "couplet" on 1st and Oak Hill Streets (1st Street would operate one-way northbound between Deer Hill and Mount Diablo and Oak Hill would operate one-way southbound). This would simplify the circulation pattern and signal phasing on Mount Diablo Boulevard and increase capacity. This could be done within the existing right-of-way and provide opportunities for "road diets" or lane reductions on Oak Hill Road and 1st Street. This space could be used for bike/pedestrian facilities and/or parking. Figure 56 presents an illustration of this concept.

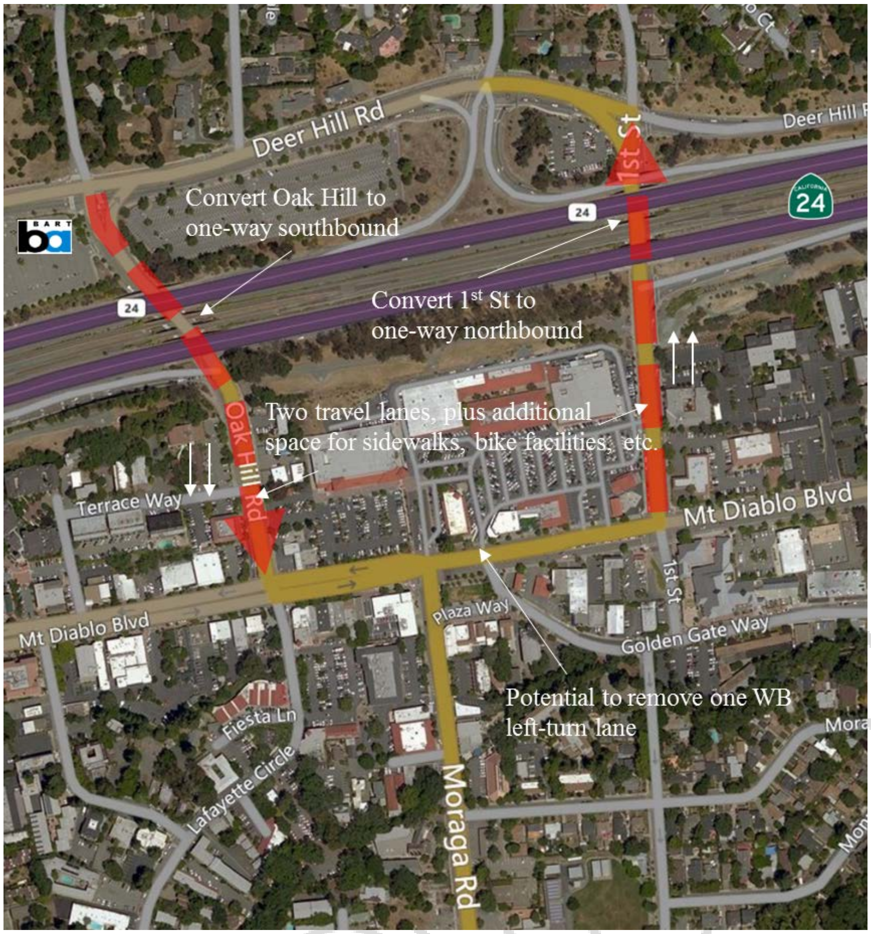

Figure 56: One-Way Couplet

Option 2: The Moraga Road extension and frontage road. This improvement would extend Moraga Road north of Mount Diablo Boulevard (between the Safeway and Whole Foods) and intersect a new eastbound (one-way) frontage road connecting the eastbound SR 24 off-ramp at Oak Hill Road to the eastbound on-ramp at 1st Street. The new road extension would likely require taking part of the McCaulou's clothing store. The frontage road could also include bike and pedestrian facilities. This connection would divert a significant amount of traffic heading to/from the eastbound ramps from Oak Hill Road and 1st Street and help to improve traffic operations at several intersections. This improvement does not provide a significant benefit to traffic heading to/from the westbound ramps that are accessed from Deer Hill Road. This option would provide opportunities for road diets on Mount Diablo Boulevard, Oak Hill Road, and 1st Street because it would divert a significant amount of traffic to the new roadway. Figure 57 presents an illustration of this concept.

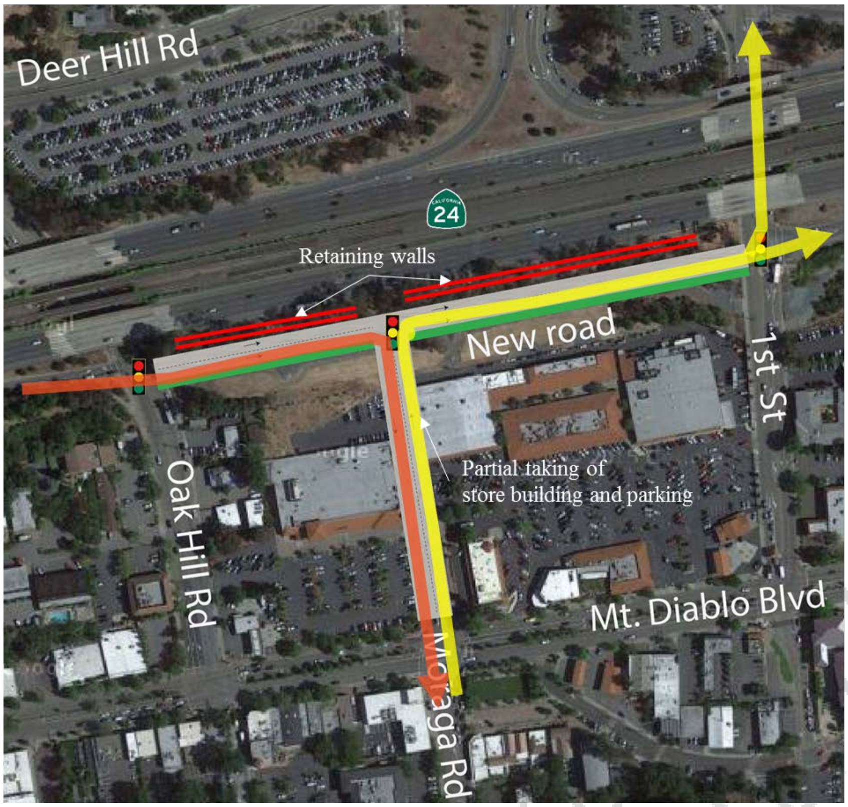

Figure 57: Moraga Road Extension

Option 3: Full Interchange Reconfiguration. The Moraga Road extension described above could be expanded to include a full interchange configuration. This would involve a new undercrossing of SR 24, an extension of Moraga Road to Deer Hill Road, and a reconfiguration of the westbound SR 24 ramps and the BART parking lots. This option would provide significant benefits to traffic heading to/from SR 24 in both directions by providing a direct route to Moraga Road south of Mount Diablo Boulevard. This option also provides another connection to BART and multiple opportunities for bike/pedestrian improvements and road diets. Figure 58 presents an illustration of this concept.

Figure 58: Full Interchange Configuration

Option 4: The Moraga Road Tunnel. This option would provide a tunnel connection from the Moraga Road / St Mary's Road intersection to SR 24 where it would connect to either Option 2 or Option 3 described above. A tunnel would provide clear travel time benefits for Moraga residents trying to access SR 24 or BART. It would have less utility for Lafayette residents as the tunnel would have limited access points and would not connect with Mount Diablo Boulevard. The other options provide a broader benefit to more drivers. Tunnel construction would also be challenging and would require a staging plan that could result in a partial or full closure of Moraga Road. The tunnel facility would require additional space for ventilation, safety/evacuation access points, and other service and maintenance access.

Additional projects and programs to support these core concepts will be presented in the next phase of the project.

9 Appendix

9.1 Appendix: Transportation Survey Results

Question 1: Do you live in Lafayette?

Answers	Count	Percentage
Yes	720	85
No	132	15
Total	*852*	*100*

Question 2: What is your home zip code?

Answers	Count	Percentage
Lafayette	695	82
Moraga	72	9
Other	71	8
Orinda	5	1
Total	*843*	*100*

Question 3: How would you rate the quality of life in Lafayette or the larger Lamorinda area?

Answers	Count	Percentage
Excellent	514	61
Good	311	37
Fair	20	2
Poor	4	0
Total	*849*	*100*

Question 4: How would you rate the level of congestion in Lafayette or the larger Lamorinda area?

Answers	Count	Percentage
Carmageddon	126	15
Severe	423	50
Moderate	275	32
Not a problem	23	3
Total	*847*	*100*

Question 5: Which of the following best describes your working status?

Answers	**Count**	**Percentage**
Work for an employer	396	46
Self-employed	182	21
Retired	148	17
Homemaker	94	11
Other Option	30	4
Student	2	0
Unemployed	1	0
Total	*853*	*100*

Question 6: How many days do you travel to work or school each week?

Answers	**Count**	**Percentage**
Seven	17	2
Six	22	3
Five	420	51
Four	76	9
Three	52	6
Two	36	4
One	16	2
None	189	23
Total	*828*	*100*

Question 7: If you have children who go to school in Lafayette, how do they get to school on a typical day?

Answers	**Count**	**Percentage**
I don't have children in Lafayette schools.	426	52
Drive with me or another family member	244	30
Walk	52	6
They drive themselves	35	4
Ride transit	24	3
Bicycle	25	3
Drive with someone else	14	2
Total	*820*	*100*

Question 8: How many days do you drive to drop off and pick up children from Lafayette schools?

Answers	**Count**	**Percentage**
Zero days, I don't have children, my children don't attend Lafayette schools, or I don't drive children to school.	459	57
Three to five days per week.	250	31
Other Option	54	7
One to two days per week.	49	6
Total	*812*	*100*

Question 9: Where do you work or go to school?

Answers	**Count**	**Percentage**
Lafayette	230	27
Not relevant	151	18
San Francisco	133	16
Oakland	63	8
Other Option	57	7
Walnut Creek	44	5
Moraga	25	3
Concord/Pleasant Hill	29	3
Berkeley	23	3
Orinda	18	2
Danville/San Ramon	15	2
Pleasanton/Livermore	13	2
Other Contra Costa County	12	1
Santa Clara County	8	1
San Mateo County	7	1
Fremont/Hayward	6	1
Other Alameda County	5	1
Total	*839*	*100*

Question 10: How do you typically get to work or school on a given day (the travel mode you're on the longest)?

Answers	Count	Percentage
Drive alone	412	49
Not relevant	145	17
BART	143	17
Work from home	60	7
Other Option	50	6
Carpool/vanpool	21	3
Bicycle	13	2
Walk	11	1
County Connection bus	4	0
Employer shuttle	3	0
Motorcycle	1	0
Taxi or rideshare (Uber, Lyft)	0	0
Total	*835*	*100*

Question 11: If you use the downtown Lafayette BART Station or County Connection, how do you get to the station or bus stop?

Answers	Count	Percentage
Drive alone	311	37
I do not use BART or County Connection.	252	30
Walk	95	11
Other Option	50	6
BART	43	5
Bicycle	37	4
Work from home	16	2
Carpool/vanpool	12	1
Taxi or rideshare (Uber, Lyft)	10	1
Motorcycle	4	0
County Connection bus	4	0
Employer shuttle	0	0
Total	*834*	*100*

Question 12: How often do you go downtown for a non-work-related reason (e.g. to shop, to have dinner, to go to a doctor's appointment, etc.)?[7]

Answers	**Count**	**Percentage**
A few times a week	350	49
Once a day	178	25
More than once a day	117	17
A few times a month	47	7
A few times a year	17	2
Total	*709*	*100*

Question 13: What mode do you use most often to make these non-work-related trips downtown?

Answers	**Count**	**Percentage**
Drive alone	460	65
Drive with others	174	24
Walk	40	6
Bicycle	21	3
Other Option	9	1
BART	3	0
Taxi or rideshare (Uber, Lyft)	2	0
Motorcycle	1	0
Not relevant	1	0
County Connection bus	0	0
Total	*711*	*100*

[7] The survey was updated mid-release to include Questions 12 and 13.

Question 14: What are your HIGHEST three priorities for improving transportation in the downtown?[8]

Answers	Count	Percentage
Reduce congestion and delay in downtown	528	21
Make it easier to find parking in downtown	320	13
Reduce congestion and delay getting to and from SR 24	273	11
Improve circulation near the downtown schools	262	11
Make it easier to find parking at BART	180	7
Improve pedestrian and bicycle access to downtown locations	179	7
Enhance the character, quality, and vibrancy of downtown	175	7
Enhance safety around the downtown schools	135	5
Enhance safety on downtown streets	105	4
Improve public transit options to BART	92	4
Other Option	87	4
Improve pedestrian and bicycle access to BART	58	2
Improve access to Lamorinda School Bus Service	21	2
Enhance safety at the BART station	12	0
Total	*2457*	*100*

[8] Respondents could select three issues for Questions 14 and 15.

Question 15: What are your LOWEST three priorities for improving transportation in the downtown?

Answers	**Count**	**Percentage**
Enhance safety at the BART station	335	14
Improve access to Lamorinda School Bus Service	310	13
Improve public transit options to BART	292	13
Improve pedestrian and bicycle access to BART	237	10
Enhance the character, quality, and vibrancy of downtown	223	10
Make it easier to find parking at BART	193	8
Improve pedestrian and bicycle access to downtown locations	170	7
Enhance safety on downtown streets	134	6
Reduce congestion and delay getting to and from SR 24	128	6
Make it easier to find parking in downtown	110	5
Enhance safety around the downtown schools	69	3
Improve circulation near the downtown schools	68	3
Reduce congestion and delay in downtown	36	2
Other Option	11	0
Total	*2316*	*100*

9.2 Appendix: Model Development

The VISSIM model was coded with the road network, traffic signals, traffic volume inputs and travel routes to produce an existing conditions model of the project study area. The following points summarize the key model development details:

- The traffic model extents encompass the Downtown Lafayette area, including Happy Valley Road, Mount Diablo Boulevard, Moraga Road, 1st Street, Oak Hill Road, and Deer Hill Road. The extents of the model are shown in Figure 59 below.

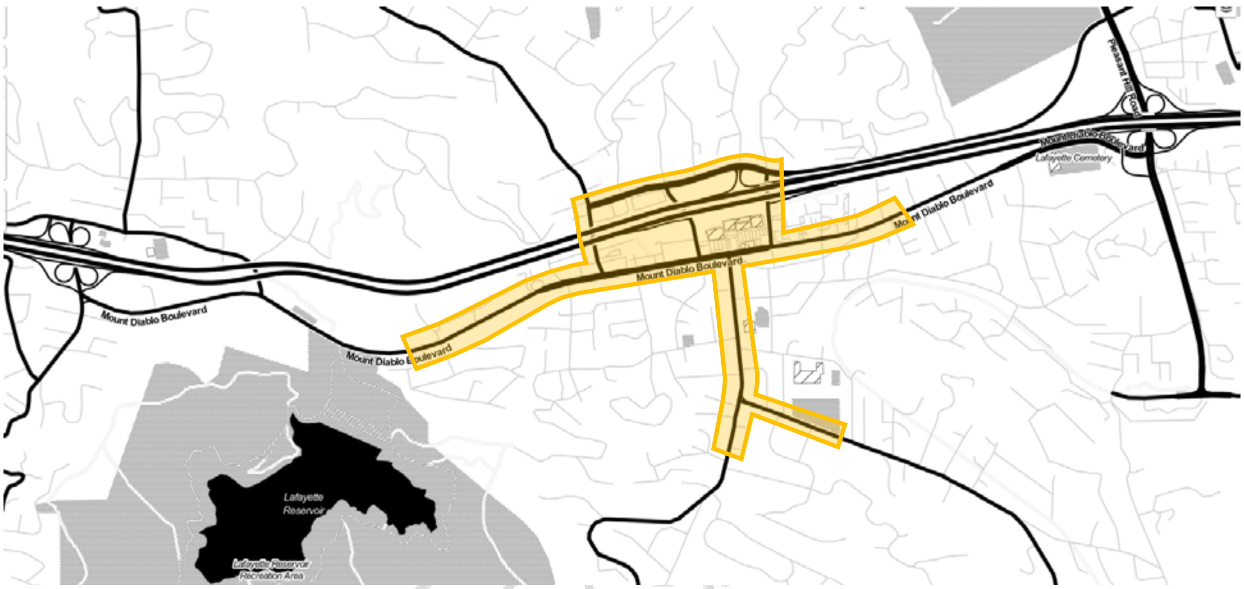

Figure 59: DLTM Model Extents

- The DLTM is a two-hour afternoon (3:00 – 5:00 PM) peak period model with a one-hour warm up period to ensure the model is populated with vehicles prior to the commencement of the assessment period. This two-hour afternoon peak period was selected because it has the highest traffic volumes over the day and the most overall activity across the study area.
- Vehicle and pedestrian traffic volumes have been assigned in 15-minute intervals from the traffic counts at the relevant intersections undertaken in September 2013 and May 2015. Additional sources of traffic data, including site spot counts and observations, have been used to augment the traffic volume data set.
- The turning movement counts and the StreetLight O-D data have been used to assign traffic routes through the study area. These routes are separately assigned for the 3:00 – 4:00 PM and 4:00 – 5:00 PM model periods.
- Travel speeds have been modeled to match posted speed limits in downtown. Localized speed reductions have been applied in school zones.
- Traffic and pedestrian signal operations have been modeled based on the traffic signal plans and site observations. Traffic signals have been modeled with actuated operations and coordination along Mount Diablo Boulevard and Moraga Road.

- Figure 60 shows a screenshot of the VISSIM model with congestion and queuing around the Mount Diablo Boulevard / Moraga Road intersection.

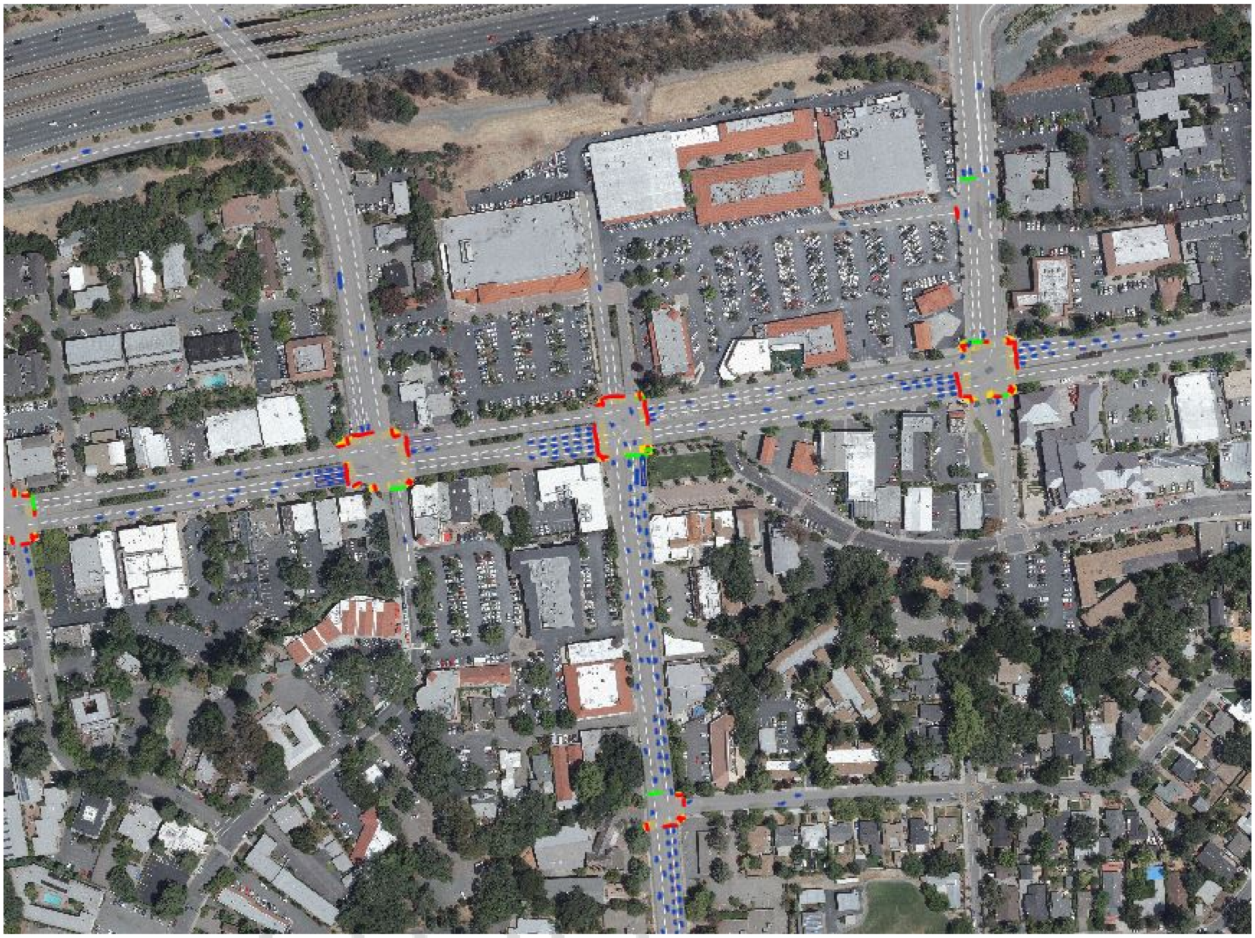

Figure 60: DLTM VISSIM model screenshot

9.2.1 Model Calibration

Model calibration refers to the process of refining the traffic model to adequately represent existing traffic conditions. Calibration is an important step as the model must be able to replicate reality before it can be used to evaluate analysis scenarios. This section details the model calibration process for traffic volumes, travel times, and intersection LOS.

9.2.1.1 Traffic Volumes

The DLTM has been calibrated for traffic volumes against the turning movement counts at each study intersection. Traffic volumes are calibrated using the GEH statistic.[9] The GEH statistic is a standard traffic modeling calibration measure used to evaluate the accuracy of flows given a

[9] The GEH statistic (named for its inventor, Geoffrey E. Havers) allows for a range of model flows to be statistically accurate, instead of comparing absolute or relative flow differences. For example, where an absolute difference of 100 vehicles/hour can be considered significant when compared against 200 vehicles/hour, it is largely insignificant when compared against a flow of 2,000 vehicles/hour.

wide range of observed volumes. The GEH statistic essentially measures the percent difference, but adjusts for the volume on the segment. A GEH less than 5.0 is generally considered an acceptable threshold. A typical performance standard states that 85% of the volumes in a traffic model should have a GEH less than 5.0 and 100% should have a GEH less than 10.0.

Table 7 summarizes the result of the turning movement volume calibration against the observed volumes for each of the one-hour analysis periods. Figure 60 shows the scatter plot of the PM peak period turning movement volumes at each of the study intersections and the acceptable range of the 5.0 GEH statistic. The results show a strong correlation between the modeled volumes and the observed traffic counts.

Table 7: Traffic Volume Calibration Summary

Statistic	**Target**	**Time Period 3:00 – 4:00 PM**		**Time Period 4:00 – 5:00 PM**	
		Result	**Passed?**	**Result**	**Passed?**
GEH < 5.0	85%	97%	**Yes**	96%	**Yes**
GEH < 10.0	100%	100%	**Yes**	100%	**Yes**
R^2 (Correlation)	0.9 – 1.1	0.99	**Yes**	0.98	**Yes**

9.2.1.2 Travel Times

Modeled travel times have been calibrated against observed travel time data obtained from the INRIX data. Travel time data has been collected for a weekday afternoon in April/May 2015 to match the dates of the most recent traffic count data and the field observations. Figure 60 shows the observed data from the INRIX database (including median and percentile times by section) compared to the average modeled travel times in the PM peak period.

The travel time calibration results show a good correlation of the modeled and observed travel times on Mount Diablo Boulevard and Moraga Road. In most instances, the average modeled travel times are within 10 percent of the average observed times and are within the 95th percentile of observed times.

Travel time calibration results show differences between modeled and observed travel times on Moraga Road. It is noted that both northbound and southbound travel times on Moraga Road are within the 5th to 95th percentile band.

Subsequent site observations indicated that the INRIX travel times were considered low for the PM peak hour conditions along Moraga Road. Furthermore, observed queue conditions along Moraga Road appear to be well replicated in the DLTM. As such, there is confidence that the modeled travel times on Moraga Road replicate the existing condition.

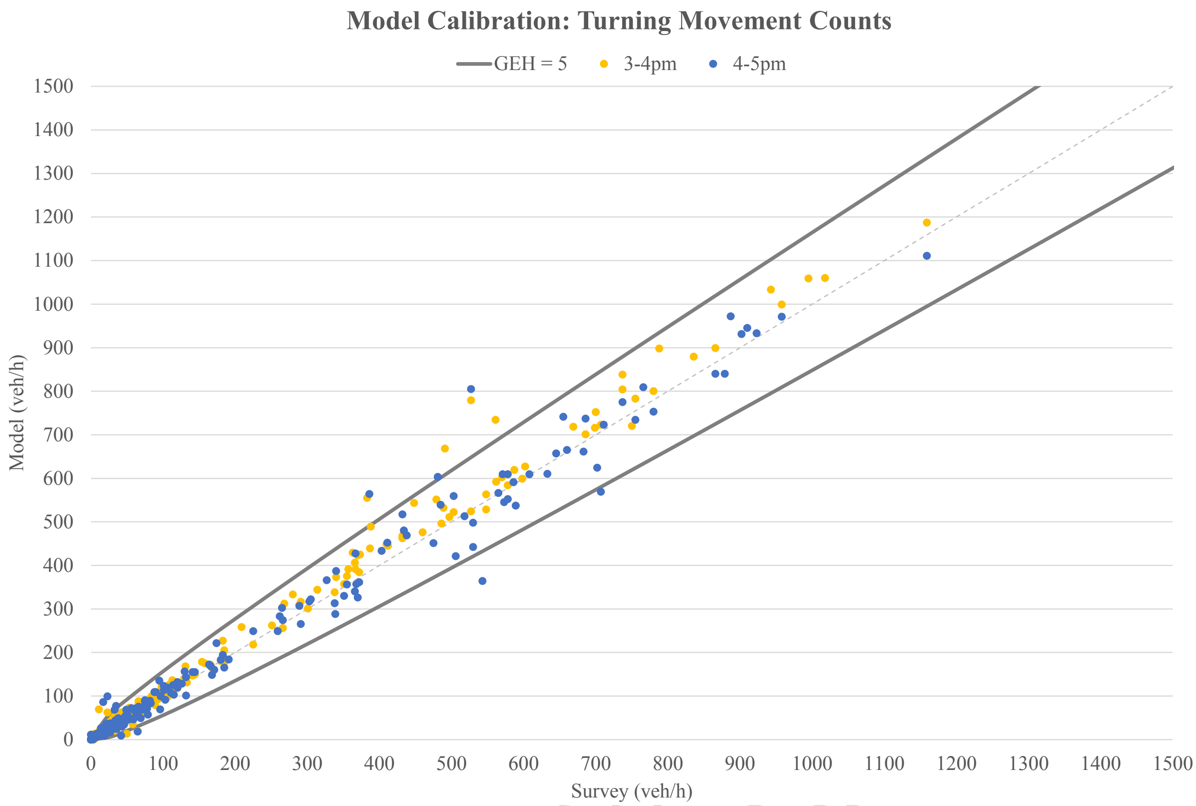

Figure 61: Scatter plot of the turning movement calibration

Table 8: Travel time calibration summary

Road	Section		Travel Time (seconds) (3:00–4:00 p.m.)				Travel Time (seconds) (4:00–5:00 p.m.)			
	From	To	Observed			DLTM	Observed			DLTM
			Avg	*5th %ile*	*95th %ile*	Avg	Ave.	*5th %ile*	*95th %ile*	Avg
Moraga Rd (NB)	St Marys	Mount Diablo Blvd	112	*58*	*207*	204	97	*69*	*161*	140
Moraga Rd (SB)	Mount Diablo Blvd	St Mary's Rd	69	*53*	*161*	87	68	*47*	*161*	83
Mount Diablo (EB)	Happy Valley Rd	1st St	125	*71*	*207*	129	125	*74*	*221*	124
Mount Diablo (WB)	1st St	Happy Valley Rd	109	*65*	*198*	116	103	*71*	*190*	112