

APPENDIX F

TRANSPORTATION IMPACT STUDY

This page intentionally left blank



Transportation Impact Study for the Northgate Town Square Project



Prepared for the City of San Rafael

Submitted by
W-Trans

February 14, 2023



**TRAFFIC ENGINEERING
TRANSPORTATION PLANNING**
Balancing Functionality and Livability since 1995
w-trans.com



This page intentionally left blank

Table of Contents

Executive Summary.....	1
Introduction.....	2
Transportation Setting	5
Project Data	11
Alternative Modes.....	16
Vehicle Miles Traveled	24
Safety Issues	28
Emergency Access	33
Conclusions and Recommendations.....	34
Study Participants and References.....	35

Figures

1. Study Area and Bicycle Facilities	4
2. Master Plan Site Plan.....	12
3. Vision Plan Site Plan	13
4. Master Plan Existing and Proposed Pedestrian Facilities	17
5. Vision Plan Existing and Proposed Pedestrian Facilities.....	18

Tables

1. Collision Rates for the Study Intersections.....	8
2. 2025 Master Plan Trip Generation Summary.....	14
3. 2040 Vision Plan Trip Generation Summary	15
4. Bicycle Facility Summary	19
5. Residential City Code Vehicle Parking Requirements	21
6. Transit Routes	22
7. Residential VMT Analysis Summary.....	26
8. Project Site Retail VMT Analysis Summary	27
9. Cumulative VMT Analysis Summary.....	27
10. Maximum AM Peak Hour Queues	31

Plates

1. Restricted Sight Line to Left (South) from Driveway 280 feet North of Northgate Dr/Thorndale Dr	29
2. Sight Triangle Diagram with Recommended Clear Zone in Blue	29



Appendices

- A. Collision Rate Calculations
- B. Turn Lane Warrant Worksheets
- C. Queuing Calculations

Executive Summary

The Northgate Town Square project would replace some existing retail space at the Northgate Mall in the City of San Rafael with multifamily housing. The project is envisioned in two phases. The first phase, referred to as the 2025 Master Plan, as proposed includes up to 977 multifamily residential units and retention of 498,661 total square feet of retail space. The second phase would include conversion of additional land currently used for retail to residential. Both phases combined constitute the 2040 Vision Plan, which as proposed includes up to 1,422 residential units and 225,100 square feet of retail space. The analysis addresses the maximum potential development of the 2025 Master Plan and the 2040 Vision Plan. Based on these development levels, the Master Plan would have an estimated average daily trip generation of 3,585 fewer trips per weekday compared to the existing shopping center uses, including 172 additional trips during the a.m. peak hour and 345 fewer trips during the p.m. peak hour. The Vision Plan would add further residential units in lieu of retail area and result in an estimated reduction totaling 8,384 daily trips, with 177 new morning peak hour trips and 886 fewer evening peak hour trips.

Generally, on-site bicycle and pedestrian facilities would be adequate, and the project would have a less-than-significant impact on pedestrian, bicycle, and transit facilities in the vicinity of the project. On-site bicycle parking should be provided with a total of 178 short-term and 100 long-term bicycle parking spaces for the Master Plan, which could be reduced to a total of 157 short-term and 45 long-term spaces for the Vision Plan.

The project would be expected to have a less-than-significant impact in terms of Vehicle Miles Traveled as the residential component would have a per capita VMT below the threshold of 11.4 for all scenarios evaluated and the retail component would result in a reduced total VMT both in the short term and cumulatively.

Project access is generally adequate, with no new left-turn lanes warranted under either the Master Plan or Vision Plan scenarios. Sight distance in both directions is adequate for each project driveway except for the driveway 280 feet north of Northgate Drive/Thorndale Drive, where a vertical grade and dense foliage combine to block sight lines to the south. The applicant has ensured that a clear zone would be established for this area as part of the project application.

The study area is comprised of the Northgate Mall and a network of 17 intersections in the area around the Mall chosen with input from City staff. The project would have a less-than-significant impact to queuing at these intersections.

The project would have a less-than-significant impact on emergency response times in the area and on-site emergency access would be adequate under either development scenario.

Introduction

This report presents an analysis of the potential transportation impacts that would be associated with the redevelopment of the Northgate Mall in the City of San Rafael. The redevelopment would be constructed in two phases. The “2025 Master Plan” includes up to 977 multifamily residential units and retention of 498,661 total square feet of retail space compared to the existing 766,507 square feet of retail space. The second phase would result in conversion of additional land currently used for retail into residential; both phases combined constitute the “2040 Vision Plan” which would reduce the retail square footage to 225,100 square feet and increase the residential unit count to 1,422. Both plans include at least ten percent affordable housing. The traffic study was completed in accordance with criteria established by the City of San Rafael and is consistent with standard traffic engineering techniques.

Prelude

The purpose of a transportation impact study is to provide City staff and policy makers with data that they can use to make an informed decision regarding the potential transportation impacts of a proposed project, and any associated improvements that would be required to mitigate these impacts to an acceptable level under the California Environmental Quality Act (CEQA). This report provides an analysis of those items that are identified as areas of environmental concern under CEQA and that, if significant, require an Environmental Impact Report (EIR). Impacts associated with access for pedestrians, bicyclists, and to transit; the vehicle miles traveled (VMT) generated by the project; potential safety concerns such as increased queuing in dedicated turn lanes, adequacy of sight distance, need for turn lanes, and need for additional right-of-way controls; and emergency access and response are addressed in the context of the CEQA criteria.

The report is organized to provide background data that supports the various aspects of the analysis, followed by the assessment of the following CEQA criteria.

As adopted from the *Transportation Impact Analysis Guidelines*, City of San Rafael, June 2021, the CEQA thresholds of significance applied to this analysis are as follows. Would the project:

- a. Conflict with a program, plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities?

Roadway System – The project would create a significant impact related to the roadway system if any of the following criteria are met:

1. At unsignalized intersections, the project results in any of the traffic signal warrants included in the CA Manual on Uniform Traffic Control Devices (MUTCD) to be satisfied, or for a location where any of the warrants are satisfied prior to the project, the project increases overall travel through the intersection by more than 1 percent.
2. The project creates the potential for excessive vehicle queue spillback that could periodically block or interfere with pedestrian, bicycle or transit facilities.

Transit System – The project would create a significant impact related to transit service if the following criterion is met:

1. The project interferes with existing transit facilities or precludes the construction of planned transit facilities.

Bicycle System - The project would create a significant impact related to the bicycle system if any of the following criteria are met:

1. Disrupt existing bicycle facilities;
2. Interfere with planned bicycle facilities; or,
3. Create inconsistencies with adopted bicycle system plans, guidelines, policies, or standards.

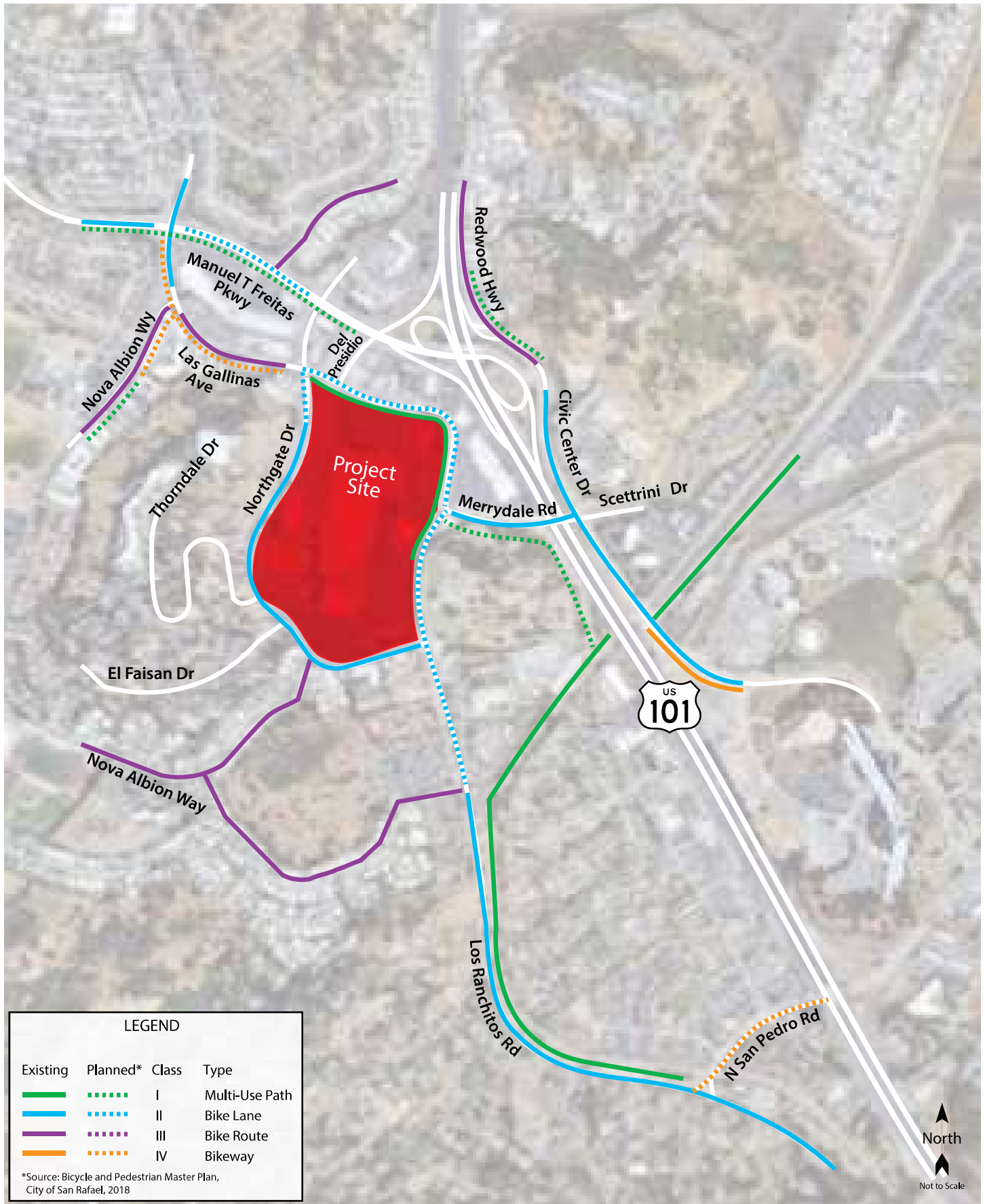
Pedestrian System - The project would create a significant impact related to the pedestrian system if any of the following criteria are met:

1. Disrupt existing pedestrian facilities; or

2. Interfere with planned pedestrian facilities; or
 3. Create inconsistencies with adopted pedestrian system plans, guidelines, policies, or standards.
- b. Conflict or be inconsistent with CEQA Guidelines § 15064.3, subdivision (b)?
 - c. Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?
 - d. Result in inadequate emergency access?

Project Profile

The project is to be located at the site of the Northgate Mall in the City of San Rafael and would result in several existing retail areas and parking lots being replaced with new commercial and residential spaces centered around a “town square” concept. The project site is located at the Northgate Mall, as shown in Figure 1. This figure also shows the existing bicycle facilities in the vicinity of the project site, as well as the planned bicycle facilities documented in the *Bicycle and Pedestrian Master Plan*, City of San Rafael, 2018.



Transportation Impact Study for the Northgate Town Square Project
Figure 1 – Study Area and Bicycle Facilities

Transportation Setting

Operational Analysis

Study Area and Periods

The study area varies depending on the topic. For pedestrian trips, it consists of all streets within a half-mile of the project site that would lie along primary routes of pedestrian travel, or those leading to nearby generators or attractors. For bicycle trips, it consists of all streets within one mile of the project site that would lie along primary routes of bicycle travel. For the safety analysis, the study area consists of the following intersections:

1. Freitas Parkway/Las Gallinas Avenue
2. Freitas Parkway/Northgate Drive
3. Freitas Parkway/Del Presidio Boulevard
4. Freitas Parkway/US 101 South Ramps
5. Redwood Highway/US 101 North On-ramp
6. Freitas Parkway/US 101 North Ramps
7. Freitas Parkway/Redwood Highway-Civic Center Drive
8. Las Gallinas Avenue/Nova Albion Way
9. Las Gallinas Avenue/Northgate Drive
10. Las Gallinas Avenue/Del Presidio Boulevard
11. Las Gallinas Avenue/Merrydale Road
12. Merrydale Road/Civic Center Drive
13. Northgate Drive/Thorndale Drive
14. Northgate Drive/El Faisan Drive
15. Northgate Drive/Nova Albion Way
16. Los Ranchitos Road-Las Gallinas Avenue/Northgate Drive
17. Los Ranchitos Road/North San Pedro Road

It is noted that the project driveways were not considered as study intersections, unless at an existing intersection between two off-site streets such as Las Gallinas Avenue/Del Presidio Boulevard or Las Gallinas Avenue/Merrydale Road. The *California Vehicle Code* defines an intersection as “the area embraced within the prolongation of the lateral curb lines, or, if none, then the lateral boundary lines of the roadways, of two highways which join one another at approximately right angles or the area within which vehicles traveling upon different highways joining at any other angle may come in conflict.” This definition specifies that intersections are created where two “highways,” or public streets, intersect. As driveways are not public streets, where they connect with a public road is not an intersection, so it would be unreasonable to evaluate it as such. The driveway connections were, however, evaluated for operational issues such as adequacy of sight distance, need for turn lanes, and delay as relevant in some cases, though it would not be associated with a Level of Service metric.

Study Intersections

Freitas Parkway/Las Gallinas Avenue is a signalized four-legged intersection with protected left-turn phasing on the eastbound and westbound approaches and permitted left-turn phasing on the northbound and southbound approaches. There is a stop-controlled channelized right-turn lane on the westbound approach. Pedestrian crosswalks and phasing exist on the north, west, and south legs, and there are bicycle lanes on all four legs.

Freitas Parkway/Northgate Drive is a four-legged signalized intersection with protected left-turn phasing on the Freitas Parkway approaches and permitted left-turn phasing on the Northgate Drive approaches. There are crosswalks on all but the east leg.

Freitas Parkway/Del Presidio Boulevard is a signalized intersection with four legs. The northbound and southbound approaches have permitted left-turn phasing; left-turns from Freitas Parkway are prohibited. The north leg of the intersection is the off-ramp from southbound US 101 and includes a channelized right-turn lane. There are crosswalks with pedestrian phasing on the south and east legs.

Freitas Parkway/US 101 South Ramps includes two slip ramps from Freitas Parkway in each direction to US 101 South. There is a crosswalk across the ramp from westbound Freitas Parkway.

Redwood Highway/US 101 North On-ramp is a tee intersection enabling access to US 101 North from Redwood Highway in both directions. There is a sidewalk on the east side of Redwood Highway.

Freitas Parkway/US 101 North Ramps is a tee intersection directly adjacent to Freitas Parkway/Redwood Highway-Civic Center Drive with a sidewalk along the northeast corner. There are channelized right-turn lanes for movements to and from the connector to Civic Center Drive.

Freitas Parkway/Redwood Highway-Civic Center Drive is an intersection with three approaches and four departures, as the east leg is eastbound only. The Redwood Highway and Civic Center Drive approaches are stop controlled, whereas the Freitas Parkway approach is uncontrolled. There are sidewalks on the northeast, northwest, and southeast corners, and a crosswalk on the north leg. Bicycle lanes exist on Civic Center Drive south of the intersection.

Las Gallinas Avenue/Nova Albion Way is a signalized intersection with four legs, a protected northbound left-turn phase, split phasing on the eastbound and westbound approaches, and a southbound right-turn overlap. Crosswalks and pedestrian signals exist on all four legs, and there are bicycle lanes on Las Gallinas Avenue.

Las Gallinas Avenue/Northgate Drive is a four-legged intersection controlled by a traffic signal with protected left-turn phasing on Northgate Drive and permissive phasing on Las Gallinas Avenue. There are crosswalks and pedestrian signals on all four legs, and bicycle route pavement markings on Las Gallinas Avenue west of the intersection.

Las Gallinas Avenue/Del Presidio Boulevard is a signalized intersection with protected left-turn phasing in the eastbound direction, and a right-turn overlap in the westbound direction. The south leg is southbound only and left turns are prohibited on westbound Las Gallinas Avenue. Crosswalks and pedestrian signals exist across all but the east leg, and a multi-use trail runs along the south side of Las Gallinas Avenue in addition to a bicycle lane on the southbound departure on Del Presidio Boulevard.

Las Gallinas Avenue/Merrydale Road is a four-legged signalized intersection with protected left-turn phasing in all directions and crosswalks with pedestrian signals on the west, north, and east legs. There is a multi-use trail on the west side of Las Gallinas Avenue in addition to bicycle lanes on Las Gallinas Avenue south of the intersection and Merrydale Road west of the intersection.

Merrydale Road/Civic Center Drive is a signalized intersection with four legs and protected left-turn phasing in all four directions. Crosswalks and pedestrian signals exist on the north and east legs, as do bicycle lanes on the north, west, and south legs.

Northgate Drive/Thorndale Drive is a four-legged intersection with stop controls on the eastbound and westbound approaches, and no controls on Northgate Drive. There is a crosswalk on the west leg and bicycle lanes on Northgate Drive.

Northgate Drive/El Faisan Drive is a tee intersection with stop control on El Faisan Drive and bicycle lanes on Northgate Drive.

Northgate Drive/Nova Albion Way has three legs and stop control on the Nova Albion Way approach with no controls on the Northgate Drive approaches. Crosswalks exist on the west and south legs, and there are bicycle lanes on Northgate Drive.

Los Ranchitos Road-Las Gallinas Avenue/Northgate Drive is a four-legged signalized intersection with protected left-turn phasing on the northbound approach and permissive phasing for all other movements. The east leg is a driveway to the Mt. Olivet Cemetery. There are crosswalks and pedestrian signals on the east and south legs, and bicycle lanes on the west and north legs.

Los Ranchitos Road/North San Pedro Road is an intersection with three legs and signal control, including a protected phase for the eastbound left-turn movement. Crosswalks and pedestrian signals exist on the north and west legs, and there are bicycle lanes on Los Ranchitos Road including high-visibility markings in the westbound direction.

Collision History

The collision history for the study area was reviewed to determine any trends or patterns that may indicate a safety issue. Collision rates were calculated based on records available from the California Highway Patrol as published in their *Statewide Integrated Traffic Records System (SWITRS)* reports. The most current five-year period available is July 2016 through June 2021.

Study Intersections

As presented in Table 1, the calculated collision rates for the study intersections were compared to average collision rates for similar facilities statewide, as indicated in *2018 Collision Data on California State Highways*, California Department of Transportation (Caltrans). These average rates statewide are for intersections in the same environment (urban, suburban, or rural), with the same number of approaches (three or four), and the same controls (all-way stop, two-way stop, or traffic signal). Nine of the 17 study intersections had collision rates higher than the statewide average for similar facilities and were examined further. The collision rate calculations are provided in Appendix A.

Table 1 – Collision Rates for the Study Intersections

Study Intersection	Number of Collisions (2016-2021)	Calculated Collision Rate (c/mve)	Statewide Average Collision Rate (c/mve)
1. Freitas Pkwy/Las Gallinas Ave	17	0.29	0.24
2. Freitas Pkwy/Northgate Dr	18	0.31	0.24
3. Freitas Pkwy/Del Presidio Blvd	68	0.95	0.24
4. Freitas Pkwy/US 101 S Ramps	2	0.03	0.06
5. Redwood Hwy/US 101 N On-ramp	3	1.89	0.06
6. Freitas Pkwy/US 101 N Ramps	4	0.08	0.06
7. Freitas Pkwy/Redwood Hwy-Civic Center Dr	10	0.35	0.14
8. Las Gallinas Ave/Nova Albion Wy	6	0.22	0.24
9. Las Gallinas Ave/Northgate Dr	26	1.14	0.24
10. Las Gallinas Ave/Del Presidio Blvd	7	0.38	0.24
11. Las Gallinas Ave/Merrydale Rd	4	0.21	0.24
12. Merrydale Rd/Civic Center Dr	2	0.11	0.24
13. Northgate Dr/Thorndale Dr	0	0.00	0.14
14. Northgate Dr/El Faisan Dr	2	0.23	0.09
15. Northgate Dr/Nova Albion Wy	0	0.00	0.09
16. Los Ranchitos Rd-Las Gallinas Ave/Northgate Dr	3	0.23	0.24
17. Los Ranchitos Rd/N San Pedro Rd	3	0.12	0.20

Note: c/mve = collisions per million vehicles entering; **bold** = intersection collision rate is higher than statewide average for similar facilities

The top three primary collision factors for Freitas Parkway/Las Gallinas Avenue were failure to yield right-of-way (five collisions) and speeding and red light running (three collisions each). Of the collisions resulting from failure to yield right-of-way, two involved turning vehicles colliding with pedestrians in the crosswalk. Implementing a leading pedestrian interval may reduce this collision type by providing pedestrians a chance to get into the crosswalk and become more visible ahead of the vehicle green phase. Two other right-of-way collisions involved drivers turning left from Las Gallinas Avenue, which currently has one permissive phase for all movements from both directions. While implementation of a protected left-turn phase would likely alleviate this collision type, two collisions would not meet the warrant for such phasing so the City may wish to instead monitor this location for potential future need of such a change.

At Freitas Parkway/Northgate Drive, the most common primary collision factor was speeding, to which seven of the 18 collisions were attributed, all caused by through drivers on Freitas Parkway. Enhanced speed enforcement may counteract this collision trend, especially on Mondays and Wednesdays when six of the seven speed-related collisions occurred. Additionally, three collisions were caused by southbound drivers running a red light and colliding with eastbound through vehicles. Enhanced signal head visibility may decrease this collision type, including upgrading eight-inch signal heads to 12-inch, adding backplates, or adding new signal heads, though it is noted that this location had a below-average incidence of injuries, so the above-average crash rate does not appear to translate to a safety concern. The *Marin County Travel Safety Plan* (MCTSP), November 2018, details the Northgate Drive corridor between Freitas Parkway and just south of Las Gallinas as a high-collision network, which includes Freitas Parkway/Northgate Drive. The MCTSP suggests improving the signal timing and detection; providing advance dilemma zone detection; converting signal pedestals to mast arms; and installing bicycle lanes.

Of the 68 collisions at Freitas Parkway/Del Presidio Boulevard, 19 were attributed to drivers disobeying posted signage and 11 to drivers making improper turns. For most of these 30 collisions, the at-fault driver was traveling westbound and turning left at the intersection, which is a prohibited movement at this location. Additional signage alerting drivers of the prohibition, installation of signal heads with through-arrow lenses, and/or construction of additional geometric constraints may discourage westbound drivers from turning left and reduce the high rate of collisions at this intersection. Another top collision factor for this location was speeding, which resulted in 15 collisions all between the hours of 10:30 a.m. and 8:00 p.m. Enhanced speed enforcement may alleviate this collision type though it is again noted that the incidence of injuries at this location was below the Statewide average. The MCTSP lists Freitas Parkway/Del Presidio Boulevard as a high-collision location with countermeasures that include improving signal hardware, timing, and detection; checking for or installing pedestrian signal heads; enhancing safety features for the pedestrian crossings such as “squaring up” the intersection; and removing slip lanes.

All three collisions at Redwood Highway/US 101 North On-ramp were the result of a northbound driver turning in front of a southbound through vehicle. Squaring the intersection may slow drivers and provide additional time to become aware of the right-of-way priority – one collision was listed as head-on which would require the drivers to be facing each other, which may be aided by the geometry of the intersection enabling a straighter path of travel for turning drivers. Because the percentage of crashes resulting in injuries was less than the statewide average there is not corresponding evidence of a safety concern.

Three of the collisions reported at Freitas Parkway/US 101 North Ramps were attributed primarily to speeding, while the fourth was caused by driving while intoxicated; only one resulted in injuries. All four collisions occurred when eastbound drivers were traveling away from the intersection on the 180-degree curve portion of the US 101 North On-ramp, with three colliding with fixed objects and one rear-ending another vehicle. Because the rate was so marginally above average and injuries resulted infrequently, no actions are suggested.

For Freitas Parkway/Redwood Highway-Civic Center Drive, the most common collision factor was failure to yield right-of-way, with four collisions attributed to drivers entering from the stop-controlled approaches. Another two collisions resulted from speeding. Caltrans has been exploring the possibility of replacing the existing intersection with a single-lane roundabout. This would change the traffic patterns at this intersection and likely decrease the rate of collisions – converting an urban stop-controlled intersection to a roundabout has been demonstrated to reduce all collision types by 72 percent and injury collisions by 88 percent (*Observational Before-After Study of the Safety Effect of U.S. Roundabout Conversions Using the Empirical Bayes Method*, Persaud et al., 2001).

Over half of the 26 collisions at Las Gallinas Avenue/Northgate Drive were the result of red light running, with 14 crashes. Improving signal head visibility may reduce this collision type, including upgrading eight-inch heads to 12-inch and installing backplates with yellow reflective strips around the outside edges. The second highest primary collision factor reported was violating right-of-way, attributed to five collisions. Four of these were caused by westbound drivers turning left. Implementation of a protected left-turn phase may reduce the incidence of these types of collisions, though it would require converting the westbound through-left lane into left-turn only or splitting the eastbound and westbound phases. Given that there were no more than two crashes of this type in a twelve-month period and the injury rate was below the statewide average, such a change is not recommended at this time though the City may wish to monitor this situation. The MCTSP includes installing a protected left-turn phase at Las Gallinas Avenue/Northgate Drive as a potential safety countermeasure, along with improving signal timing and detection, providing advance dilemma zone detection, converting signal pedestals to mast arms, and installing bicycle lanes.

Four of the seven collisions reported at Las Gallinas Avenue/Del Presidio Boulevard were primarily caused by improper turning, including two collisions between northbound vehicles departing the intersection. Given that there are two eastbound left-turn lanes that lead to two northbound departure lanes that then split into a right-turn and left-turn lane at Freitas Parkway/Del Presidio Boulevard, installation of advance wayfinding signage visible to these two turn lanes may enable drivers to select the appropriate lane before turning, rather than trying to merge into the correct lane after turning.

With two collisions in five years, a crash trend was not determined for Northgate Drive/El Faisan Drive. One collision involved a driver turning left in front of an oncoming bicyclist, while the other involved a driver on a different approach turning left in front of a through vehicle.

Los Ranchitos Road-Las Gallinas Avenue/Northgate Drive had a below-average collision rate compared to statewide data, with three collisions during the five-year study period. Nonetheless, it is included in the MCTSP as a high-collision location which lists countermeasures including improving signal hardware, converting the intersection to a roundabout, checking for or installing pedestrian countdown signal heads, upgrading the crosswalk markings to high visibility, and installing bulb-outs or other enhanced safety features for the pedestrian crossings.

Study Driveways

The project site currently has nine driveways in addition to access at the intersections of Las Gallinas Avenue/Del Presidio Boulevard, Las Gallinas Avenue/Merrydale Road, and Northgate Drive/Thorndale Drive. Collisions at these 12 locations were assessed to determine any trends involving access to or from the project site. There were no collisions reported involving drivers turning into or out of the project site at the three intersections. For driveways, one collision each was reported for the driveway 400 feet south of Las Gallinas Avenue/Northgate Drive and the driveway 100 feet west of Northgate Drive/El Faisan Drive. The first collision involved a southbound driver turning left into the site failing to yield right-of-way to an oncoming northbound driver, while the second involved a driver turning left out of the project site also failing to yield right-of-way to an oncoming driver. With two collisions at 12 locations across the five-year study period, a mitigable trend was not determined. It is noted that the driveway 100 feet west of Northgate Drive/El Faisan Drive would be removed during construction of the project.

Project Data

The project is proposed to replace portions of the existing Northgate Mall and its surrounding commercial pads and parking lots with housing and a reduced commercial area. The Master Plan phase is envisioned for 2025 and would consist of up to 977 apartment units and 498,661 square feet of retail space. The second phase would result in additional existing retail area being replaced by residential units, and both phases combined would constitute the Vision Plan, proposed for 2040, which would increase the housing count to 1,422 apartment units and reduce the retail area to 225,100 square feet. Both plans would consist of at least ten percent affordable housing and a central “town square” concept. An interior network of roadways, bicycle lanes, and sidewalks would connect the various on-site buildings and amenities.

The proposed project site plans are shown in Figure 2 for the Master Plan and Figure 3 for the Vision Plan.

Trip Generation

The anticipated trip generations for the existing mall and proposed project were estimated using standard rates published by the Institute of Transportation Engineers (ITE) in *Trip Generation Manual*, 11th Edition, 2021 for “Shopping Center (> 150k)” (ITE LU 820) and “Multifamily Housing (Mid-Rise)” (ITE LU 221). As trip generation rates for shopping centers grow logarithmically with size (larger shopping centers generate fewer trips per square foot than smaller shopping centers), the fitted curve equation was applied for the existing and proposed retail land uses to reflect the increased rates as the size decreases.

Internal Capture Trips

The *Trip Generation Manual* also includes data and methodologies that can be applied to determine the proportion of internal trips that may occur within a development area that includes a variety of land uses. Internal trips occur at mixed-use developments, and in the case of the Northgate Town Square would consist of residents working at or patronizing adjacent retail uses. The majority of these trips would be made by walking, and the few that would be made by automobile would only travel on-site, so would not affect the adjacent street network.

Pass-by Trips

Some portion of traffic associated with retail uses is drawn from existing traffic on nearby streets. These vehicle trips are not considered “new,” but are instead comprised of drivers who are already driving on the adjacent street system and choose to make an interim stop and are referred to as “pass-by.” The percentage of these pass-by trips was developed based on information provided in the *Trip Generation Manual*. This reference includes p.m. peak hour pass-by data collected at numerous locations for many land uses, such as the retail use applied in this traffic analysis. It is noted that larger shopping centers tend to have lower pass-by rates as they act more as primary destinations. Therefore, only data points with areas within 150,000 square feet of each shopping center size were used, resulting in average pass-by rates of 15 percent for the existing 766,507-square-foot shopping center, 20 percent for the Master Plan shopping center of 498,661 square feet, and 32 percent for the Vision Plan shopping center of 225,100 square feet. While fewer pass-by trips would occur during the a.m. peak hour, a portion of the p.m. peak hour pass-by rate was assigned to the a.m. peak hour to account for trips made to uses such as the existing Peets Coffee that may attract some drivers from Northgate Drive or Las Gallinas Avenue heading to work or from dropping children off at area schools. A pass-by value between the a.m. peak hour and p.m. peak hour was assigned to each daily rate to account for the overall average pass-by across a typical weekday.



Transportation Impact Study for the Northgate Town Square Project Figure 2 – Master Plan Site Plan





Transportation Impact Study for the Northgate Town Square Project

Figure 3 – Vision Plan Site Plan



Total Project Trip Generation

The expected trip generation potential for the proposed project is indicated in Table 2 for the Master Plan, with deductions taken for trips made to and from the existing Mall at the site, which will cease with the construction of the project, as well as for pass-by and internal capture. The proposed project for the Master Plan scenario is expected to generate an average of 20,739 trips per day, including 735 trips during the a.m. peak hour and 1,734 during the p.m. peak hour. After deductions are taken into account, the project would be expected to generate a net reduction of 3,585 trips on a daily basis, including adding 172 trips during the morning peak hour and 345 fewer trips during the evening peak hour; these new morning peak hour trips represent the increase in traffic associated with the project compared to existing volumes.

Table 2 – 2025 Master Plan Trip Generation Summary

Land Use	Units	Daily		AM Peak Hour				PM Peak Hour			
		Rate	Trips	Rate	Trips	In	Out	Rate	Trips	In	Out
Existing											
Shopping Center	-766.507 ksf	33.76	-25,877	-0.76	-586	-363	-223	3.19	-2,446	-1,174	-1,272
Pass-by		-6%	1,553	-4%	23	15	8	-15%	367	176	191
<i>Existing Subtotal</i>			-24,324		-563	-348	-215		-2,079	-998	-1,081
Proposed											
Shopping Center	498.661 ksf	37.87	18,884	0.86	428	265	163	3.60	1,795	861	934
Townhouses	92 du	7.20	662	0.48	44	14	30	0.57	52	30	22
Apartments	885 du	4.54	4,018	0.37	327	75	252	0.39	345	211	134
<i>Proposed Subtotal</i>			23,564		799	354	445		2,192	1,102	1,090
Internal Capture		-5%	-1,178	-5%	-40	-18	-22	-5%	-110	-55	-55
Pass-by		-9%	-1,647	-6%	-24	-15	-9	-20%	-348	-167	-181
Proposed Total			20,739		735	321	414		1,734	880	854
Net New Total (Proposed Less Existing)			-3,585		172	-27	199		-345	-118	-227

Note: ksf = 1,000 square feet; du = dwelling unit

For the Vision Plan scenario, and as shown in Table 3, the project would generate an average of 15,940 trips per day including 740 during the morning peak hour and 1,193 during the evening peak hour. With deductions for the existing land use, pass-by trips, and internal capture included, the project is anticipated to result in 8,384 fewer trips per day, including a net decrease of 886 trips during the p.m. peak hour, though a net increase of 177 trips during the a.m. peak hour is anticipated. These changes represent the change in traffic volumes anticipated to occur upon completion of the Vision Plan compared to retention of the existing shopping center use.

Table 3 – 2040 Vision Plan Trip Generation Summary

Land Use	Units	Daily		AM Peak Hour				PM Peak Hour			
		Rate	Trips	Rate	Trips	In	Out	Rate	Trips	In	Out
Existing											
Shopping Center	-766.507 ksf	33.76	-25,877	-0.76	-586	-363	-223	3.19	-2,446	-1,174	-1,272
Pass-by		-6%	1,553	-4%	23	15	8	-15%	367	176	191
<i>Existing Subtotal</i>			-24,324		-563	-348	-215		-2,079	-998	-1,081
Proposed											
Shopping Center	225.100 ksf	52.16	11,741	1.18	266	165	101	4.50	1,012	486	526
Townhouses	92 du	7.20	662	0.48	44	14	30	0.57	52	30	22
Apartments	1,330 du	4.54	6,038	0.37	492	113	379	0.39	519	316	203
<i>Proposed Subtotal</i>			18,441		802	292	510		1,583	832	751
Internal Capture		-5%	-922	-5%	-40	-15	-25	-5%	-79	-42	-37
Pass-by		-14%	-1,579	-9%	-22	-14	-8	-32%	-311	-149	-162
Proposed Total			15,940		740	263	477		1,193	641	552
Net New Total (Proposed Less Existing)			-8,384		177	-85	262		-886	-357	-529

Note: ksf = 1,000 square feet; du = dwelling unit

The trip generations presented for the 2025 Master Plan and 2040 Vision Plan were used as inputs for the Vehicle Miles Traveled, Site Access, Queueing, and Emergency Access analyses as further detailed in their respective sections.

Alternative Modes

This section addresses the first transportation bullet point on the CEQA checklist, which relates to the potential for a project to conflict with a program, plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities.

Pedestrian Facilities

Existing and Planned Pedestrian Facilities

Pedestrian facilities include sidewalks, crosswalks, pedestrian signal phases, curb ramps, curb extensions, and various streetscape amenities such as lighting, benches, etc. In general, a network of sidewalks, crosswalks, pedestrian signals, and curb ramps provide access for pedestrians in the vicinity of the proposed project site.

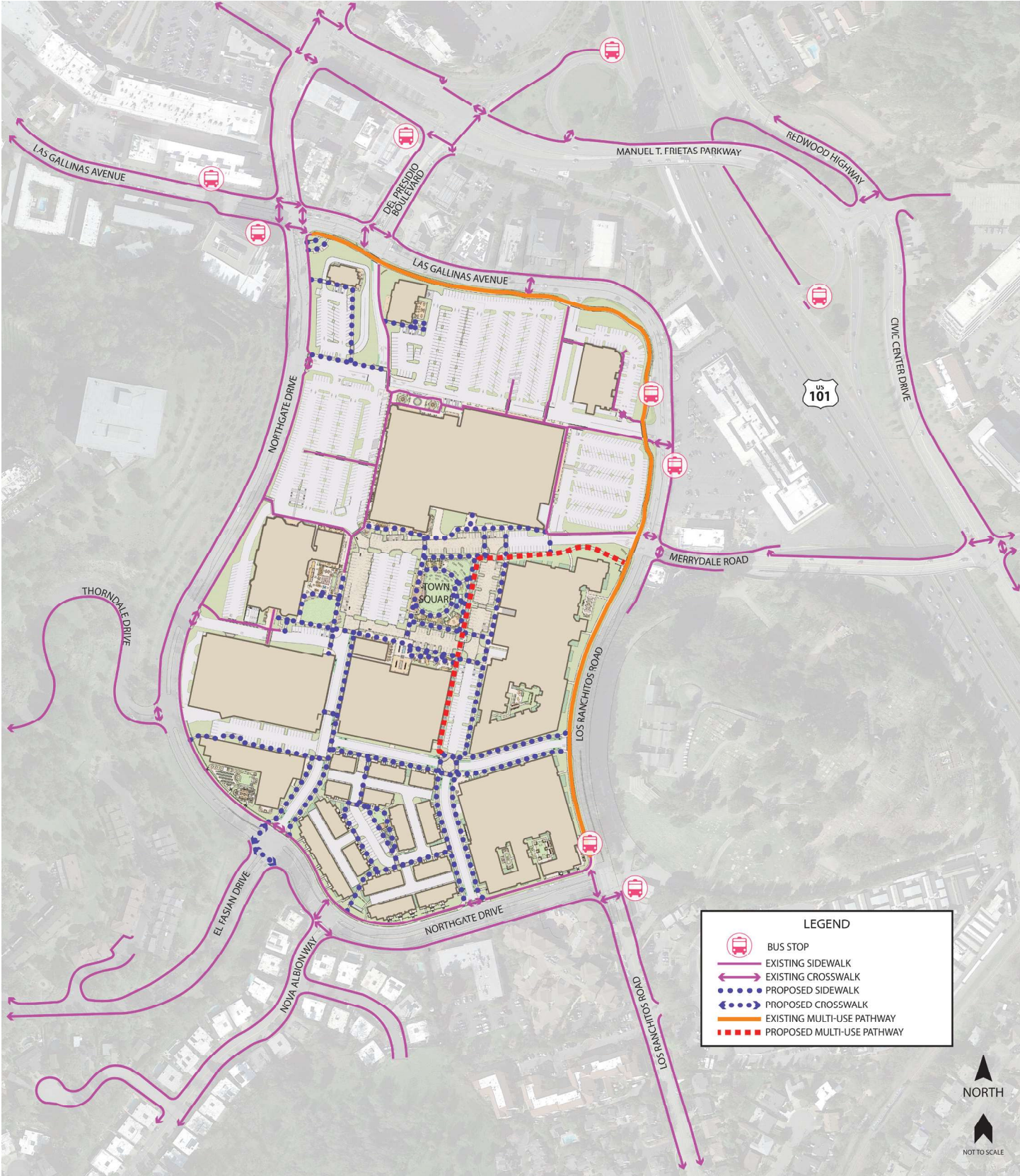
There are no sidewalks on Merrydale Road between the Merrydale Road overpass over US 101 and the Marin Civic Center SMART station. Currently, pedestrians routing between the project site and station must either cross over the freeway to access the sidewalk along Civic Center Drive or walk in traffic along Merrydale Road. A multi-use trail to close this gap is included in the *Bicycle and Pedestrian Master Plan*, City of San Rafael, 2018. The City prepared the *Merrydale Conceptual Design Informational Report*, April 2022, to address the potential alternative designs which generally include a 12-foot shared-use trail along the north and east sides of Merrydale Road between Las Gallinas Avenue and the SMART station. It is anticipated that this path would be completed prior to the project being occupied, though it is noted that these improvements are not currently funded.

The *North San Rafael Vision and Promenade Conceptual Plan*, Whittenkeller and Associates and Brian Powell & Associates, November 2002, includes a variety of recommendations to improve pedestrian and bicycle connectivity between the Terra Linda Community Center and Pool and the Marin County Civic Center. In the study area, the *Conceptual Plan* calls for widening the sidewalks on Freitas Parkway and adding pathway lighting, widening the sidewalk on the south side of Las Gallinas Avenue, installing pedestrian facilities on Merrydale Road between Las Gallinas Avenue and what is now the Marin Civic Center SMART station, and extending these facilities parallel to the railroad tracks under US 101 to Civic Center Drive. The *Conceptual Plan* also recommends working with the Northgate One Shopping Center, Northgate Three Shopping Center, and “The Mall” to negotiate installation of the various facilities proposed within the *Plan*.

Project Impacts on Pedestrian Facilities

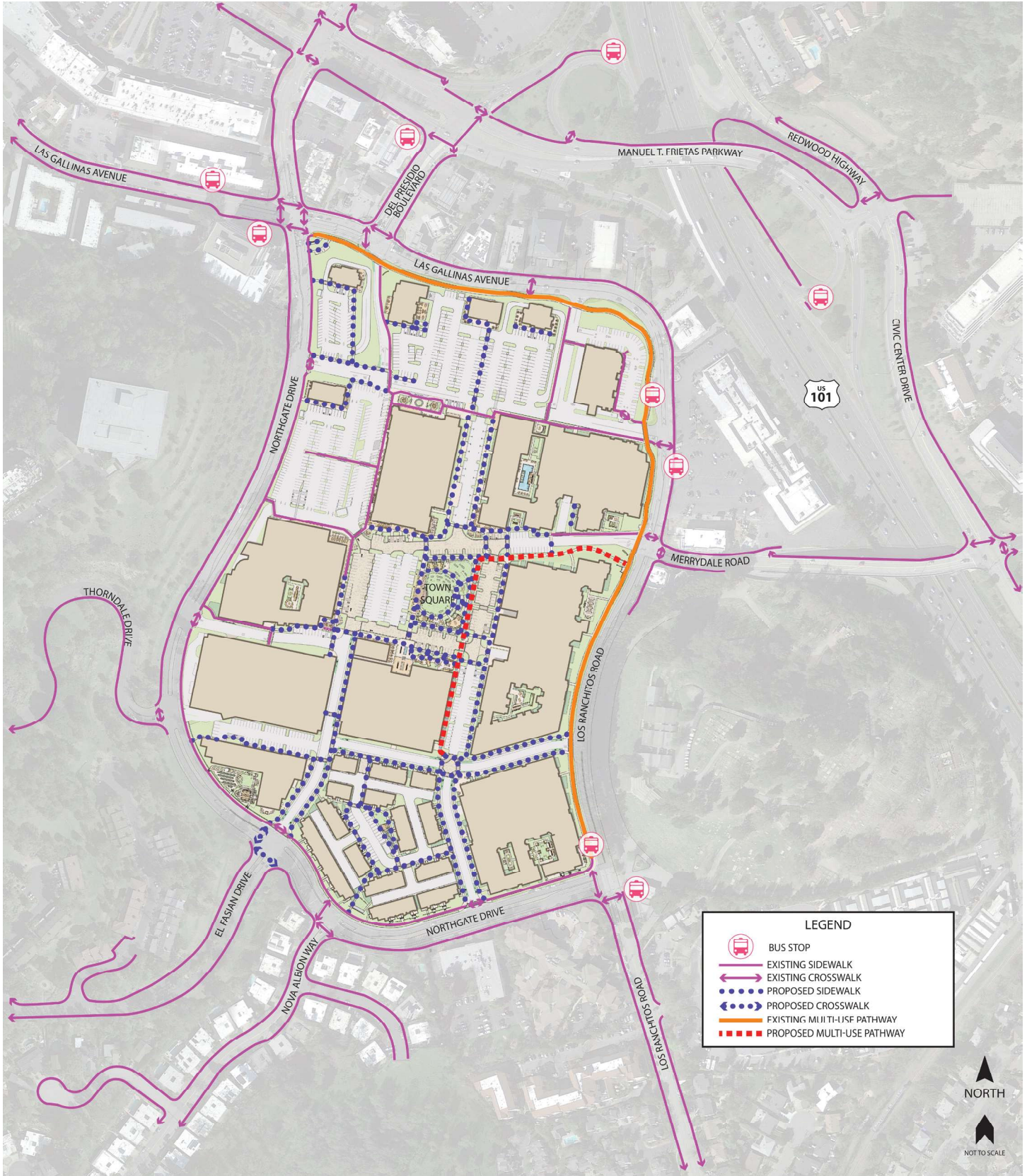
Given the proximity of residential, retail, service, and other uses surrounding the site, it is reasonable to assume that some project patrons and residents would want to walk, bicycle, and/or use transit for trips to and from the project site. In addition to nearby housing and the SMART station generating pedestrian traffic to and from the site’s commercial facilities, there are several nearby trip attractors that may induce pedestrian traffic from and to the proposed residential uses. These include schools such as the St. Isabella School, Mark Day School, Vallecito Elementary School, and Terra Linda High School; parks such as Freitas Park, Hartzell Park, Lagoon Park, institutional uses such as the Kaiser Permanente San Rafael Medical Center and Marin Civic Center, and retail and restaurant uses such as those across Las Gallinas Avenue in the Northgate One and Three shopping centers.

There are continuous sidewalks along the project frontages surrounding the site on Northgate Drive and Las Gallinas Avenue. The site plans for both the Master Plan and Vision Plan scenarios demonstrate a well-developed internal network of sidewalks and walkways connecting the various project buildings and amenities. Crosswalks are provided as appropriate. The existing and proposed project’s sidewalks and crosswalks are depicted in Figure 4 for the Master Plan scenario, and Figure 5 for the Vision Plan scenario.



Transportation Impact Study for the Northgate Town Square Project
Figure 4 – Master Plan Existing and Proposed Pedestrian Facilities





Transportation Impact Study for the Northgate Town Square Project
Figure 5 – Vision Plan Existing and Proposed Pedestrian Facilities



As shown in these figures, the proposed project would connect to existing and planned pedestrian facilities, including the planned multi-modal path along Merrydale to the Marin Civic Center SMART station. Accordingly, the proposed project would not disrupt existing pedestrian facilities, interfere with planned pedestrian facilities, or create inconsistencies with adopted pedestrian system plans, guidelines, policies, or standards.

Finding – The project would present a less-than-significant impact to pedestrian facilities.

Bicycle Facilities

Existing and Planned Bicycle Facilities

The *Highway Design Manual*, Caltrans, 2020, classifies bikeways into four categories:

- **Class I Multi-Use Path** – a completely separated right-of-way for the exclusive use of bicycles and pedestrians with cross flows of motorized traffic minimized.
- **Class II Bike Lane** – a striped and signed lane for one-way bike travel on a street or highway.
- **Class III Bike Route** – signing only for shared use with motor vehicles within the same travel lane on a street or highway.
- **Class IV Bikeway** – also known as a separated bikeway, a Class IV Bikeway is for the exclusive use of bicycles and includes a separation between the bikeway and the motor vehicle traffic lane. The separation may include, but is not limited to, grade separation, flexible posts, inflexible physical barriers, or on-street parking.

Table 4 – Bicycle Facility Summary

Status Facility	Class	Length (miles)	Begin Point	End Point
Existing				
Las Gallinas Ave	I	0.42	Northgate Dr (N)	425 ft north of Northgate Dr (S)
McInnis Pkwy Side path	I	0.68	North End	Civic Center Dr
SMART Pathway	I	0.86	Civic Center Dr	N San Pedro Rd
Freitas Pkwy	II	0.76	Montecillo Rd	Las Gallinas Ave
Las Gallinas Ave	II	1.34	City Limit	Nova Albion Wy
Civic Center Dr	II	0.52	Freitas Pkwy	Peter Behr Dr (N)
Northgate Dr	II	0.54	Las Gallinas Ave (N)	Las Gallinas Ave (S)
Las Gallinas Ave	II	0.18	Merrydale Rd	Northgate Dr (S)
Merrydale Rd	II	0.13	Las Gallinas Ave	Civic Center Dr
Los Ranchitos Rd	II	1.21	Golden Hinde Blvd	Hammondale Ct
Los Gamos Rd	III	0.39	North End	Freitas Pkwy
Las Gallinas Ave	III	0.20	Nova Albion Wy	Northgate Dr
Nova Albion Wy	III	1.12	Las Gallinas Ave	Northgate Dr
Golden Hinde Blvd	III	0.48	Nova Albion Wy	Los Ranchitos Rd
Redwood Hwy	III	1.16	Smith Ranch Rd	Freitas Pkwy
Civic Center Dr	IV	0.17	SMART Crossing	Peter Behr Dr (N)
Planned				
Freitas Pkwy	I	0.72	Montecillo Rd	Del Presidio Blvd
Nova Albion Wy	I	0.26	155 ft south of Arias St	Montecillo Rd
Redwood Hwy	I	0.25	Professional Center Pkwy	Freitas Pkwy

Table 4 – Bicycle Facility Summary

Status Facility	Class	Length (miles)	Begin Point	End Point
Merrydale Rd	I	0.34	Las Gallinas Ave	SMART Pathway
Freitas Pkwy	II	0.23	Las Gallinas Ave	Northgate Dr
Las Gallinas Ave	II	0.53	Northgate Dr (N)	Golden Hinde Blvd
Northgate Dr	II	0.05	Las Gallinas Ave (N)	270 ft south of Las Gallinas Ave (N)
Las Gallinas Ave	IV	0.32	Freitas Pkwy	Northgate Dr
Nova Albion Wy	IV	0.03	Las Gallinas Ave	155 ft south of Arias St
N San Pedro Rd	IV	0.57	Civic Center Dr	Los Ranchitos Rd

Source: *Bicycle and Pedestrian Master Plan*, City of San Rafael, 2018

In the project area there are Class I Multi-Use Paths parallel to Las Gallinas Avenue, McInnis Parkway, and the SMART railroad tracks. There are Class II Bike Lanes on Freitas Parkway, Las Gallinas Avenue, Civic Center Drive, Northgate Drive, Merrydale Road, and Los Ranchitos Road. Bicyclists ride in the roadway and/or on sidewalks along all other streets within the project study area. Table 4 summarizes the existing and planned bicycle facilities in the project vicinity, as contained in the *Bicycle and Pedestrian Master Plan*. Figure 1 presents these facilities in relation to the project site and study area.

Project Impacts on Bicycle Facilities

Existing bicycle facilities together with shared use of minor streets provide adequate access for bicyclists. The facilities adjacent to the project site include bicycle lanes on Northgate Drive, Las Gallinas Avenue, and Del Presidio Boulevard, and the multi-use trail parallel to Las Gallinas Avenue. These facilities would be maintained upon construction of the project. A network of bicycle lanes would be provided on the internal streets around the residential area of the project, while the remainder of the streets would have shared lane markings. A new multi-use trail is proposed to extend from the existing multi-use trail at Las Gallinas Avenue/Merrydale Road into the center of the project site, where a bicycle station with a repair area and bicycle lockers would be located. Additionally, the multi-use trail along the Las Gallinas Avenue frontage would be extended south to Northgate Drive as part of the project.

Finding – The project’s impact to bicycle facilities would be less-than-significant.

Bicycle Storage

The project site plan does not identify the provision of bicycle parking or storage facilities. The San Rafael Municipal Code Section 14.18.090 requires commercial and multi-family residential uses to provide short-term bicycle parking at a rate of five percent of required automobile spaces, and long-term parking at a rate of five percent of required spaces for nonresidential buildings with over ten tenant-occupants.

For market-rate residential units, the City of San Rafael’s *Municipal Code* requires one to two vehicle parking spaces per multifamily dwelling unit depending on the number of bedrooms, in addition to one guest space per five units. *Resolution 14891*, City of San Rafael, February 2021, stipulates that affordable housing developments are to provide one parking space per studio or one-bedroom unit. Table 5 shows the proposed unit counts by numbers of bedrooms, proposed parking supply, and City requirements for the Master Plan and Vision Plan development scenarios.

Table 5 – Residential City Code Vehicle Parking Requirements

Category	Rate	Master Plan		Vision Plan	
		Units	Spaces Required	Units	Spaces Required
Affordable Rate					
0- or 1-Bed Apartment	1 per du	96	96	138	138
Market Rate					
Studio Apartment	1 per du	88	88	156	156
1-Bed Apartment	1.5 per du	469	704	696	1,044
2-Bed Apartment/Townhouse	2 per du	211	422	287	574
3-Bed Apartment/Townhouse	2 per du	36	72	36	72
4-Bed Apartment/Townhouse	2 per du	7	14	7	14
Guest Parking	1 per 5 du	811 ¹	162	1,182 ¹	236
Total Spaces Required by City Code		1,558		2,234	

Note: du = dwelling unit;

¹ Guest parking is not required for affordable housing

The *Municipal Code* also requires one parking space per 250 square feet of retail, which when applied to the proposed Master Plan retail area of 498,661 square feet results in a requirement of 1,995 parking spaces. For the Vision Plan scenario, the proposed 225,100 square feet of retail area would net a requirement for 900 parking spaces. Combined, under the Master Plan scenario 3,553 vehicle parking spaces would be required including 1,995 for the retail buildings. Five percent of each translates to 178 short-term bicycle parking spaces and 100 long-term parking spaces. The Vision Plan scenario would require 3,134 total spaces including 900 retail parking spaces, requiring 157 short-term and 45 long-term bicycle parking spaces.

Finding – On-site bicycle storage would need to be provided in compliance with the Municipal Code.

Recommendation – The project should provide 178 short-term and 100 long-term bicycle parking spaces under the Master Plan scenario, which could be reduced to 157 short-term and 45 long-term bicycle parking spaces under the Vision Plan scenario.

Transit Facilities

Existing and Planned Transit Facilities

Regional and local fixed-route bus transit service is provided by the County of Marin through Marin Transit, the Golden Gate Bridge, Highway & Transportation District through Golden Gate Transit, and the Sonoma-Marín Rail Transit District (SMART). These services connect to locations from the Mark West community north of Santa Rosa to San Francisco. Transit stations in the area provide a connection between local and regional transit services and the project site as summarized in Table 6.

Table 6 – Transit Routes

Transit Agency Route	Distance to Stop (mi) ¹	Service			Destinations
		Days of Operation	Time	Frequency	
Marin Transit					
Route 35	Adjacent to Site	Weekdays Weekends	6:30 AM–8:45 PM 7:00 AM–8:45 PM	30 min 30 min	Novato, Northgate, Civic Center, Downtown San Rafael, Canal
Route 49	Adjacent to Site	Weekdays Weekends	6:30 AM–8:30 PM 7:30 AM–10:45 PM	30 min 60 min	Novato, Hamilton, Northgate, Downtown San Rafael
Route 71	0.19 (SB) 0.38 (NB)	Weekdays Weekends	5:30 AM–12:45 AM 5:45 AM–12:45 AM	30-60 min 30-60 min	Novato, San Rafael, Marin City
Route 257	Adjacent to Site	Weekdays	6:00 AM–10:45 PM	60 min	Novato (Ignacio), Hamilton, Kaiser, Downtown San Rafael
Route 645	Adjacent to Site	School days	AM (North) PM (South)	1x NB 1x SB	Terra Linda High School, Northgate, Civic Center, Downtown San Rafael, Canal
Golden Gate Transit					
Route 54	0.19 (SB) 0.38 (NB)	Weekdays	6:00 AM–8:00 AM 4:45 PM–6:45 PM	4x SB 4x NB	Novato, San Rafael, San Francisco
Route 70	0.19 (SB) 0.38 (NB)	Daily	5:15 AM–10:15 PM	60 min	Novato, San Rafael, Larkspur, Corte Madera, San Francisco
Sonoma-Marín Rail Transit District (SMART)					
SMART	0.39	Weekdays Weekends	5:00 AM–9:45 PM 7:30 AM–9:00 PM	0.5–3.5 hrs 2 hrs	Larkspur to Sonoma County Airport

Note: ¹ Defined as the shortest walking distance between the project site and the nearest bus stop

The nearest stop for Marin Transit Routes 35, 49, 257, and 645 is adjacent to the project site on Las Gallinas Avenue just north of Merrydale Road. The Terra Linda bus pads serve Marin Transit Route 71 and Golden Gate Transit Routes 54 and 70 and are located between the on- and off-ramps for US 101 in each direction at the Freitas Parkway interchange. The pad for southbound bus service is located 0.19 miles from the site, and the northbound pad is located 0.38 miles from the site.

Regional rail service is provided by SMART at the Marin Civic Center Station, a 0.39-mile walk southeast of the project site along Merrydale Road. As noted under the Pedestrian Facilities section, this connection currently does not have a sidewalk and pedestrians must either walk in the road or take a longer route to the station. However, a multi-use trail is planned to close this gap as documented in the *Bicycle and Pedestrian Master Plan*, though this planned improvement is not currently funded.

Two bicycles can be stored on the rack on the front of most Marin Transit buses, Golden Gate Transit buses have either a front rack for three bicycles or an undercarriage rack for two bicycles, and 24 bicycles can be brought onto each two-car SMART train. For all transit services, bicycle storage is on a first come, first served basis.

Dial-a-ride, also known as paratransit, or door-to-door service, is available for those who are unable to independently use the transit system due to a physical or mental disability. Marin Transit offers a dial-a-ride service designed to serve the needs of individuals with disabilities within the project area and Marin County overall.

Project Impacts on Transit Facilities

Existing transit routes are adequate to accommodate project-generated transit trips. Existing transit stops are within an acceptable walking distance of the site.

Finding – The project would have a less-than-significant impact to transit facilities.

Vehicle Miles Traveled

The potential for the project to conflict or be inconsistent with CEQA Guidelines § 15064.3, subdivision (b) was evaluated based the project’s anticipated Vehicle Miles Traveled (VMT).

City Vehicle Miles Traveled Impact Thresholds

The City of San Rafael *Transportation Impact Analysis Guidelines* (TIAG), June 2021, prescribes VMT thresholds of significance and local criteria for analysis. The TIAG defines the following project types and thresholds of significance for transportation VMT under Baseline Conditions:

- **Residential** – Home-based VMT per capita exceeds the existing regional average minus 15 percent;
- **Employment (e.g., office)** – Home-based work VMT per employee exceeds the existing regional average minus 15 percent;
- **Retail** – Project total VMT rate exceeds the existing regional average rate per employee minus 15 percent;
- **Mixed-use projects and land use plans** – Each land use type evaluated individually against residential, office, and retail thresholds above, and aggregate VMT per service population exceeds the regional average minus 15 percent;
- **Other land use types** – City to develop project-specific threshold; and
- **Redevelopment** – If a redevelopment project leads to a net increase in VMT, based on evaluation of individual land uses, or project exceeds the respective thresholds above for applicable land use types.

The proposed project is unique in that it would include a mix of residential and retail uses and would also entail redevelopment of some existing retail space with residential uses. Recognizing that the project does not fit squarely into a single VMT threshold category, the project CEQA team and City Staff coordinated to establish the specific VMT significance thresholds to be applied. The chosen approach entails directly applying the City’s VMT significance threshold for residential uses as presented in the TIAG. For retail uses, VMT was assessed in a manner consistent with the City’s redevelopment threshold given that there are existing retail uses on the site that will be redeveloped; to analyze the specific VMT effects of retail redevelopment the total retail VMT generated at the site under plus project conditions was compared to that generated under a no-build condition. Following are the resulting significance thresholds applied to the project.

- **Residential** – the impact would be significant if the home-based VMT per capita exceeds 11.4 miles (15 percent below the nine-County Bay Area regional average of 13.4 VMT per capita as obtained from TAMDM);
- **Retail** – the impact would be significant if the total retail VMT exceeds that generated under “no build” conditions.

In addition to assessing project VMT under baseline conditions, the TIAG specifies that cumulative conditions shall also be assessed. The TIAG indicates that the citywide average total VMT per service population should be compared between the cumulative “no project” and “plus project” scenarios. Following is the applied significance threshold for cumulative conditions.

- **Cumulative (Year 2040)** – the impact would be significant if the City of San Rafael cumulative (year 2040) average total VMT per service population of 18.8 miles increases as a result of the project.

Methodology

VMT Background

VMT represents a number of daily miles driven and can be expressed in different ways including total VMT, which is an aggregate value measured in miles, or as performance metrics such as VMT per capita and VMT per service

population, which are measured in the number of miles driven per person. Many factors affect VMT including the average distance residents commute to work, school, and shopping, as well as the proportion of trips that are made by non-automobile modes. Areas that have a diverse land use mix and ample facilities for non-automobile modes of travel, including transit, tend to generate lower VMT than auto-oriented suburban areas.

TAMDM Model

Forecasts of regional travel by various modes were determined using the Transportation Authority of Marin Demand Model (TAMDM). The travel model is a set of mathematical procedures and equations that represent the variety of transportation choices that people make, and how those choices result in trips on the transportation network. The TAM regional travel model is an activity-based model that is a member of the Coordinated Travel – Regional Activity-Based Modeling Platform (CT-RAMP) family of models. TAMDM is nested within the nine-county Bay Area Travel Model Two activity-based model maintained by the Metropolitan Transportation Commission (MTC). The MTC version of the CT-RAMP features a very detailed spatial system including an all-streets transportation network with 4,800 Transportation Analysis Zones (TAZs) and almost 40,000 Micro-Analysis Zones (MAZs). The project site is located within TAZ 800168 and MAZs 811396, 811677, 812868, 812896 in the TAMDM. All modeling conducted for the Northgate Town Square project was performed by Kittelson & Associates.

The most recently updated version of the TAM regional activity-based travel demand model was used to identify the VMT generated by land uses in Marin County as well as the entire Bay Area region. For the proposed Northgate Town Square project, the 2019 version of the TAMDM that includes the SMART commuter rail service, and the 2040 version that incorporates changes envisioned by long-range land use plans throughout the County including the San Rafael General Plan adopted in 2021, were used to produce VMT estimates. The TAMDM requires land uses to be defined for each geographic area in the region, i.e., the MAZ. The model land use inputs include numbers of households, persons and their attributes, employees by employment category, as well as enrollment at schools. The land use and population changes associated with the proposed project were compiled and used in the applied model runs.

For analysis of residential uses, the vehicle travel miles associated with all home-based trips made by residents are assessed. The associated average residential VMT per capita is calculated by summing this total vehicle mileage and dividing by the projected number of residents. Similarly, the regional average VMT per capita is calculated by summing the vehicle mileage for all bay area trips and dividing by the bay area population. For retail uses, VMT is analyzed as total retail VMT rather than in a per-person efficiency metric. The total retail VMTs associated with existing and proposed quantities of retail development within the project TAZ and MAZs were extracted from TAMDM for each analysis scenario. For the cumulative (2040) scenarios, a total VMT per service population performance metric was used, focusing on the total VMT generated within the City of San Rafael. This total citywide VMT and corresponding service populations were extracted from TAMDM for each cumulative scenario. The service population is defined as the sum of all residents and workers in San Rafael.

Screening

The TIAG identifies several types of development projects that may potentially qualify for VMT screening, meaning they may be presumed to result in a less than significant VMT impact and not require further VMT analysis. One potential screening threshold is related to Transit Priority Areas (TPA); this includes projects within a half-mile walkshed of a major transit stop such as a SMART Station. While much of the Northgate Town Square project is located within this distance, the entirety of the site is not, and it is unclear whether other provisions of this screening threshold would be met (such as minimum floor area ratio requirements and provision of no more parking than required by code). The TIAG also allows for screening of residential projects in areas that are shown in TAMDM mapping to have low residential VMT. While several TAZs and MAZs surrounding the project site are shown to have low residential VMT, the TAZ and MAZs containing the project site contain no existing housing, so cannot be definitively shown to have low VMT levels without additional modeling. Given these factors, and in consideration of the size and complexity of the Northgate Town Square project, City Staff elected to require a full

VMT analysis rather than to further assess whether the project (or individual components of the project) could qualify for any form of VMT screening.

Project VMT Assessment

Residential Land Uses

The TAMDM indicates that the nine-county Bay Area has a baseline average VMT of 13.4 miles per capita. Applying the TIAG residential significance threshold, the project would have a significant VMT impact if its residential VMT per capita exceeds a level of 15 percent below the regional average, or 11.4 VMT per capita.

The proposed Northgate Town Square Master Plan is projected to produce 11.0 VMT per capita under the 2019 baseline scenario, reducing to 9.0 VMT per capita under the 2040 scenario. The long-range Vision Plan is projected to result in 10.7 VMT per capita under the 2040 scenario. All results fall below the applied significance threshold of 11.4 VMT per capita. Accordingly, the project’s residential component is considered to have a less-than-significant impact on VMT.

A summary of the residential VMT analysis results is shown in Table 7. It is noted that the residential population used in this assessment is based on the TAMDM and due to its limitations, such as rounding population per unit to the nearest whole number, therefore potentially differs from population values derived for other environmental studies relevant to this project. As the thresholds are based on VMT per capita and not total residential VMT, it is anticipated that adjusting the population size would not materially affect the determination of a less-than-significant impact on VMT.

Table 7 – Residential VMT Analysis Summary

Scenario	VMT per Capita Significance Threshold	Project			
		Residential VMT	Residential Population	VMT per Capita	Below Threshold?
2019 plus Master Plan	11.4	26,187	2,391	11.0	Yes
2040 plus Master Plan	11.4	21,570	2,391	9.0	Yes
2040 plus Vision Plan	11.4	39,340	3,662	10.7	Yes

Notes: VMT Rate is measured in home-based VMT per capita; VMT threshold is 15 percent below the baseline (nine-county Bay Area) regional VMT per capita of 13.4 miles

Source: TAMDM, Kittelson & Associates, W-Trans, 2022

Retail Land Uses

The project would have a significant VMT impact if its total retail VMT exceeds that generated under “no build” conditions. Dedicated runs of the TAMDM were performed for 2019 and 2040 conditions without the project, as well as 2019 conditions with the proposed Northgate Town Square Master Plan, 2040 conditions with the Northgate Town Square Master Plan, and 2040 conditions with the Vision Plan. Post-processing of the TAMDM model output was conducted to isolate the total retail VMT projected to be generated by retail uses at the project site.

The TAMDM modeling results indicate that the proposed Master Plan would be expected to reduce the total retail VMT generated at the project site by approximately 38,350 to 39,600 miles per day as compared to no build conditions. In the year 2040 with buildout of the Vision Plan, total retail VMT is projected to be approximately 81,100 miles less per day than no build conditions. Since the redevelopment of retail uses proposed by the project would lead to a reduction in total retail VMT, the project’s retail component is considered to have a less-than-significant impact on VMT.

A summary of the retail VMT analysis results is shown in Table 8.

Table 8 – Project Site Retail VMT Analysis Summary					
Scenario	No Build Conditions		Plus Project Conditions		
	Model Base Year	Total Retail VMT	Total Retail VMT	Change	Below Threshold?
2019 plus Master Plan	2019	95,846	57,495	-38,351	Yes
2040 plus Master Plan	2040	108,865	69,253	-39,612	Yes
2040 plus Vision Plan	2040	108,865	27,721	-81,114	Yes

Source: TAMDM, Kittelson & Associates, W-Trans, 2022

Cumulative VMT

As specified in the City's TIAG, a project would have a significant cumulative impact on VMT if it causes the City's cumulative (year 2040) average total VMT per service population to increase. Based on the TAMDM model runs performed for the project, the City of San Rafael is projected to have an average total VMT per service population of 18.8 under the 2040 no build condition. In 2040 with the proposed Master Plan, the City's average total VMT per service population is projected to be 18.1 miles, and in 2040 with the Vision Plan it is projected to be 18.0 miles. Because the Master Plan and Vision Plan would each result in reductions to the City's average total VMT per service population, the project would be considered to have a less-than-significant cumulative impact on VMT.

A summary of the cumulative VMT analysis results is shown in Table 9.

Table 9 – Cumulative VMT Analysis Summary				
Scenario	Total VMT City of San Rafael	Total Service Population	Total VMT per Service Population	Below Threshold?
2040 No Build	2,130,263	113,571	18.8	-
2040 plus Master Plan	2,095,779	115,515	18.1	Yes
2040 plus Vision Plan	2,089,433	116,330	18.0	Yes

Source: TAMDM, Kittelson & Associates, W-Trans, 2022

Finding – The proposed project, including both Master Plan and Vision Plan phases, would have a less-than-significant VMT impact under 2019 baseline and 2040 cumulative scenarios based on the established significance thresholds.

Safety Issues

This section addresses the third bullet on the CEQA checklist which is whether or not the project would substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment). The potential for the project to impact safety was evaluated in terms of the adequacy of sight distance and need for turn lanes at the project driveways as well as the adequacy of stacking space in dedicated turn lanes at the study intersections to accommodate additional queuing due to adding project-generated trips.

Site Access

The site has 12 access points. Clockwise from the northwest corner, they are:

- The intersection of Las Gallinas Avenue/Del Presidio Boulevard (inbound only);
- Driveway 580 feet east of Las Gallinas Avenue/Del Presidio Boulevard;
- Driveway 300 feet north of Las Gallinas Avenue/Merrydale Road;
- The intersection of Las Gallinas Avenue/Merrydale Road;
- Driveway 400 feet north of Los Ranchitos Road-Las Gallinas Avenue/Northgate Drive;
- Driveway 230 feet north of Los Ranchitos Road-Las Gallinas Avenue/Northgate Drive;
- Driveway 140 feet north of Los Ranchitos Road-Las Gallinas Avenue/Northgate Drive;
- Driveway 340 feet west of Los Ranchitos Road-Las Gallinas Avenue/Northgate Drive;
- Driveway 100 feet west of Northgate Drive/El Faisan Drive;
- The intersection of Northgate Drive/Thorndale Drive;
- Driveway 280 feet north of Northgate Drive/Thorndale Drive; and
- Driveway 400 feet south of Las Gallinas Avenue/Northgate Drive.

With construction of the project, the driveways 230 feet and 140 feet north of Los Ranchitos Road-Las Gallinas Avenue/Northgate Drive would be removed and the driveway 100 feet west of Northgate Drive/El Faisan Drive would be moved to Northgate Drive/El Faisan Drive, converting the existing tee intersection into a four-legged intersection. The other driveways would be unchanged.

Sight Distance

Sight distances along Northgate Drive and Las Gallinas Avenue at the project driveways were evaluated using sight distance criteria contained in the *Highway Design Manual* (HDM) published by Caltrans. The recommended sight distances for approaches on the major street to driveways and private street intersections are based on stopping sight distance with approach travel speed used as the basis for determining the recommended sight distance.

For the posted speed limit of 25 miles per hour (mph) on Northgate Drive and Las Gallinas Avenue, the minimum stopping sight distance needed is 150 feet. Sight distances from each driveway except two were measured in excess of 250 feet in both directions, providing adequate stopping sight distance for speeds of 35 mph. One of the exceptions is the driveway 580 feet east of Las Gallinas Avenue/Del Presidio Boulevard. At this location, sight distance to the right (of traffic heading westbound) was measured as 210 feet. The speed of westbound drivers was checked through an informal speed survey using a speed radar gun. Due to the horizontal curve east of the driveway, no westbound drivers were recorded traveling faster than 23 mph. Since 150 feet of stopping sight distance is recommended for 25 mph and 210 feet of sight distance is available, sight lines to and from this driveway are adequate.

The other exception is the driveway 280 feet north of Northgate Drive/Thorndale Drive. Due to dense vegetation south of this driveway combined with vertical grade on the driveway ascending up to the roadway, sight distance from the driveway to the left (of northbound traffic) is restricted to 160 feet. Another informal speed study was

conducted to estimate the critical speed of traffic, which is defined as the speed at or below which 85 percent of drivers are observed to be traveling. Based on this informal study, the critical speed of northbound drivers on Northgate Drive just south of this driveway was measured as 32 mph.

The HDM provides minimum stopping sight distances for increments of five mph. Between these increments, the HDM defers to *A Policy on Geometric Design of Highways and Streets* (“the Greenbook”), American Association of State Highway and Transportation Officials, 2018. The Greenbook prescribes a formula for converting speed into stopping sight distance that results in 216 feet for 32 mph. The vegetation should be trimmed, or new vegetation selected to increase the existing 160 feet of sight distance at this driveway to at least 216 feet to provide adequate sight distance at the prevailing speed. The Federal Highway Administration (FHWA) recommends in its guide on *Vegetation Control for Safety*, 2007, that bushes and shrubs in the motorists’ line of sight should be kept under three feet of height, and that trees and hanging branches be trimmed to a minimum height of seven feet. This provides a gap in vegetation for drivers on a cross street to observe oncoming traffic .

It is noted that due to the vertical rise of the driveway as it ascends to match Northgate Drive, the eye level of a driver looking to enter Northgate Drive is lower than on a descending or level driveway and therefore ground-based foliage such as shrubs and grasses may restrict sight lines more than at other locations. An image of the restricted sight line is shown in Plate 1. It was recommended to the project applicant that construction of the project result in entirely removing foliage in the sight triangle bound by a driver waiting 15 feet from the edge of travel on Northgate Drive, a northbound driver approaching from 216 feet from the south, and a straight line between the two. A diagram of this triangle is shown in Plate 2.

Although the project would not exacerbate this existing condition, the project applicant has agreed to modify its project application to incorporate the clear zone, and ensure that the site owner would maintain the clear zone.

Finding – Adequate sight distance would be available from all but one of the existing and proposed project driveway locations. The driveway 280 feet north of Northgate Drive/Thorndale Drive has visibility to the south of 160 feet due to dense foliage south of the driveway, which is short of the 216 feet recommended by the HDM for the measured critical speed of northbound traffic of 32 mph. As the project applicant has ensured that this deficiency would be remediated as part of its project application, this would constitute a less-than-significant project impact.



Plate 1 Restricted Sight Line to Left (South) from Driveway 280 feet North of Northgate Dr/Thorndale Dr

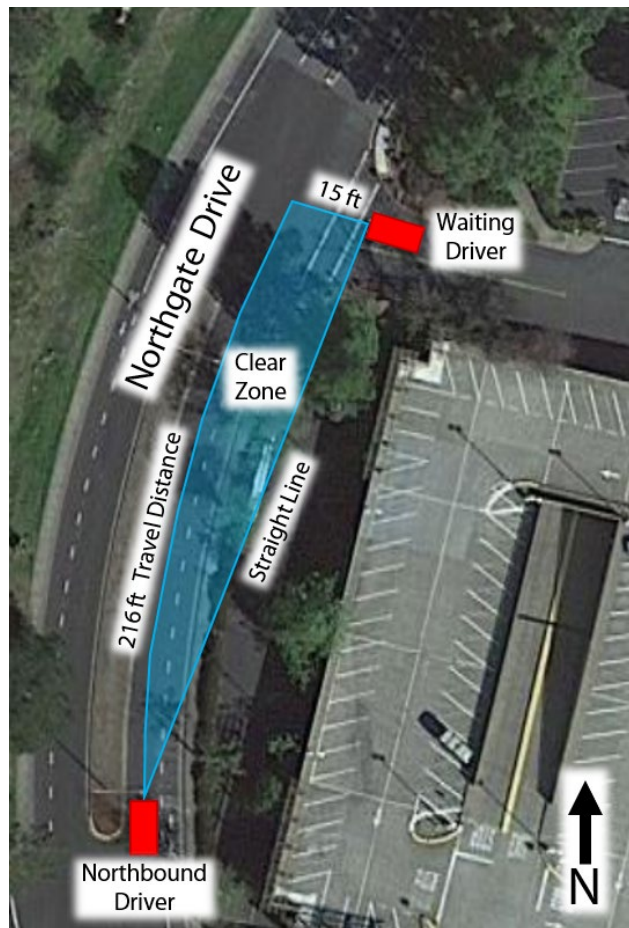


Plate 2 Sight Triangle Diagram with Recommended Clear Zone in Blue

Access Analysis

Most driveways that would serve the project have existing left-turn lanes. The exceptions that were assessed for the need for a left-turn lane are:

- The driveway 580 feet east of Las Gallinas Avenue/Del Presidio Boulevard;
- The driveway 400 feet north of Los Ranchitos Road-Las Gallinas Avenue/Northgate Drive; and
- The intersection of Northgate Drive/Thorndale Drive.

It is noted that a left-turn lane into the project site does not exist at Las Gallinas Avenue/Del Presidio Boulevard, however this movement is prohibited so a warrant was not studied.

The need for a left-turn lane at each of the three driveways was evaluated based on criteria contained in the *Intersection Channelization Design Guide*, National Cooperative Highway Research Program (NCHRP) Report No. 279, Transportation Research Board, 1985, as well as an update of the methodology developed by the Washington State Department of Transportation and published in the *Method for Prioritizing Intersection Improvements*, January 1997. The NCHRP report references a methodology developed by M. D. Harmelink that includes equations that can be applied to expected or actual traffic volumes to determine the need for a left-turn pocket based on safety issues. Warrants were assessed for each driveway for both Master Plan and Vision Plan scenarios under Future conditions, as this represents the highest background traffic volumes assessed. As the left-turn lane warrant is based on traffic volumes, this presents the “worst case” scenario for warranted a left-turn lane. Under the a.m. peak hour conditions assessed, a left-turn lane is not warranted at any of the three driveways.

Conditions for the p.m. peak hour were not assessed as the Master Plan and the Vision Plan would both result in a reduction to inbound volumes during the p.m. peak hour compared to the existing shopping center, precluding a project effect on the need for left-turn lanes. Additionally, there is not a history of collisions involving drivers turning left into the project site which would demonstrate the need for additional left-turn lanes, as there was only one collision reported during the five-year study period involving a driver turning left into the project site, and that was at a location that already has a left-turn lane.

A copy of the turn lane warrant worksheets is contained in Appendix B.

Finding – Under Future conditions with traffic anticipated to be generated by the Master Plan and Vision Plan scenarios applied, left-turn lanes into the project site would not be warranted at the driveway 580 feet east of Las Gallinas Avenue/Del Presidio Boulevard, the driveway 400 feet north of Los Ranchitos Road-Las Gallinas Avenue/Northgate Drive, and the intersection of Northgate Drive/Thorndale Drive. All of the other access points have left-turn lanes except for Las Gallinas Avenue/Del Presidio Boulevard, where left-turn movements into the project site are prohibited. Therefore, the project would have a less-than-significant impact to safety with regard to site access.

Queuing

The *Transportation Impact Analysis Guidelines*, City of San Rafael, June 2021, detail mobility deficiency criteria for development projects. For queuing, the Guidelines prescribe that a deficiency would occur when the 95th percentile vehicle queues would exceed the existing or planned length of a turn pocket or freeway off-ramp or would result in a speed differential between two adjacent lanes of travel. Where queues exceed the available storage without the addition of project traffic, a deficiency would occur if the stacking distance is increased by more than 50 feet with project traffic added.

Under each scenario, the projected maximum queues in turn pockets and on freeway off-ramps at the study intersections were determined using the SIMTRAFFIC application of Synchro and averaging the maximum projected queue for each of ten runs. Summarized in Table 10 are the predicted queue lengths for each scenario without and with project trips. Copies of the SIMTRAFFIC projections are contained in Appendix C. Note that the

Master Plan and Vision Plan scenarios were assessed using more conservative trip generation totals of 223 and 260 net new a.m. peak hour trips instead of 150 and 141 such trips, respectively.

Table 10 – Maximum AM Peak Hour Queues

Study Intersection Lane	Available Storage	Maximum Queues					
		E	B	B+MP	F	F+MP	F+VP
1. Freitas Pkwy/Las Gallinas Ave							
Eastbound Left-Turn	175	138	165	168	211	217	207
Eastbound Right-Turn	160	221	242	234	252	253	246
Westbound Left-Turn	475	362	440	468	582	578	597
Northbound Left-Turn	125	95	94	105	95	113	121
Northbound Right-Turn	110	134	138	135	147	151	149
Southbound Left-Turn	120	163	172	169	173	174	170
Southbound Right-Turn	125	92	103	92	108	121	95
2. Freitas Pkwy/Northgate Dr							
Eastbound Left-Turn	220	58	69	51	72	75	60
Westbound Left-Turn	375	178	179	171	186	187	202
Northbound Right-Turn	45	66	61	86	71	85	84
Southbound Left-Turn	50	59	56	53	67	64	62
3. Freitas Pkwy/Del Presidio Blvd							
Southbound Off-Ramp ¹	515	268	351	333	694	662	663
5. Redwood Hwy/US 101 N On-Ramp							
Northbound Left-Turn	130	53	55	59	57	65	67
7. Freitas Pkwy/Redwood Hwy-Civic Center Dr							
Southbound Through/Left-Turn	200	73	83	85	144	131	142
8. Las Gallinas Ave/Nova Albion Wy							
Eastbound Right-Turn	115	176	178	174	177	181	179
Northbound Left-Turn	140	147	158	170	150	169	178
Southbound Right-Turn	95	145	153	153	162	162	162
9. Las Gallinas Ave/Northgate Dr							
Eastbound Left-Turn	135	27	29	30	27	35	28
Northbound Left-Turn	160	48	52	62	59	74	79
Northbound Right-Turn	220	19	24	24	26	33	26
Southbound Left-Turn	210	89	98	93	87	107	100
10. Las Gallinas Ave/Del Presidio Blvd							
Westbound Right-Turn	415	57	55	62	55	65	87
Southbound Right-Turn	100	84	90	89	104	104	94
11. Las Gallinas Ave/Merrydale Rd							
Eastbound Left-Turn	150	13	13	NA	10	NA	39
Westbound Left-Turn	300	79	80	95	84	96	96

Table 10 – Maximum AM Peak Hour Queues

Study Intersection Lane	Available Storage	Maximum Queues					
		E	B	B+MP	F	F+MP	F+VP
Northbound Left-Turn	130	11	11	NA	14	NA	NA
Southbound Left-Turn	150	71	85	89	118	123	132
12. Merrydale Rd/Civic Center Dr							
Eastbound Left-Turn	310	65	74	118	99	135	154
Westbound Left-Turn	250	19	22	22	27	24	24
Northbound Left-Turn	320	54	59	63	79	72	70
14. Northgate Dr/El Faisan Dr							
Eastbound Left-Turn (Plus Project Only)	200	-	-	12	-	13	NA
Northbound Left-Turn	70	39	41	40	41	40	40
15. Northgate Dr/Nova Albion Wy							
Westbound Left-Turn	100	54	58	56	56	63	65
16. Los Ranchitos Rd-Las Gallinas Ave/ Northgate Dr							
Eastbound Left-Turn	120	65	69	89	77	95	99
Eastbound Right-Turn	120	59	68	66	71	78	73
Northbound Left-Turn	100	55	50	52	51	58	53
17. Los Ranchitos Rd/N San Pedro Rd							
Eastbound Left-Turn	110	109	125	129	155	156	157
Southbound Left-Turn ²	70	118	145	147	319	350	340
Southbound Right-Turn ²	75	85	105	110	140	139	140

Notes: Maximum Queue based on the average of the maximum value from ten SIMTRAFFIC runs; all distances are measured in feet; E = Existing conditions; B = Baseline conditions; F = Future conditions; B+MP = Baseline plus Master Plan conditions; F+MP = Future plus Master Plan conditions; F+VP = Future plus Vision Plan conditions; NP = queue length was not reported due to low or nonexistent volumes; **Bold** text = queue length exceeds available storage

¹ Off-ramp length calculated by subtracting stopping sight distance for 55 mph (500 feet) from the ramp length of 1,015 feet, as measured from stop bar to start of gore.

² Distance between stop bar and transverse marking parallel to SMART railroad tracks.

For all study intersections, the queue would either be contained within each turn lane without or with the addition of traffic associated with either project scenario, or the queue would extend beyond capacity without the project and the addition of project traffic would increase the stacking distance by less than 50 feet.

Finding – The addition of project traffic associated with either the Master Plan or Vision Plan scenarios would result in a less-than-significant impact as the increases would either be contained within the existing turn lane capacities, or the increase in an already deficient stacking distance would be less than 50 feet.

Emergency Access

The final bullet on the CEQA checklist requires an evaluation as to whether the project would result in inadequate emergency access or not.

Adequacy of Emergency Access

The City of San Rafael Municipal Code Chapter 4.08 adopts the 2019 California Fire Code with several amendments as regards emergency access. With regard to traffic, a fire access road of at least 20 feet in unobstructed width must be provided within 150 feet of all exterior building walls. The Master Plan and Vision Plan both include a network of interior roads and parking aisles at least 20 feet wide that provide access within 150 feet of all building exteriors when combined with the public streets of Las Gallinas Avenue and Northgate Drive around the outside of the project site. There would be multiple interior paths through the project connecting the multiple driveways together, providing alternative routes in the event one aisle or driveway is blocked. The project would therefore have adequate emergency access.

Impact on Response Times

As the project would result in a reduction in traffic on the surrounding roadway network over the course of the day and during the critical p.m. peak period, it would reasonably be expected to have a less-than-significant, and in fact beneficial, impact on emergency response times within the study area. Further, if emergency response vehicles are traveling with their flashing lights and sirens operating, drivers are required to pull to the side to allow their passage. This condition would not change as a result of the project.

Finding – Both project scenarios would have adequate emergency access and would not negatively impact emergency response times. The project’s impact in terms of emergency access is therefore considered to be less than significant.

Conclusions and Recommendations

Conclusions

- Upon construction of the Master Plan scenario, a net decrease of 3,585 daily trips is anticipated, including a decrease of 345 p.m. peak hour trips but an increase of 172 a.m. peak hour trips. For the Vision Plan, the estimated trip generation includes a decrease in daily traffic of 8,384 daily trips, though there would be an increase of 177 trips during the morning peak hour and a decrease of 886 trips during the evening peak hour.
- The project's impact on pedestrian, bicycle, and transit facilities in the vicinity of the project site would be less-than-significant. Adequate on-site bicycle and pedestrian facilities would be provided, though bicycle parking should be provided to conform with City Code.
- The project would have a less-than-significant impact in terms of VMT.
- There would be adequate sight distance at all but one proposed or existing project driveway location, with the exception being the driveway 280 feet north of Northgate Drive/Thorndale Drive which has insufficient sight distance to the south due to a combination of vertical grade and dense foliage. It is understood that providing a clear zone at this driveway will be incorporated into the project application, resulting in a less-than-significant impact.
- The project's impact to safety with regard to site access would be less than significant as additional left-turn lanes into the project site would not be warranted under Future conditions with the addition of traffic associated with either the Master Plan or Vision Plan scenarios.
- The project would have a less-than-significant impact on queuing for all intersections and all scenarios assessed.
- The project would have a less-than-significant impact on emergency response times in the area and would have adequate emergency access under both development scenarios.

Recommendations

- The Master Plan scenario should include 178 short-term and 100 long-term bicycle parking spaces to conform with the City Code, which could be reduced for the Vision Plan scenario to a total of 157 short-term and 45 long-term bicycle parking spaces.

Study Participants and References

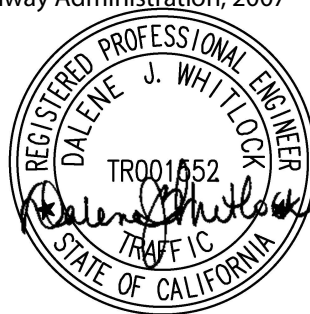
Study Participants

Principal in Charge	Dalene J. Whitlock, PE, PTOE
Traffic Engineer	Kevin Carstens, PE
Graphics	Cameron Wong
Editing/Formatting	Hannah Yung-Boxdell, Cameron Wong, Jessica Bender
Quality Control	Dalene J. Whitlock, PE, PTOE
Modeling	Damian Stefanakis, Kittelson & Associates, Inc.

References

- 2018 Collision Data on California State Highways*, California Department of Transportation, 2020
- A Policy on Geometric Design of Highways and Streets*, American Association of State Highway and Transportation Officials, 2018
- Bicycle and Pedestrian Master Plan*, City of San Rafael, 2018
- California Manual on Uniform Traffic Control Devices for Streets and Highways Revision 6*, California Department of Transportation, 2021
- California Vehicle Code*, State of California, 2018,
<http://leginfo.ca.gov/faces/codesTOCSelected.xhtml?tocCode=VEH&tocTitle=+Vehicle+Code+--+VEH>
- Capital Improvement Program*, City of San Rafael, 2021
- City of San Rafael Transportation Impact Analysis Guidelines*, City of San Rafael, June 2021
- General Plan 2040*, City of San Rafael, 2021
- Golden Gate Bridge Highway & Transportation District, <https://www.goldengate.org>
- Highway Design Manual*, 7th Edition, California Department of Transportation, 2020
- Intersection Channelization Design Guide*, National Cooperative Highway Research Program Report No. 279, Transportation Research Board, 1985
- Marin County Travel Safety Plan*, County of Marin, 2018
- Marin Transit*, <https://marintransit.org/>
- Merrydale Conceptual Design Informational Report*, City of San Rafael, 2022
- Method for Prioritizing Intersection Improvements*, Washington State Department of Transportation, 1997
- North San Rafael Vision and Promenade Conceptual Plan*, Whittenkeller and Associates and Brian Powell & Associates, 2002
- Observational Before-After Study of the Safety Effect of U.S. Roundabout Conversions Using the Empirical Bayes Method*, Persaud et al., 2001
- Resolution 14891*, City of San Rafael, 2021
- San Rafael, California Municipal Code*, Municipal Code Corporation, 2021
- San Rafael General Plan 2040*, City of San Rafael, 2021
- Sonoma-Marin Rail Transit District (SMART)*, <https://www.sonomamarintrain.org/>
- Statewide Integrated Traffic Records System (SWITRS)*, California Highway Patrol, 2016-2021
- Technical Advisory on Evaluating Transportation Impacts in CEQA*, Governor's Office of Planning and Research, 2018
- Trip Generation Manual*, 11th Edition, Institute of Transportation Engineers, 2021
- Vegetation Control for Safety*, Federal Highway Administration, 2007

SRA130-2





This page intentionally left blank

Appendix A

Collision Rate Calculations





This page intentionally left blank

Intersection Collision Rate Worksheet

Northgate Town Square Project

Intersection # 1: Manuel T Freitas Parkway & Las Gallinas Avenue

Date of Count: Wednesday, September 15, 2021

Number of Collisions: 17
Number of Injuries: 11
Number of Fatalities: 0
Average Daily Traffic (ADT): 31800
Start Date: July 1, 2016
End Date: June 30, 2021
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{17}{31,800} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.29 c/mve	0.0%	64.7%
Statewide Average*	0.24 c/mve	0.5%	46.9%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection # 2: Freitas Parkway & Northgate Drive

Date of Count: Wednesday, September 15, 2021

Number of Collisions: 18
Number of Injuries: 7
Number of Fatalities: 0
Average Daily Traffic (ADT): 31900
Start Date: July 1, 2016
End Date: June 30, 2021
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{18}{31,900} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.31 c/mve	0.0%	38.9%
Statewide Average*	0.24 c/mve	0.5%	46.9%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Worksheet

Northgate Town Square Project

Intersection # 3: Freitas Parkway & Del Presidio Boulevard
Date of Count: Wednesday, September 15, 2021

Number of Collisions: 68
Number of Injuries: 24
Number of Fatalities: 0
Average Daily Traffic (ADT): 39900
Start Date: July 1, 2016
End Date: June 30, 2021
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{68}{39,900} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.93 c/mve	0.0%	35.3%
Statewide Average*	0.24 c/mve	0.5%	46.9%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection # 4: Freitas Parkway & US 101 South Ramps
Date of Count: Wednesday, September 15, 2021

Number of Collisions: 2
Number of Injuries: 0
Number of Fatalities: 0
Average Daily Traffic (ADT): 33500
Start Date: July 1, 2016
End Date: June 30, 2021
Number of Years: 5

Intersection Type: Other
Control Type: No Controls
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{2}{33,500} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.03 c/mve	0.0%	0.0%
Statewide Average*	0.06 c/mve	1.9%	41.7%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Worksheet

Northgate Town Square Project

Intersection # 5: Redwood Highway & US 101 North On-Ramp

Date of Count: Wednesday, September 15, 2021

Number of Collisions: 3
Number of Injuries: 1
Number of Fatalities: 0
Average Daily Traffic (ADT): 870
Start Date: July 1, 2016
End Date: June 30, 2021
Number of Years: 5

Intersection Type: Tee
Control Type: No Controls
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{3}{870} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	1.89 c/mve	0.0%	33.3%
Statewide Average*	0.06 c/mve	1.9%	41.7%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection # 6: Freitas Parkway & US 101 North Ramps

Date of Count: Wednesday, September 15, 2021

Number of Collisions: 4
Number of Injuries: 1
Number of Fatalities: 0
Average Daily Traffic (ADT): 29000
Start Date: July 1, 2016
End Date: June 30, 2021
Number of Years: 5

Intersection Type: Tee
Control Type: No Controls
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{4}{29,000} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.08 c/mve	0.0%	25.0%
Statewide Average*	0.06 c/mve	1.9%	41.7%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Worksheet

Northgate Town Square Project

Intersection # 7: Freitas Parkway & Redwood Highway-Civic Center Drive
Date of Count: Wednesday, September 15, 2021

Number of Collisions: 10
Number of Injuries: 1
Number of Fatalities: 0
Average Daily Traffic (ADT): 15500
Start Date: July 1, 2016
End Date: June 30, 2021
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Stop & Yield Controls
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{10}{15,500} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.35 c/mve	0.0%	10.0%
Statewide Average*	0.14 c/mve	1.1%	46.2%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection # 8: Las Gallinas Ave & Nova Albion Way
Date of Count: Wednesday, September 15, 2021

Number of Collisions: 6
Number of Injuries: 2
Number of Fatalities: 0
Average Daily Traffic (ADT): 14900
Start Date: July 1, 2016
End Date: June 30, 2021
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{6}{14,900} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.22 c/mve	0.0%	33.3%
Statewide Average*	0.24 c/mve	0.5%	46.9%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Worksheet

Northgate Town Square Project

Intersection # 9: Las Gallinas Ave & Northgate Drive

Date of Count: Wednesday, September 15, 2021

Number of Collisions: 26
Number of Injuries: 10
Number of Fatalities: 0
Average Daily Traffic (ADT): 12500
Start Date: July 1, 2016
End Date: June 30, 2021
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{26}{12,500} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	1.14 c/mve	0.0%	38.5%
Statewide Average*	0.24 c/mve	0.5%	46.9%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection # 10: Las Gallinas Ave & Del Presidio Boulevard

Date of Count: Wednesday, September 15, 2021

Number of Collisions: 7
Number of Injuries: 2
Number of Fatalities: 0
Average Daily Traffic (ADT): 10200
Start Date: July 1, 2016
End Date: June 30, 2021
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{7}{10,200} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.38 c/mve	0.0%	28.6%
Statewide Average*	0.24 c/mve	0.5%	46.9%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Worksheet

Northgate Town Square Project

Intersection # 11: Las Gallinas Ave & Merrydale Road

Date of Count: Wednesday, September 15, 2021

Number of Collisions: 3
Number of Injuries: 1
Number of Fatalities: 0
Average Daily Traffic (ADT): 7700
Start Date: July 1, 2016
End Date: June 30, 2021
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{3}{7,700} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.21 c/mve	0.0%	33.3%
Statewide Average*	0.24 c/mve	0.5%	46.9%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection # 12: Merrydale Road-Scettrini Drive & Civic Center Drive

Date of Count: Wednesday, September 15, 2021

Number of Collisions: 2
Number of Injuries: 1
Number of Fatalities: 0
Average Daily Traffic (ADT): 9900
Start Date: July 1, 2016
End Date: June 30, 2021
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{2}{9,900} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.11 c/mve	0.0%	50.0%
Statewide Average*	0.24 c/mve	0.5%	46.9%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Worksheet

Northgate Town Square Project

Intersection # 13: Northgate Drive & Throntdale Drive

Date of Count: Wednesday, September 15, 2021

Number of Collisions: 0
Number of Injuries: 0
Number of Fatalities: 0
Average Daily Traffic (ADT): 5000
Start Date: July 1, 2016
End Date: June 30, 2021
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Stop & Yield Controls
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{0}{5,000} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.00 c/mve	0.0%	0.0%
Statewide Average*	0.14 c/mve	1.1%	46.2%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection # 14: Northgate Drive & El Faisan Drive

Date of Count: Wednesday, September 15, 2021

Number of Collisions: 2
Number of Injuries: 2
Number of Fatalities: 0
Average Daily Traffic (ADT): 4800
Start Date: July 1, 2016
End Date: June 30, 2021
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{2}{4,800} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.23 c/mve	0.0%	100.0%
Statewide Average*	0.09 c/mve	1.2%	46.9%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Worksheet

Northgate Town Square Project

Intersection # 15: Northgate Drive & Nova Albion Way
Date of Count: Wednesday, September 15, 2021

Number of Collisions: 0
Number of Injuries: 0
Number of Fatalities: 0
Average Daily Traffic (ADT): 7100
Start Date: July 1, 2016
End Date: June 30, 2021
Number of Years: 5

Intersection Type: Tee
Control Type: Stop & Yield Controls
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{0}{7,100} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.00 c/mve	0.0%	0.0%
Statewide Average*	0.09 c/mve	1.2%	46.9%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection # 16: Los Ranchitos Road-Las Gallinas Ave & Northgate Drive
Date of Count: Wednesday, September 15, 2021

Number of Collisions: 3
Number of Injuries: 0
Number of Fatalities: 0
Average Daily Traffic (ADT): 7200
Start Date: July 1, 2016
End Date: June 30, 2021
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{3}{7,200} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.23 c/mve	0.0%	0.0%
Statewide Average*	0.24 c/mve	0.5%	46.9%

Notes

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2018 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Worksheet

Northgate Town Square Project

Intersection # 17: Los Ranchitos Road & North San Pedro Road

Date of Count: Wednesday, September 15, 2021

Number of Collisions: 3

Number of Injuries: 2

Number of Fatalities: 1

Average Daily Traffic (ADT): 13900

Start Date: July 1, 2016

End Date: June 30, 2021

Number of Years: 5

Intersection Type: Tee

Control Type: Signals

Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times \text{Days per Year} \times \text{Number of Years}}$$

$$\text{Collision Rate} = \frac{3}{13,900} \times \frac{1,000,000}{365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.12 c/mve	33.3%	66.7%
Statewide Average*	0.20 c/mve	0.5%	46.8%

Notes

ADT = average daily total vehicles entering intersection

c/mve = collisions per million vehicles entering intersection

* 2018 Collision Data on California State Highways, Caltrans



This page intentionally left blank

Appendix B

Turn Lane Warrant Worksheets





This page intentionally left blank

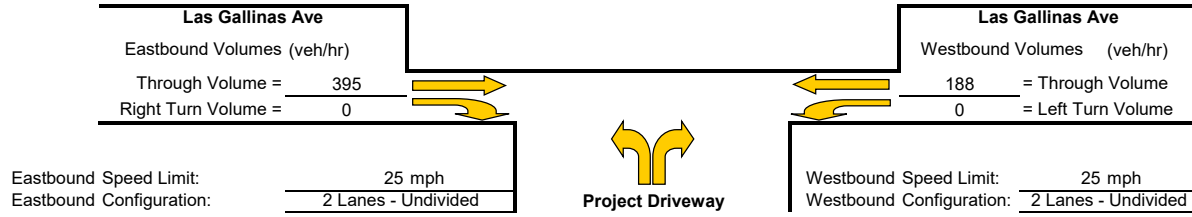
Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: Driveway 580 Feet East of Las Gallinas Ave/Del Presidio Blvd

Study Scenario: Future plus Master Plan Conditions

Direction of Analysis Street: East/West

Cross Street Intersects: From the South



Eastbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold AV = 1050.1
 Advancing Volume Va = 395
 If $AV < Va$ then warrant is met No

Right Turn Lane Warranted: NO

Eastbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

2. Check advance volume threshold criteria for taper

Advancing Volume Threshold AV = -
 Advancing Volume Va = 395
 If $AV < Va$ then warrant is met -

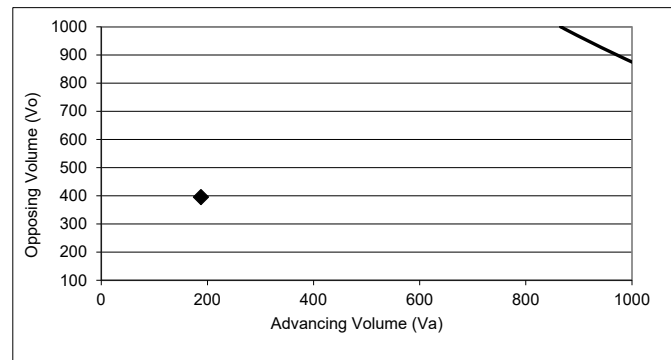
Right Turn Taper Warranted: NO

Westbound Left Turn Lane Warrants

Percentage Left Turns %lt 0.0 %

Advancing Volume Threshold AV 1737 veh/hr

If $AV < Va$ then warrant is met



◆ Study Intersection

Two lane roadway warrant threshold for: 25 mph

Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: NO

Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements*, January 1997.

The right turn lane and taper analysis is based on work conducted by Cottrell in 1981.

The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.

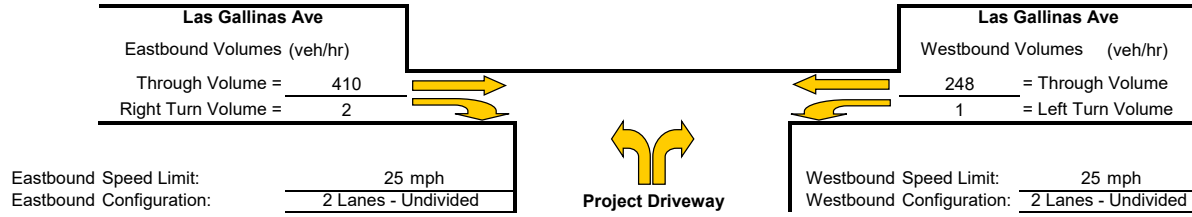
Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: Driveway 580 Feet East of Las Gallinas Ave/Del Presidio Blvd

Study Scenario: Future plus Vision Plan Conditions

Direction of Analysis Street: East/West

Cross Street Intersects: From the South



Eastbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold AV = 1035.1
 Advancing Volume Va = 412
 If $AV < Va$ then warrant is met No

Right Turn Lane Warranted: NO

Eastbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

2. Check advance volume threshold criteria for taper

Advancing Volume Threshold AV = -
 Advancing Volume Va = 412
 If $AV < Va$ then warrant is met -

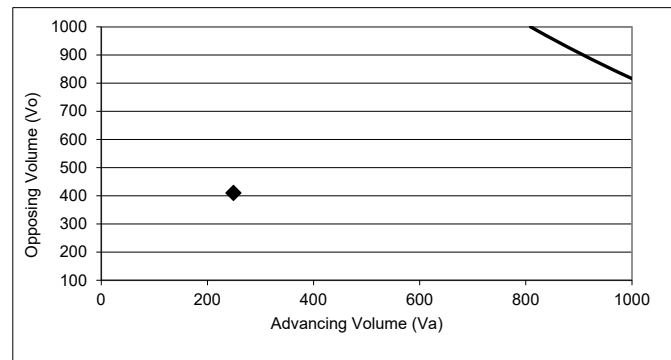
Right Turn Taper Warranted: NO

Westbound Left Turn Lane Warrants

Percentage Left Turns %lt 0.4 %

Advancing Volume Threshold AV 1595 veh/hr

If $AV < Va$ then warrant is met



◆ Study Intersection

Two lane roadway warrant threshold for: 25 mph

Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: NO

Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements*, January 1997.

The right turn lane and taper analysis is based on work conducted by Cottrell in 1981.

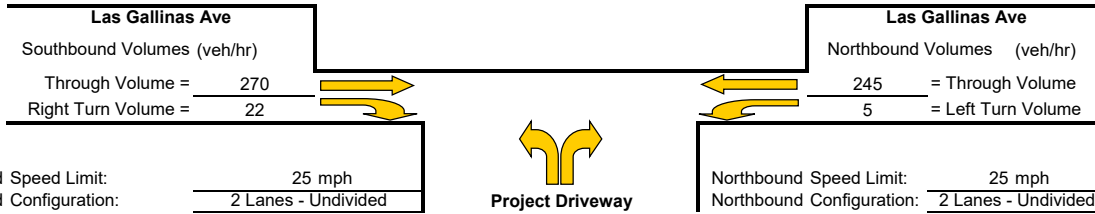
The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.

Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: Driveway 400 feet north of Los Ranchitos Road-Las Gallinas Avenue/Northgate Drive
 Study Scenario: Future plus Master Plan Conditions

Direction of Analysis Street: North/South

Cross Street Intersects: From the West



Southbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold AV = 885.1
 Advancing Volume Va = 292
 If $AV < Va$ then warrant is met No

Right Turn Lane Warranted: NO

Southbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

Thresholds not met, continue to next step

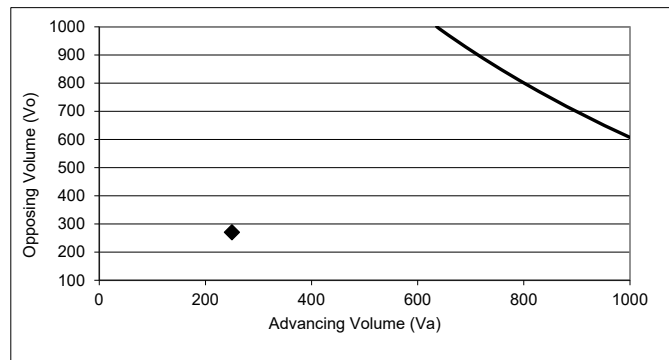
2. Check advance volume threshold criteria for taper

Advancing Volume Threshold AV = 680
 Advancing Volume Va = 292
 If $AV < Va$ then warrant is met No

Right Turn Taper Warranted: NO

Northbound Left Turn Lane Warrants

Percentage Left Turns %lt 2.0 %
 Advancing Volume Threshold AV 1473 veh/hr
 If $AV < Va$ then warrant is met



◆ Study Intersection

Two lane roadway warrant threshold for: 25 mph

Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: NO

Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements*, January 1997.

The right turn lane and taper analysis is based on work conducted by Cottrell in 1981.

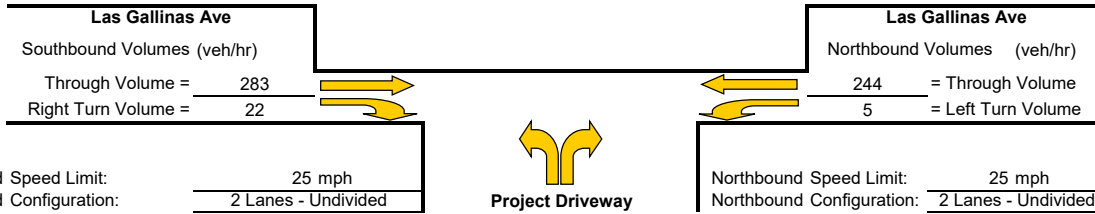
The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroorty in 1991.

Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: Driveway 400 feet north of Los Ranchitos Road-Las Gallinas Avenue/Northgate Drive
 Study Scenario: Future plus Vision Plan Conditions

Direction of Analysis Street: North/South

Cross Street Intersects: From the West



Southbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold	AV =	885.1
Advancing Volume	Va =	305
If $AV < Va$ then warrant is met		

Right Turn Lane Warranted: NO

Southbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

Thresholds not met, continue to next step

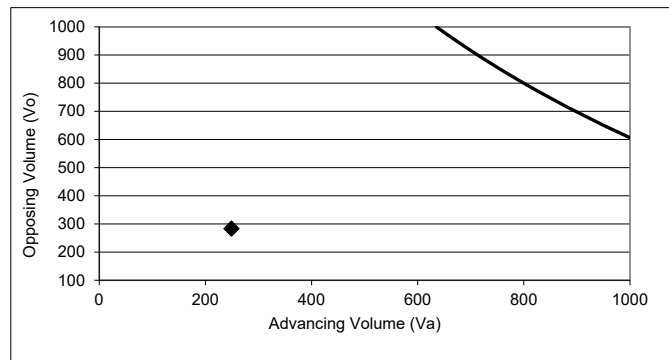
2. Check advance volume threshold criteria for taper

Advancing Volume Threshold	AV =	680
Advancing Volume	Va =	305
If $AV < Va$ then warrant is met		

Right Turn Taper Warranted: NO

Northbound Left Turn Lane Warrants

Percentage Left Turns %lt	2.0 %
Advancing Volume Threshold AV	1450 veh/hr
If $AV < Va$ then warrant is met	



◆ Study Intersection
 — Two lane roadway warrant threshold for: 25 mph
 Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: NO

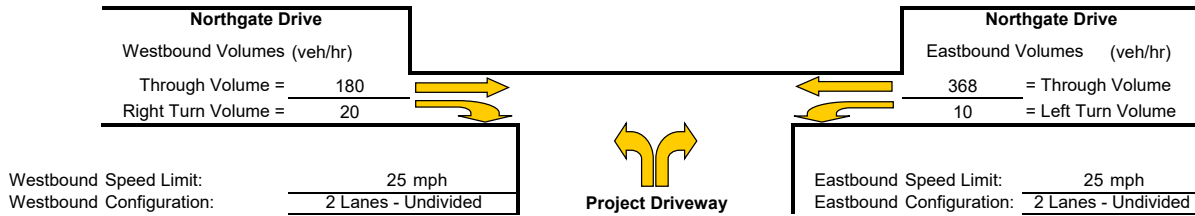
Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements*, January 1997.
 The right turn lane and taper analysis is based on work conducted by Cottrell in 1981.
 The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.

Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: Driveway 340 feet west of Los Ranchitos Road-Las Gallinas Avenue/Northgate Drive
 Study Scenario: Future plus Vision Plan Conditions

Direction of Analysis Street: East/West

Cross Street Intersects: From the North



Westbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold	AV =	900.1
Advancing Volume	Va =	200
If $AV < Va$ then warrant is met		
No		

Right Turn Lane Warranted: NO

Westbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for taper

Advancing Volume Threshold	AV =	700
Advancing Volume	Va =	200
If $AV < Va$ then warrant is met		
No		

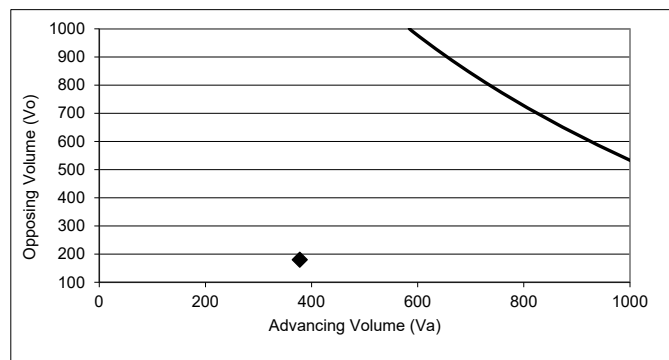
Right Turn Taper Warranted: NO

Eastbound Left Turn Lane Warrants

Percentage Left Turns %lt 2.6 %

Advancing Volume Threshold AV 1501 veh/hr

If $AV < Va$ then warrant is met



◆ Study Intersection

Two lane roadway warrant threshold for: 25 mph

Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: NO

Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements*, January 1997.

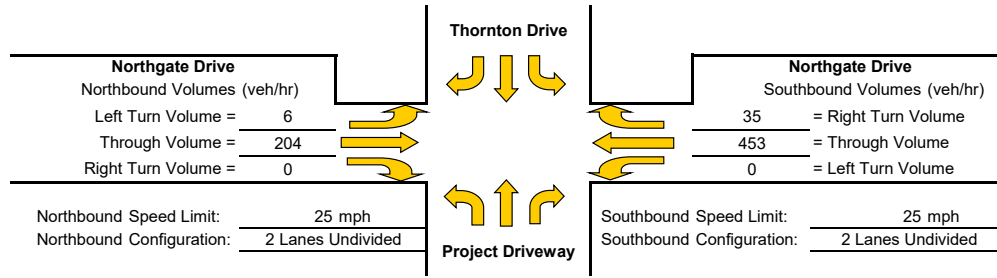
The right turn lane and taper analysis is based on work conducted by Cottrell in 1981.

The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.

Turn Lane Warrant Analysis - 4 Legged Intersections

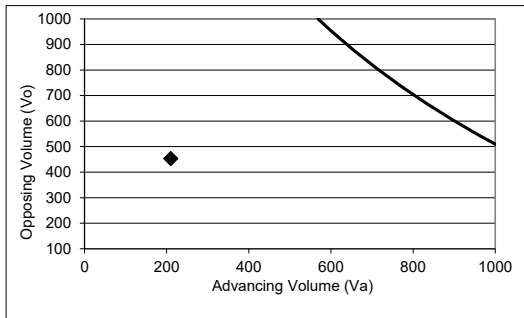
Study Intersection: Northgate Drive/Thornton Drive
 Study Scenario: Future plus Master Plan

Direction of Analysis Street: North/South



Northbound Left Turn Lane Warrants

Percentage Left Turns %lt 2.9 %
 Advancing Volume Threshold AV 1068 veh/hr
 If $AV < Va$ then warrant is met



◆ Study Intersection
 Two lane roadway warrant threshold for: 25 mph
 Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: NO

Note: If one direction has a left turn lane warranted, a left turn lane should be installed on the other side as well

Northbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane
 Advancing Volume Threshold: AV = -
 Advancing Volume Va = 210
 If $AV < Va$ then warrant is met No

Right Turn Lane Warranted: NO

Northbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

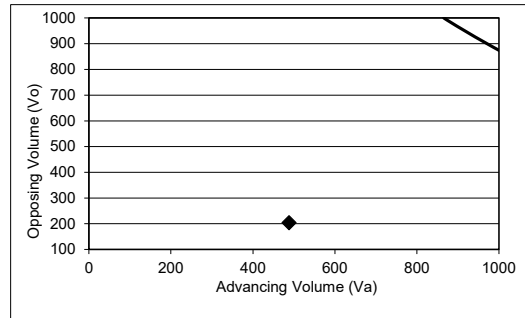
NOT WARRANTED - Less than 40 vehicles

2. Check advance volume threshold criteria for taper
 Advancing Volume Threshold AV = 1333
 Advancing Volume Va = 210
 If $AV < Va$ then warrant is met No

Right Turn Taper Warranted: NO

Southbound Left Turn Lane Warrants

Percentage Left Turns %lt 0.0 %
 Advancing Volume Threshold AV 2164 veh/hr
 If $AV < Va$ then warrant is met



◆ Study Intersection
 Two lane roadway warrant threshold for: 25 mph
 Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: NO

Southbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane
 Advancing Volume Threshold: AV = 787.5
 Advancing Volume Va = 488
 If $AV < Va$ then warrant is met No

Right Turn Lane Warranted: NO

Southbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for taper
 Advancing Volume Threshold AV = 550
 Advancing Volume Va = 488
 If $AV < Va$ then warrant is met No

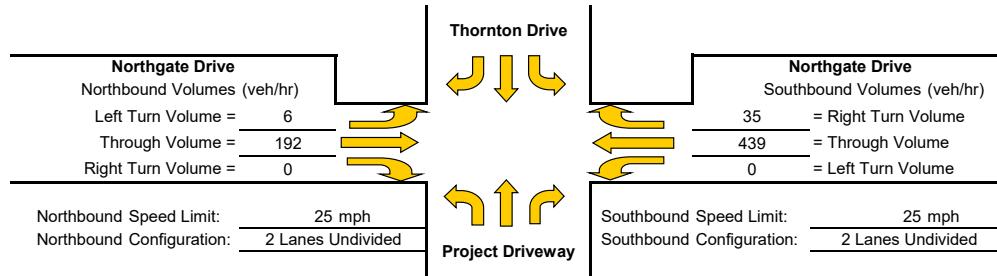
Right Turn Taper Warranted: NO

Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements*, Jan. 1997.
 The right turn lane and taper analysis is based on work conducted by Cottrell in 1981. The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.

Turn Lane Warrant Analysis - 4 Legged Intersections

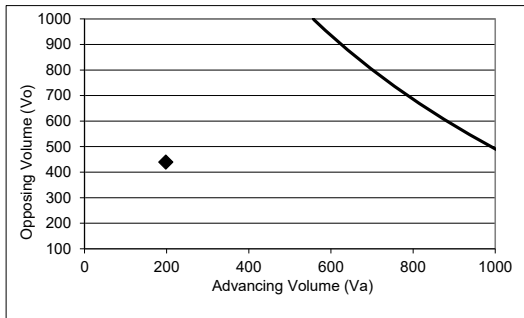
Study Intersection: Northgate Drive/Thornton Drive
 Study Scenario: Future plus Vision Plan

Direction of Analysis Street: North/South



Northbound Left Turn Lane Warrants

Percentage Left Turns %lt 3.0 %
 Advancing Volume Threshold AV 1062 veh/hr
 If $AV < Va$ then warrant is met



◆ Study Intersection
 Two lane roadway warrant threshold for: 25 mph
 Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: NO

Note: If one direction has a left turn lane warranted, a left turn lane should be installed on the other side as well

Northbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane
 Advancing Volume Threshold: AV = -
 Advancing Volume Va = 198
 If $AV < Va$ then warrant is met No

Right Turn Lane Warranted: NO

Northbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

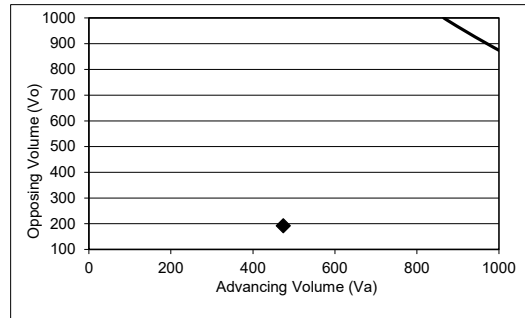
NOT WARRANTED - Less than 40 vehicles

2. Check advance volume threshold criteria for taper
 Advancing Volume Threshold AV = 1333
 Advancing Volume Va = 198
 If $AV < Va$ then warrant is met No

Right Turn Taper Warranted: NO

Southbound Left Turn Lane Warrants

Percentage Left Turns %lt 0.0 %
 Advancing Volume Threshold AV 2194 veh/hr
 If $AV < Va$ then warrant is met



◆ Study Intersection
 Two lane roadway warrant threshold for: 25 mph
 Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: NO

Southbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane
 Advancing Volume Threshold: AV = 787.5
 Advancing Volume Va = 474
 If $AV < Va$ then warrant is met No

Right Turn Lane Warranted: NO

Southbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for taper
 Advancing Volume Threshold AV = 550
 Advancing Volume Va = 474
 If $AV < Va$ then warrant is met No

Right Turn Taper Warranted: NO

Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements*, Jan. 1997.
 The right turn lane and taper analysis is based on work conducted by Cottrell in 1981. The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.



This page intentionally left blank

Appendix C

Queuing Calculations





This page intentionally left blank

Queuing and Blocking Report

11/14/2021

Intersection: 1: Las Gallinas Avenue & Freitas Parkway

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	UL	T	T	R	UL	T	T	R	L	T	R	L
Maximum Queue (ft)	184	524	544	185	404	246	210	89	125	278	134	145
Average Queue (ft)	44	260	291	90	213	83	92	4	40	78	65	103
95th Queue (ft)	138	517	549	221	362	180	181	56	95	194	134	163
Link Distance (ft)		928	928			1110	1110			461		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	175			160	450			200	110		110	120
Storage Blk Time (%)	0	27	39	0	0		0	0	1	5	2	12
Queuing Penalty (veh)	0	7	27	0	1		0	0	3	11	3	30

Intersection: 1: Las Gallinas Avenue & Freitas Parkway

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	449	143
Average Queue (ft)	166	25
95th Queue (ft)	364	92
Link Distance (ft)	668	
Upstream Blk Time (%)	1	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		120
Storage Blk Time (%)	16	0
Queuing Penalty (veh)	31	0

Intersection: 2: Northgate Drive & Freitas Parkway

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB	
Directions Served	UL	T	TR	UL	L	T	TR	LT	R	L	TR	
Maximum Queue (ft)	82	516	628	206	181	284	287	74	66	68	83	
Average Queue (ft)	20	121	211	110	88	85	84	20	27	25	14	
95th Queue (ft)	58	383	513	178	154	206	210	57	66	59	52	
Link Distance (ft)		1110	1110		431	431	431	427			528	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	220			375					45	50		
Storage Blk Time (%)		1						4	2	8	1	
Queuing Penalty (veh)		0						1	0	2	0	

Queuing and Blocking Report

11/14/2021

Intersection: 3: Del Presidio Boulevard/101 SB Ramp & Freitas Parkway

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB	
Directions Served	T	TR	T	T	T	LT	R	LT	TR	
Maximum Queue (ft)	326	433	130	174	148	30	294	287	401	
Average Queue (ft)	96	212	52	89	70	4	109	106	109	
95th Queue (ft)	250	403	111	151	128	22	262	198	268	
Link Distance (ft)	431	431	245	245	245	334	334	615	615	
Upstream Blk Time (%)	0	0					1		0	
Queuing Penalty (veh)	0	2					1		0	
Storage Bay Dist (ft)										
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 4: 101 SB Ramp & Freitas Parkway

Movement	WB
Directions Served	TR
Maximum Queue (ft)	4
Average Queue (ft)	0
95th Queue (ft)	4
Link Distance (ft)	802
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 5: Redwood Highway & 101 NB Ramp

Movement	NB	SB
Directions Served	L	TR
Maximum Queue (ft)	63	109
Average Queue (ft)	22	14
95th Queue (ft)	53	63
Link Distance (ft)		464
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	130	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report

11/14/2021

Intersection: 6: US 101 On-/Off-Ramps & Manuel T Freitas Pkwy

Movement	NB	NB	SB
Directions Served	T	R	UL
Maximum Queue (ft)	32	53	269
Average Queue (ft)	1	7	105
95th Queue (ft)	30	31	209
Link Distance (ft)	293	293	802
Upstream Blk Time (%)	0		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 7: Civic Center Dr/Redwood Hwy & Manuel T Freitas Pkwy /Private Driveway

Movement	EB	EB	NB	NB	SB	SB
Directions Served	ULT	R	UL	TR	ULT	R
Maximum Queue (ft)	38	6	58	77	96	167
Average Queue (ft)	5	0	25	38	41	68
95th Queue (ft)	26	5	47	63	73	122
Link Distance (ft)	93	93	562	562		486
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)					200	
Storage Blk Time (%)						0
Queuing Penalty (veh)						0

Intersection: 8: Las Gallinas Avenue & Nova Albion Drive

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	L	TR	LT	R
Maximum Queue (ft)	337	140	88	156	191	349	120
Average Queue (ft)	189	92	33	85	33	101	74
95th Queue (ft)	330	176	73	147	115	249	145
Link Distance (ft)	320		170		791	461	
Upstream Blk Time (%)	2						0
Queuing Penalty (veh)	0						1
Storage Bay Dist (ft)		115		140			95
Storage Blk Time (%)	24	0		4	0	9	3
Queuing Penalty (veh)	42	1		3	0	36	4

Queuing and Blocking Report

11/14/2021

Intersection: 9: Northgate Drive & Las Gallinas Avenue

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	LT	TR	L	T	R	L	T	TR
Maximum Queue (ft)	35	44	167	142	73	56	66	38	121	126	80
Average Queue (ft)	8	5	57	57	14	21	29	2	38	50	10
95th Queue (ft)	27	23	123	114	44	48	59	19	89	103	45
Link Distance (ft)		198	198	154	154		338			427	427
Upstream Blk Time (%)			0	0	0						
Queuing Penalty (veh)			0	0	0						
Storage Bay Dist (ft)	135					160		220	210		
Storage Blk Time (%)									0		
Queuing Penalty (veh)									0		

Intersection: 10: Mall Entrance/Del Presidio Boulevard & Las Gallinas Avenue

Movement	EB	EB	EB	WB	WB	B29	SB	SB	SB
Directions Served	L	L	TR	T	R	T	L	LT	R
Maximum Queue (ft)	59	134	115	134	63	2	165	103	105
Average Queue (ft)	4	52	25	61	27	0	63	21	44
95th Queue (ft)	28	113	74	115	57	2	127	62	84
Link Distance (ft)	154	154	154	127	127	213	334	334	
Upstream Blk Time (%)	0	0	1						
Queuing Penalty (veh)	0	0	1						
Storage Bay Dist (ft)									100
Storage Blk Time (%)								0	0
Queuing Penalty (veh)								0	0

Intersection: 11: Las Gallinas Avenue & Merrydale Road/Merrydale Overpass

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	23	27	97	81	20	118	90	87
Average Queue (ft)	2	4	46	39	1	57	33	30
95th Queue (ft)	13	18	79	67	11	97	71	68
Link Distance (ft)		376		930		945		975
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	150		300		130		150	
Storage Blk Time (%)						0		
Queuing Penalty (veh)						0		

Queuing and Blocking Report

11/14/2021

Intersection: 12: Civic Center Drive & Merrydale Overpass/Merrydale Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	UL	TR
Maximum Queue (ft)	85	99	29	50	66	82	51	202
Average Queue (ft)	33	41	4	20	28	30	17	88
95th Queue (ft)	65	77	19	43	54	67	44	157
Link Distance (ft)	930		422		416		387	387
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	310		250		320			
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 13: Northgate Drive/Northgate & Thorndale Drive/Northgate Mall

Movement	EB	NB	B31
Directions Served	LTR	LTR	T
Maximum Queue (ft)	33	28	2
Average Queue (ft)	11	1	0
95th Queue (ft)	30	11	2
Link Distance (ft)	202	421	338
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 14: El Faisan Drive & Northgate Drive

Movement	EB	WB	NB	NB
Directions Served	TR	LT	L	R
Maximum Queue (ft)	11	36	34	31
Average Queue (ft)	0	4	15	11
95th Queue (ft)	7	23	39	34
Link Distance (ft)	421	198	261	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	70			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Queuing and Blocking Report

11/14/2021

Intersection: 15: Nova Albion Way & Northgate Drive/Northgate

Movement	EB	EB	WB	WB	NB
Directions Served	T	R	UL	T	LR
Maximum Queue (ft)	8	33	66	6	100
Average Queue (ft)	0	2	21	0	47
95th Queue (ft)	5	15	54	5	79
Link Distance (ft)	198		798		230
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	100		100		
Storage Blk Time (%)	0				
Queuing Penalty (veh)	0				

Intersection: 16: Los Ranchitos Road/Las Gallinas Avenue & Northgate Drive

Movement	EB	EB	NB	NB	SB
Directions Served	L	R	L	TR	LTR
Maximum Queue (ft)	72	70	69	62	121
Average Queue (ft)	35	35	26	14	54
95th Queue (ft)	65	59	55	41	102
Link Distance (ft)				1079	945
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	120	120	100		
Storage Blk Time (%)				0	0
Queuing Penalty (veh)				0	0

Intersection: 17: Los Ranchitos Road & N. San Pedro Road

Movement	EB	EB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (ft)	131	257	138	165	99
Average Queue (ft)	60	97	61	64	23
95th Queue (ft)	109	184	111	118	85
Link Distance (ft)	807		514	421	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	110				75
Storage Blk Time (%)	0	4	4		0
Queuing Penalty (veh)	2	5	8		0

Network Summary

Network wide Queuing Penalty: 225

Queuing and Blocking Report

11/14/2021

Intersection: 1: Las Gallinas Avenue & Freitas Parkway

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	UL	T	T	R	UL	T	T	R	L	T	R	L
Maximum Queue (ft)	199	653	710	185	447	354	291	88	131	307	135	145
Average Queue (ft)	55	383	418	110	260	99	102	4	41	94	67	111
95th Queue (ft)	165	728	776	242	440	277	232	50	94	225	138	172
Link Distance (ft)		928	928			1110	1110			461		
Upstream Blk Time (%)		0	1							0		
Queuing Penalty (veh)		0	0							0		
Storage Bay Dist (ft)	175			160	450			200	110		110	120
Storage Blk Time (%)	0	46	58	0	3	0	0	0	1	7	1	19
Queuing Penalty (veh)	0	15	41	0	9	0	1	0	2	16	3	53

Intersection: 1: Las Gallinas Avenue & Freitas Parkway

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	546	144
Average Queue (ft)	229	31
95th Queue (ft)	496	103
Link Distance (ft)	668	
Upstream Blk Time (%)	1	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		120
Storage Blk Time (%)	20	0
Queuing Penalty (veh)	42	0

Intersection: 2: Northgate Drive & Freitas Parkway

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	UL	T	TR	UL	L	T	TR	LT	R	L	TR
Maximum Queue (ft)	96	527	624	198	217	294	323	69	66	61	54
Average Queue (ft)	22	145	254	113	92	100	101	19	24	26	10
95th Queue (ft)	69	424	570	179	162	225	235	54	61	56	37
Link Distance (ft)		1110	1110		431	431	431	427			528
Upstream Blk Time (%)						0	0				
Queuing Penalty (veh)						0	1				
Storage Bay Dist (ft)	220			375					45	50	
Storage Blk Time (%)		1						3	2	7	1
Queuing Penalty (veh)		0						1	0	2	0

Queuing and Blocking Report

11/14/2021

Intersection: 3: Del Presidio Boulevard/101 SB Ramp & Freitas Parkway

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	T	TR	T	T	T	LT	R	LT	TR
Maximum Queue (ft)	377	456	147	195	179	35	322	335	491
Average Queue (ft)	104	236	51	92	74	5	132	118	144
95th Queue (ft)	282	450	115	160	141	24	297	224	351
Link Distance (ft)	431	431	245	245	245	334	334	615	615
Upstream Blk Time (%)	0	1		0	0		1		0
Queuing Penalty (veh)	0	5		0	0		1		0
Storage Bay Dist (ft)									
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 4: 101 SB Ramp & Freitas Parkway

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 5: Redwood Highway & 101 NB Ramp

Movement	NB	SB
Directions Served	L	TR
Maximum Queue (ft)	63	99
Average Queue (ft)	23	12
95th Queue (ft)	55	57
Link Distance (ft)		464
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	130	
Storage Blk Time (%)	0	
Queuing Penalty (veh)	0	

Queuing and Blocking Report

11/14/2021

Intersection: 6: US 101 On-/Off-Ramps & Manuel T Freitas Pkwy

Movement	NB	NB	SB
Directions Served	T	R	UL
Maximum Queue (ft)	30	77	269
Average Queue (ft)	1	10	116
95th Queue (ft)	30	48	219
Link Distance (ft)	293	293	802
Upstream Blk Time (%)	0	0	
Queuing Penalty (veh)	0	0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 7: Civic Center Dr/Redwood Hwy & Manuel T Freitas Pkwy /Private Driveway

Movement	EB	EB	NB	NB	SB	SB
Directions Served	ULT	R	UL	TR	ULT	R
Maximum Queue (ft)	36	6	59	94	111	160
Average Queue (ft)	6	0	27	44	49	67
95th Queue (ft)	27	5	50	73	83	120
Link Distance (ft)	93	93	562	562		486
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)					200	
Storage Blk Time (%)						0
Queuing Penalty (veh)						0

Intersection: 8: Las Gallinas Avenue & Nova Albion Drive

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	L	TR	LT	R
Maximum Queue (ft)	338	140	98	163	234	442	120
Average Queue (ft)	203	91	30	92	40	153	83
95th Queue (ft)	351	178	75	158	126	351	153
Link Distance (ft)	320		170		791	461	
Upstream Blk Time (%)	3						0
Queuing Penalty (veh)	0						2
Storage Bay Dist (ft)		115		140			95
Storage Blk Time (%)	26	0		6	0	15	3
Queuing Penalty (veh)	47	1		5	0	63	5

Queuing and Blocking Report

11/14/2021

Intersection: 9: Northgate Drive & Las Gallinas Avenue

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	LT	TR	L	T	R	L	T	TR
Maximum Queue (ft)	41	70	177	147	87	59	70	50	129	135	82
Average Queue (ft)	9	5	66	67	13	24	27	3	43	53	10
95th Queue (ft)	29	31	139	126	51	52	58	24	98	106	47
Link Distance (ft)		198	198	154	154		338			427	427
Upstream Blk Time (%)			0	0	0						
Queuing Penalty (veh)			0	0	0						
Storage Bay Dist (ft)	135					160		220	210		
Storage Blk Time (%)											
Queuing Penalty (veh)											

Intersection: 10: Mall Entrance/Del Presidio Boulevard & Las Gallinas Avenue

Movement	EB	EB	EB	WB	WB	SB	SB	SB
Directions Served	L	L	TR	T	R	L	LT	R
Maximum Queue (ft)	54	134	96	136	62	182	118	113
Average Queue (ft)	3	59	29	65	26	79	24	48
95th Queue (ft)	23	121	79	118	55	148	74	90
Link Distance (ft)	154	154	154	127	127	334	334	
Upstream Blk Time (%)	0	0	1					
Queuing Penalty (veh)	0	0	1					
Storage Bay Dist (ft)							100	
Storage Blk Time (%)							0	0
Queuing Penalty (veh)							0	0

Intersection: 11: Las Gallinas Avenue & Merrydale Road/Merrydale Overpass

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	21	26	106	81	23	124	98	99
Average Queue (ft)	2	4	45	38	1	56	42	34
95th Queue (ft)	13	18	80	64	11	96	85	77
Link Distance (ft)		376		930		945		975
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	150		300		130		150	
Storage Blk Time (%)						0	0	
Queuing Penalty (veh)						0	0	

Queuing and Blocking Report

11/14/2021

Intersection: 12: Civic Center Drive & Merrydale Overpass/Merrydale Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	UL	TR
Maximum Queue (ft)	90	103	35	58	69	103	59	265
Average Queue (ft)	37	44	4	19	30	39	19	116
95th Queue (ft)	74	82	22	46	59	81	48	205
Link Distance (ft)		930		422		416	387	387
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	310		250		320			
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 13: Northgate Drive/Northgate & Thorndale Drive/Northgate Mall

Movement	EB	NB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (ft)	30	22	18
Average Queue (ft)	11	2	1
95th Queue (ft)	30	12	9
Link Distance (ft)	202	421	1042
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 14: El Faisan Drive & Northgate Drive

Movement	EB	WB	NB	NB
Directions Served	TR	LT	L	R
Maximum Queue (ft)	6	30	39	35
Average Queue (ft)	0	4	16	10
95th Queue (ft)	5	21	41	34
Link Distance (ft)	421	198		261
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			70	
Storage Blk Time (%)			0	0
Queuing Penalty (veh)			0	0

Queuing and Blocking Report

11/14/2021

Intersection: 15: Nova Albion Way & Northgate Drive/Northgate

Movement	EB	EB	WB	WB	NB
Directions Served	T	R	UL	T	LR
Maximum Queue (ft)	16	33	74	6	95
Average Queue (ft)	1	2	24	0	49
95th Queue (ft)	9	15	58	4	78
Link Distance (ft)	198			798	230
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		100	100		
Storage Blk Time (%)			0		
Queuing Penalty (veh)			0		

Intersection: 16: Los Ranchitos Road/Las Gallinas Avenue & Northgate Drive

Movement	EB	EB	NB	NB	SB
Directions Served	L	R	L	TR	LTR
Maximum Queue (ft)	83	85	62	53	137
Average Queue (ft)	37	39	26	15	56
95th Queue (ft)	69	68	50	41	105
Link Distance (ft)				1079	945
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	120	120	100		
Storage Blk Time (%)	0	0	0		
Queuing Penalty (veh)	0	0	0		

Intersection: 17: Los Ranchitos Road & N. San Pedro Road

Movement	EB	EB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (ft)	130	247	151	193	100
Average Queue (ft)	70	103	66	76	35
95th Queue (ft)	125	197	121	145	105
Link Distance (ft)		807	514	421	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	110				75
Storage Blk Time (%)	1	4		6	0
Queuing Penalty (veh)	4	8		14	0

Network Summary

Network wide Queuing Penalty: 346

Queuing and Blocking Report

11/14/2021

Intersection: 1: Las Gallinas Avenue & Freitas Parkway

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	UL	T	T	R	UL	T	T	R	L	T	R	L
Maximum Queue (ft)	199	928	935	185	475	1012	983	201	130	415	135	145
Average Queue (ft)	77	765	791	121	406	527	428	16	39	136	75	134
95th Queue (ft)	211	1144	1148	252	582	1152	1034	111	95	327	147	173
Link Distance (ft)		928	928			1110	1110			461		
Upstream Blk Time (%)		31	41			2	1			0		
Queuing Penalty (veh)		0	0			11	3			1		
Storage Bay Dist (ft)	175			160	450			200	110		110	120
Storage Blk Time (%)	0	74	80	0	47	0	1	0	0	15	1	46
Queuing Penalty (veh)	0	32	61	0	165	1	2	0	1	34	2	160

Intersection: 1: Las Gallinas Avenue & Freitas Parkway

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	703	144
Average Queue (ft)	519	31
95th Queue (ft)	877	108
Link Distance (ft)	668	
Upstream Blk Time (%)	40	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		120
Storage Blk Time (%)	35	0
Queuing Penalty (veh)	95	0

Intersection: 2: Northgate Drive & Freitas Parkway

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	UL	T	TR	UL	L	T	TR	LT	R	L	TR
Maximum Queue (ft)	128	793	852	199	278	362	437	79	71	70	90
Average Queue (ft)	20	328	439	114	101	130	133	21	31	33	11
95th Queue (ft)	72	782	874	180	186	289	325	58	71	67	47
Link Distance (ft)		1110	1110		431	431	431	427			528
Upstream Blk Time (%)		0				0	1				
Queuing Penalty (veh)		0				2	6				
Storage Bay Dist (ft)	220			375					45	50	
Storage Blk Time (%)		3						3	3	12	1
Queuing Penalty (veh)		1						2	1	3	0

Queuing and Blocking Report

11/14/2021

Intersection: 3: Del Presidio Boulevard/101 SB Ramp & Freitas Parkway

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	T	TR	T	T	T	LT	R	LT	TR
Maximum Queue (ft)	412	464	155	200	181	30	331	615	626
Average Queue (ft)	126	291	54	103	74	4	157	220	336
95th Queue (ft)	322	485	121	169	143	21	324	549	694
Link Distance (ft)	431	431	245	245	245	334	334	615	615
Upstream Blk Time (%)	0	2		0	0		2	4	11
Queuing Penalty (veh)	0	10		0	0		3	0	0
Storage Bay Dist (ft)									
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 4: 101 SB Ramp & Freitas Parkway

Movement	EB	WB
Directions Served	T	TR
Maximum Queue (ft)	6	2
Average Queue (ft)	0	0
95th Queue (ft)	6	2
Link Distance (ft)	245	802
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: Redwood Highway & 101 NB Ramp

Movement	NB	SB
Directions Served	L	TR
Maximum Queue (ft)	70	124
Average Queue (ft)	26	15
95th Queue (ft)	57	69
Link Distance (ft)		464
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	130	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report

11/14/2021

Intersection: 6: US 101 On-/Off-Ramps & Manuel T Freitas Pkwy

Movement	NB	NB	SB	SB
Directions Served	T	R	UL	T
Maximum Queue (ft)	36	93	479	200
Average Queue (ft)	1	21	225	19
95th Queue (ft)	30	64	474	171
Link Distance (ft)	293	293	802	802
Upstream Blk Time (%)	0		0	
Queuing Penalty (veh)	0		1	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 7: Civic Center Dr/Redwood Hwy & Manuel T Freitas Pkwy /Private Driveway

Movement	EB	EB	NB	NB	SB	SB
Directions Served	ULT	R	UL	TR	ULT	R
Maximum Queue (ft)	60	52	70	145	192	184
Average Queue (ft)	15	2	32	70	81	70
95th Queue (ft)	45	22	58	117	144	137
Link Distance (ft)	93	93	562	562		486
Upstream Blk Time (%)	0	0				
Queuing Penalty (veh)	0	0				
Storage Bay Dist (ft)					200	
Storage Blk Time (%)					0	0
Queuing Penalty (veh)					1	0

Intersection: 8: Las Gallinas Avenue & Nova Albion Drive

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	L	TR	LT	R
Maximum Queue (ft)	338	140	100	159	205	474	120
Average Queue (ft)	214	99	33	83	57	276	98
95th Queue (ft)	363	177	78	150	138	521	162
Link Distance (ft)	320		170		791	461	
Upstream Blk Time (%)	5					3	
Queuing Penalty (veh)	0					24	
Storage Bay Dist (ft)		115		140			95
Storage Blk Time (%)	27	0		4	0	31	2
Queuing Penalty (veh)	57	1		5	0	133	6

Queuing and Blocking Report

11/14/2021

Intersection: 9: Northgate Drive & Las Gallinas Avenue

Movement	EB	EB	EB	B28	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	T	LT	TR	L	T	R	L	T	TR
Maximum Queue (ft)	36	117	219	16	168	124	75	86	47	113	143	104
Average Queue (ft)	8	10	95	1	93	21	26	30	3	40	57	13
95th Queue (ft)	27	55	190	11	157	74	59	67	26	87	114	57
Link Distance (ft)		198	198	791	154	154		338				427
Upstream Blk Time (%)		0	1		1	0						
Queuing Penalty (veh)		0	1		2	0						
Storage Bay Dist (ft)	135						160		220	210		
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 10: Mall Entrance/Del Presidio Boulevard & Las Gallinas Avenue

Movement	EB	EB	EB	WB	WB	SB	SB	SB
Directions Served	L	L	TR	T	R	L	LT	R
Maximum Queue (ft)	71	151	150	146	63	206	173	119
Average Queue (ft)	6	68	47	64	25	106	27	58
95th Queue (ft)	34	132	113	122	55	187	92	104
Link Distance (ft)	154	154	154	127	127	334	334	
Upstream Blk Time (%)	0	0	1					
Queuing Penalty (veh)	1	0	1					
Storage Bay Dist (ft)							100	
Storage Blk Time (%)							0	1
Queuing Penalty (veh)							1	1

Intersection: 11: Las Gallinas Avenue & Merrydale Road/Merrydale Overpass

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	21	24	108	86	26	128	143	154
Average Queue (ft)	1	4	46	40	2	58	60	41
95th Queue (ft)	10	18	84	70	14	101	118	102
Link Distance (ft)		376		930		945		975
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	150		300		130		150	
Storage Blk Time (%)						0	0	0
Queuing Penalty (veh)						0	1	0

Queuing and Blocking Report

11/14/2021

Intersection: 12: Civic Center Drive & Merrydale Overpass/Merrydale Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB	B165	B165	
Directions Served	L	TR	L	TR	L	TR	UL	TR	T	T	
Maximum Queue (ft)	121	155	33	62	104	168	93	461	17	86	
Average Queue (ft)	51	67	8	23	36	70	22	243	1	6	
95th Queue (ft)	99	123	27	48	79	134	67	417	19	55	
Link Distance (ft)	930		422		416		387	387	562	562	
Upstream Blk Time (%)							0	3			
Queuing Penalty (veh)							0	12			
Storage Bay Dist (ft)	310		250		320						
Storage Blk Time (%)											
Queuing Penalty (veh)											

Intersection: 13: Northgate Drive/Northgate & Thorndale Drive/Northgate Mall

Movement	EB	NB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (ft)	34	28	18
Average Queue (ft)	11	2	1
95th Queue (ft)	31	15	11
Link Distance (ft)	202	421	1042
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 14: El Faisan Drive & Northgate Drive

Movement	EB	WB	NB	NB
Directions Served	TR	LT	L	R
Maximum Queue (ft)	54	43	40	37
Average Queue (ft)	3	6	16	12
95th Queue (ft)	25	27	41	37
Link Distance (ft)	421	198	261	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	70			
Storage Blk Time (%)	0		0	
Queuing Penalty (veh)	0		0	

Queuing and Blocking Report

11/14/2021

Intersection: 15: Nova Albion Way & Northgate Drive/Northgate

Movement	EB	EB	WB	WB	NB
Directions Served	T	R	UL	T	LR
Maximum Queue (ft)	29	41	65	15	107
Average Queue (ft)	2	4	27	1	49
95th Queue (ft)	16	21	56	7	82
Link Distance (ft)	198		798		230
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	100		100		
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 16: Los Ranchitos Road/Las Gallinas Avenue & Northgate Drive

Movement	EB	EB	NB	NB	SB
Directions Served	L	R	L	TR	LTR
Maximum Queue (ft)	98	81	65	58	134
Average Queue (ft)	42	45	27	15	57
95th Queue (ft)	77	71	51	43	107
Link Distance (ft)				1079	945
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	120	120	100		
Storage Blk Time (%)	0		0		
Queuing Penalty (veh)	0		0		

Intersection: 17: Los Ranchitos Road & N. San Pedro Road

Movement	EB	EB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (ft)	134	400	203	383	100
Average Queue (ft)	106	144	85	164	70
95th Queue (ft)	155	289	161	319	140
Link Distance (ft)	807		514	421	
Upstream Blk Time (%)					1
Queuing Penalty (veh)					0
Storage Bay Dist (ft)	110		75		
Storage Blk Time (%)	9	7	19		1
Queuing Penalty (veh)	32	19	60		2

Network Summary

Network wide Queuing Penalty: 962

Queuing and Blocking Report

11/14/2021

Intersection: 1: Las Gallinas Avenue & Freitas Parkway

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	UL	T	T	R	UL	T	T	R	L	T	R	L
Maximum Queue (ft)	199	666	694	185	453	444	307	67	134	318	135	145
Average Queue (ft)	55	384	423	113	270	131	117	2	44	93	70	108
95th Queue (ft)	170	725	765	242	456	376	277	39	103	224	143	170
Link Distance (ft)		928	928			1110	1110			461		
Upstream Blk Time (%)		1	2									
Queuing Penalty (veh)		0	0									
Storage Bay Dist (ft)	175			160	450			200	110		110	120
Storage Blk Time (%)		47	62	0	5		0	0	1	8	2	17
Queuing Penalty (veh)		15	44	1	15		0	0	2	17	3	45

Intersection: 1: Las Gallinas Avenue & Freitas Parkway

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	613	134
Average Queue (ft)	236	22
95th Queue (ft)	522	86
Link Distance (ft)	668	
Upstream Blk Time (%)	2	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		120
Storage Blk Time (%)	21	0
Queuing Penalty (veh)	44	0

Intersection: 2: Northgate Drive & Freitas Parkway

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	UL	T	TR	UL	L	T	TR	LT	R	L	TR
Maximum Queue (ft)	95	691	718	215	207	297	299	145	70	69	62
Average Queue (ft)	20	184	311	112	90	114	113	48	43	27	9
95th Queue (ft)	67	535	662	181	161	243	249	106	82	60	38
Link Distance (ft)		1110	1110		431	431	431	427			528
Upstream Blk Time (%)		0					0				
Queuing Penalty (veh)		0					0				
Storage Bay Dist (ft)	220			375					45	50	
Storage Blk Time (%)		1						15	4	9	1
Queuing Penalty (veh)		0						10	2	3	0

Queuing and Blocking Report

11/14/2021

Intersection: 3: Del Presidio Boulevard/101 SB Ramp & Freitas Parkway

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	T	TR	T	T	T	LT	R	LT	TR
Maximum Queue (ft)	380	462	161	208	183	33	316	265	425
Average Queue (ft)	109	255	52	96	77	5	146	106	134
95th Queue (ft)	291	467	118	166	146	24	315	202	329
Link Distance (ft)	431	431	245	245	245	334	334	615	615
Upstream Blk Time (%)	0	1	0	0	0		1		0
Queuing Penalty (veh)	0	8	0	0	0		1		0
Storage Bay Dist (ft)									
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 4: 101 SB Ramp & Freitas Parkway

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 5: Redwood Highway & 101 NB Ramp

Movement	NB	SB
Directions Served	L	TR
Maximum Queue (ft)	78	105
Average Queue (ft)	30	17
95th Queue (ft)	63	63
Link Distance (ft)		464
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	130	
Storage Blk Time (%)	0	
Queuing Penalty (veh)	0	

Queuing and Blocking Report

11/14/2021

Intersection: 6: US 101 On-/Off-Ramps & Manuel T Freitas Pkwy

Movement	NB	NB	SB
Directions Served	T	R	UL
Maximum Queue (ft)	6	89	259
Average Queue (ft)	0	11	117
95th Queue (ft)	4	59	222
Link Distance (ft)	293	293	802
Upstream Blk Time (%)	0		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 7: Civic Center Dr/Redwood Hwy & Manuel T Freitas Pkwy /Private Driveway

Movement	EB	EB	NB	NB	SB	SB
Directions Served	ULT	R	UL	TR	ULT	R
Maximum Queue (ft)	44	17	68	102	111	143
Average Queue (ft)	9	1	28	53	50	63
95th Queue (ft)	34	10	53	84	86	110
Link Distance (ft)	93	93	562	562	486	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)					200	
Storage Blk Time (%)					0 0	
Queuing Penalty (veh)					0 0	

Intersection: 8: Las Gallinas Avenue & Nova Albion Drive

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	L	TR	LT	R
Maximum Queue (ft)	342	140	104	163	241	439	120
Average Queue (ft)	199	90	35	98	53	173	86
95th Queue (ft)	339	174	80	166	156	392	157
Link Distance (ft)	320	170	791		461		
Upstream Blk Time (%)	3	0		0			
Queuing Penalty (veh)	0	0		3			
Storage Bay Dist (ft)	115		140		95		
Storage Blk Time (%)	25	0	7		0	16	4
Queuing Penalty (veh)	46	0	7		0	66	7

Queuing and Blocking Report

11/14/2021

Intersection: 9: Northgate Drive & Las Gallinas Avenue

Movement	EB	EB	EB	B28	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	T	LT	TR	L	T	R	L	T	TR
Maximum Queue (ft)	46	62	196	2	161	111	78	110	58	106	119	98
Average Queue (ft)	10	7	74	0	77	17	29	51	3	42	53	14
95th Queue (ft)	32	34	156	2	144	62	60	88	28	89	103	61
Link Distance (ft)	198		198	791	154	154	338			427 427		
Upstream Blk Time (%)	0				1 0							
Queuing Penalty (veh)					1 2 0							
Storage Bay Dist (ft)	135			1		2 0		160		220		210
Storage Blk Time (%)	0						0					
Queuing Penalty (veh)	0						0					

Intersection: 10: Mall Entrance/Del Presidio Boulevard & Las Gallinas Avenue

Movement	EB	EB	EB	WB	WB	B29	SB	SB	SB	
Directions Served	L	L	TR	T	R	T	L	LT	R	
Maximum Queue (ft)	67	136	132	174	73	17	162	98	113	
Average Queue (ft)	6	61	31	78	29	1	76	21	47	
95th Queue (ft)	33	123	91	147	61	13	140	63	90	
Link Distance (ft)	154	154	154	127	127	213	334	334		
Upstream Blk Time (%)	0 0 3									
Queuing Penalty (veh)	0 1 3									
Storage Bay Dist (ft)								100		
Storage Blk Time (%)								0 1		
Queuing Penalty (veh)								0 1		

Intersection: 11: Las Gallinas Avenue & Merrydale Road/Merrydale Overpass

Movement	WB	WB	NB	SB	SB
Directions Served	L	TR	TR	L	TR
Maximum Queue (ft)	122	76	175	108	90
Average Queue (ft)	54	35	81	41	34
95th Queue (ft)	97	63	139	85	74
Link Distance (ft)	930		945		975
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	300		150		
Storage Blk Time (%)	1				
Queuing Penalty (veh)	0				

Queuing and Blocking Report

11/14/2021

Intersection: 12: Civic Center Drive & Merrydale Overpass/Merrydale Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB	B165
Directions Served	L	TR	L	TR	L	TR	UL	TR	T
Maximum Queue (ft)	134	100	31	61	73	99	52	290	5
Average Queue (ft)	58	46	5	20	31	40	17	127	0
95th Queue (ft)	105	81	22	46	63	81	43	222	4
Link Distance (ft)		930		422		416	387	387	562
Upstream Blk Time (%)	0								
Queuing Penalty (veh)	0								
Storage Bay Dist (ft)	310		250		320				
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 13: Northgate Drive/Northgate & Thorndale Drive/Northgate Mall

Movement	EB	NB
Directions Served	LTR	LTR
Maximum Queue (ft)	29	27
Average Queue (ft)	11	2
95th Queue (ft)	30	13
Link Distance (ft)	195	419
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 14: El Faisan Drive/Project Driveway & Northgate Drive

Movement	EB	EB	WB	NB	NB	SB
Directions Served	L	TR	LTR	L	TR	LTR
Maximum Queue (ft)	28	8	31	40	31	70
Average Queue (ft)	2	0	4	14	11	34
95th Queue (ft)	13	8	20	39	35	58
Link Distance (ft)		419	198		261	151
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	200			70		
Storage Blk Time (%)						
Queuing Penalty (veh)						

Queuing and Blocking Report

11/14/2021

Intersection: 15: Nova Albion Way & Northgate Drive/Northgate

Movement	EB	EB	WB	WB	NB
Directions Served	T	R	UL	T	LR
Maximum Queue (ft)	24	35	76	21	108
Average Queue (ft)	1	2	27	1	50
95th Queue (ft)	14	16	60	10	85
Link Distance (ft)	198			798	230
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	100	100			
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 16: Los Ranchitos Road/Las Gallinas Avenue & Northgate Drive

Movement	EB	EB	NB	NB	SB
Directions Served	L	R	L	TR	LTR
Maximum Queue (ft)	108	86	62	57	162
Average Queue (ft)	48	40	26	14	66
95th Queue (ft)	86	69	52	41	123
Link Distance (ft)				1079	945
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	120	120	100		
Storage Blk Time (%)	0	0	0		
Queuing Penalty (veh)	0	0	0		

Intersection: 17: Los Ranchitos Road & N. San Pedro Road

Movement	EB	EB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (ft)	134	272	157	179	99
Average Queue (ft)	75	107	61	74	33
95th Queue (ft)	131	200	118	135	99
Link Distance (ft)		807	514	421	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	110				75
Storage Blk Time (%)	1	5		5	0
Queuing Penalty (veh)	5	10		13	0

Network Summary

Network wide Queuing Penalty: 376

Queuing and Blocking Report

11/14/2021

Intersection: 1: Las Gallinas Avenue & Freitas Parkway

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	UL	T	T	R	UL	T	T	R	L	T	R	L
Maximum Queue (ft)	200	941	959	185	475	1002	973	180	132	410	135	145
Average Queue (ft)	76	702	734	118	418	567	457	20	47	130	75	130
95th Queue (ft)	206	1113	1126	248	583	1199	1071	125	106	302	150	176
Link Distance (ft)		928	928			1110	1110			461		
Upstream Blk Time (%)		25	35			4	1			0		
Queuing Penalty (veh)		0	0			27	6			1		
Storage Bay Dist (ft)	175			160	450			200	110		110	120
Storage Blk Time (%)	0	72	79	0	50	0	1	0	1	12	2	41
Queuing Penalty (veh)	0	31	60	1	180	1	3	1	3	28	4	141

Intersection: 1: Las Gallinas Avenue & Freitas Parkway

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	704	144
Average Queue (ft)	492	32
95th Queue (ft)	858	113
Link Distance (ft)	668	
Upstream Blk Time (%)	33	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		120
Storage Blk Time (%)	36	0
Queuing Penalty (veh)	96	0

Intersection: 2: Northgate Drive & Freitas Parkway

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	UL	T	TR	UL	L	T	TR	LT	R	L	TR
Maximum Queue (ft)	150	869	905	233	278	389	464	137	71	70	94
Average Queue (ft)	21	398	515	111	104	155	177	53	48	32	13
95th Queue (ft)	84	875	956	186	208	347	435	118	86	68	57
Link Distance (ft)		1110	1110		431	431	431	427			528
Upstream Blk Time (%)					0	2	5				
Queuing Penalty (veh)					1	11	26				
Storage Bay Dist (ft)	220			375					45	50	
Storage Blk Time (%)		5			0			13	9	12	1
Queuing Penalty (veh)		1			0			11	5	3	0

Queuing and Blocking Report

11/14/2021

Intersection: 3: Del Presidio Boulevard/101 SB Ramp & Freitas Parkway

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	T	TR	T	T	T	LT	R	LT	TR
Maximum Queue (ft)	436	472	192	209	184	33	347	578	636
Average Queue (ft)	147	314	58	108	79	6	198	214	322
95th Queue (ft)	355	500	137	185	153	25	374	543	679
Link Distance (ft)	431	431	245	245	245	334	334	615	615
Upstream Blk Time (%)	0	3	0	0	0		6	6	13
Queuing Penalty (veh)	1	16	0	0	0		9	0	0
Storage Bay Dist (ft)									
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 4: 101 SB Ramp & Freitas Parkway

Movement	WB
Directions Served	T
Maximum Queue (ft)	3
Average Queue (ft)	0
95th Queue (ft)	3
Link Distance (ft)	802
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 5: Redwood Highway & 101 NB Ramp

Movement	NB	SB
Directions Served	L	TR
Maximum Queue (ft)	81	107
Average Queue (ft)	35	21
95th Queue (ft)	66	74
Link Distance (ft)		464
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	130	
Storage Blk Time (%)	0	
Queuing Penalty (veh)	0	

Queuing and Blocking Report

11/14/2021

Intersection: 6: US 101 On-/Off-Ramps & Manuel T Freitas Pkwy

Movement	NB	NB	SB	SB
Directions Served	T	R	UL	T
Maximum Queue (ft)	63	139	506	184
Average Queue (ft)	3	24	208	17
95th Queue (ft)	50	94	448	160
Link Distance (ft)	293	293	802	802
Upstream Blk Time (%)	0	0		
Queuing Penalty (veh)	0	0		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 7: Civic Center Dr/Redwood Hwy & Manuel T Freitas Pkwy /Private Driveway

Movement	EB	EB	NB	NB	SB	SB
Directions Served	ULT	R	UL	TR	ULT	R
Maximum Queue (ft)	54	61	70	184	157	154
Average Queue (ft)	17	5	32	88	79	67
95th Queue (ft)	45	33	59	147	133	121
Link Distance (ft)	93	93	562	562		486
Upstream Blk Time (%)	0	0				
Queuing Penalty (veh)	0	0				
Storage Bay Dist (ft)					200	
Storage Blk Time (%)					0	
Queuing Penalty (veh)					0	

Intersection: 8: Las Gallinas Avenue & Nova Albion Drive

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	L	TR	LT	R
Maximum Queue (ft)	341	140	99	164	277	474	120
Average Queue (ft)	221	98	33	104	69	310	101
95th Queue (ft)	365	179	77	169	181	560	163
Link Distance (ft)	320		170		791	461	
Upstream Blk Time (%)	4					5	
Queuing Penalty (veh)	0					36	
Storage Bay Dist (ft)		115		140			95
Storage Blk Time (%)	29	0		8	1	37	2
Queuing Penalty (veh)	60	1		11	1	156	5

Queuing and Blocking Report

11/14/2021

Intersection: 9: Northgate Drive & Las Gallinas Avenue

Movement	EB	EB	EB	B28	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	T	LT	TR	L	T	R	L	T	TR
Maximum Queue (ft)	43	137	244	37	171	136	92	128	73	115	123	85
Average Queue (ft)	9	14	101	2	101	23	34	56	6	44	54	11
95th Queue (ft)	30	68	200	33	165	78	71	100	38	95	104	50
Link Distance (ft)		198	198	791	154	154		338				427
Upstream Blk Time (%)		0	1		2	0						
Queuing Penalty (veh)		0	3		3	0						
Storage Bay Dist (ft)	135						160		220	210		
Storage Blk Time (%)		0						0				
Queuing Penalty (veh)		0						0				

Intersection: 10: Mall Entrance/Del Presidio Boulevard & Las Gallinas Avenue

Movement	EB	EB	EB	WB	WB	B29	SB	SB	SB
Directions Served	L	L	TR	T	R	T	L	LT	R
Maximum Queue (ft)	74	151	180	154	84	8	208	160	120
Average Queue (ft)	9	70	50	76	30	0	96	26	56
95th Queue (ft)	43	137	129	136	65	7	174	93	104
Link Distance (ft)	154	154	154	127	127	213	334	334	
Upstream Blk Time (%)		1	1	2	0				
Queuing Penalty (veh)		1	2	2	0				
Storage Bay Dist (ft)									100
Storage Blk Time (%)							0	1	
Queuing Penalty (veh)							1	1	

Intersection: 11: Las Gallinas Avenue & Merrydale Road/Merrydale Overpass

Movement	WB	WB	NB	SB	SB
Directions Served	L	TR	TR	L	TR
Maximum Queue (ft)	118	75	173	148	97
Average Queue (ft)	52	37	84	60	36
95th Queue (ft)	91	63	140	113	79
Link Distance (ft)		930	945		975
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	300			150	
Storage Blk Time (%)			1	0	
Queuing Penalty (veh)			0	0	

Queuing and Blocking Report

11/14/2021

Intersection: 12: Civic Center Drive & Merrydale Overpass/Merrydale Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB	B165
Directions Served	L	TR	L	TR	L	TR	UL	TR	T
Maximum Queue (ft)	154	152	34	70	90	174	91	468	52
Average Queue (ft)	75	65	6	26	36	75	22	265	4
95th Queue (ft)	136	117	24	55	73	142	63	434	28
Link Distance (ft)		930		422		416	387	387	562
Upstream Blk Time (%)								3	
Queuing Penalty (veh)								12	
Storage Bay Dist (ft)	310		250		320				
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 13: Northgate Drive/Northgate & Thorndale Drive/Northgate Mall

Movement	EB	NB	SB
Directions Served	LTR	LTR	TR
Maximum Queue (ft)	33	55	2
Average Queue (ft)	11	4	0
95th Queue (ft)	31	28	2
Link Distance (ft)	195	419	1041
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 14: El Faisan Drive/Project Driveway & Northgate Drive

Movement	EB	EB	WB	NB	NB	SB
Directions Served	L	TR	LTR	L	TR	LTR
Maximum Queue (ft)	22	15	42	44	37	75
Average Queue (ft)	2	1	5	17	13	34
95th Queue (ft)	14	14	25	43	38	59
Link Distance (ft)		419	198		261	151
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	200			70		
Storage Blk Time (%)				0	0	
Queuing Penalty (veh)				0	0	

Queuing and Blocking Report

11/14/2021

Intersection: 15: Nova Albion Way & Northgate Drive/Northgate

Movement	EB	EB	WB	WB	NB
Directions Served	T	R	UL	T	LR
Maximum Queue (ft)	37	40	77	23	126
Average Queue (ft)	2	4	30	1	54
95th Queue (ft)	20	21	64	11	96
Link Distance (ft)	198			798	230
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		100	100		
Storage Blk Time (%)	0		0		
Queuing Penalty (veh)	0		0		

Intersection: 16: Los Ranchitos Road/Las Gallinas Avenue & Northgate Drive

Movement	EB	EB	NB	NB	SB
Directions Served	L	R	L	TR	LTR
Maximum Queue (ft)	101	94	64	59	151
Average Queue (ft)	52	48	28	16	66
95th Queue (ft)	86	79	54	44	121
Link Distance (ft)				1079	945
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	120	120	100		
Storage Blk Time (%)	0	0	0	0	
Queuing Penalty (veh)	0	0	0	0	

Intersection: 17: Los Ranchitos Road & N. San Pedro Road

Movement	EB	EB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (ft)	134	454	176	386	100
Average Queue (ft)	113	168	84	160	74
95th Queue (ft)	156	342	154	315	138
Link Distance (ft)		807	514	421	
Upstream Blk Time (%)		0		0	
Queuing Penalty (veh)		0		0	
Storage Bay Dist (ft)	110				75
Storage Blk Time (%)	11	9		20	1
Queuing Penalty (veh)	40	25		62	3

Network Summary

Network wide Queuing Penalty: 1095

Queuing and Blocking Report

11/14/2021

Intersection: 1: Las Gallinas Avenue & Freitas Parkway

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	UL	T	T	R	UL	T	T	R	L	T	R	L
Maximum Queue (ft)	200	953	954	185	475	1034	984	221	134	443	135	145
Average Queue (ft)	83	720	751	122	422	584	451	18	55	157	76	137
95th Queue (ft)	216	1113	1117	253	588	1176	1056	116	120	355	151	169
Link Distance (ft)		928	928			1110	1110			461		
Upstream Blk Time (%)		23	31			2	1			1		
Queuing Penalty (veh)		0	0			14	4			3		
Storage Bay Dist (ft)	175			160	450			200	110		110	120
Storage Blk Time (%)	0	74	80	0	53	1	1	0	1	15	1	50
Queuing Penalty (veh)	0	32	61	0	190	5	3	0	5	38	3	172

Intersection: 1: Las Gallinas Avenue & Freitas Parkway

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	708	143
Average Queue (ft)	528	26
95th Queue (ft)	874	100
Link Distance (ft)	668	
Upstream Blk Time (%)	43	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		120
Storage Blk Time (%)	31	0
Queuing Penalty (veh)	83	0

Intersection: 2: Northgate Drive & Freitas Parkway

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	UL	T	TR	UL	L	T	TR	LT	R	L	TR
Maximum Queue (ft)	154	859	904	202	260	362	478	138	71	69	83
Average Queue (ft)	20	440	557	106	97	140	150	44	44	31	11
95th Queue (ft)	76	955	1019	172	186	295	350	105	82	66	47
Link Distance (ft)		1110	1110		431	431	431	427			528
Upstream Blk Time (%)		0	0			0	1				
Queuing Penalty (veh)		0	2			1	5				
Storage Bay Dist (ft)	220			375					45	50	
Storage Blk Time (%)		6						12	8	12	1
Queuing Penalty (veh)		1						9	4	3	0

Queuing and Blocking Report

11/14/2021

Intersection: 3: Del Presidio Boulevard/101 SB Ramp & Freitas Parkway

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	T	TR	T	T	T	LT	R	LT	TR
Maximum Queue (ft)	434	475	137	192	162	60	355	546	615
Average Queue (ft)	147	328	47	102	75	5	222	177	272
95th Queue (ft)	370	508	108	166	136	40	386	450	620
Link Distance (ft)	431	431	245	245	245	334	334	615	615
Upstream Blk Time (%)	0	3					7	3	6
Queuing Penalty (veh)	0	18					11	0	0
Storage Bay Dist (ft)									
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 4: 101 SB Ramp & Freitas Parkway

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 5: Redwood Highway & 101 NB Ramp

Movement	NB	SB
Directions Served	L	TR
Maximum Queue (ft)	70	108
Average Queue (ft)	33	20
95th Queue (ft)	61	72
Link Distance (ft)		464
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	130	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report

11/14/2021

Intersection: 6: US 101 On-/Off-Ramps & Manuel T Freitas Pkwy

Movement	NB	SB	SB
Directions Served	R	UL	T
Maximum Queue (ft)	103	392	102
Average Queue (ft)	22	197	9
95th Queue (ft)	68	401	117
Link Distance (ft)	293	802	802
Upstream Blk Time (%)	0		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 7: Civic Center Dr/Redwood Hwy & Manuel T Freitas Pkwy /Private Driveway

Movement	EB	EB	NB	NB	SB	SB
Directions Served	ULT	R	UL	TR	ULT	R
Maximum Queue (ft)	46	50	70	221	168	161
Average Queue (ft)	16	4	34	88	75	67
95th Queue (ft)	43	26	60	160	129	121
Link Distance (ft)	93	93	562	562		486
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)					200	
Storage Blk Time (%)					0	0
Queuing Penalty (veh)					0	0

Intersection: 8: Las Gallinas Avenue & Nova Albion Drive

Movement	EB	EB	WB	NB	NB	SB	SB
Directions Served	LT	R	LTR	L	TR	LT	R
Maximum Queue (ft)	339	140	102	164	258	473	120
Average Queue (ft)	220	90	31	106	81	270	102
95th Queue (ft)	359	174	74	173	200	512	160
Link Distance (ft)	320		170		791	461	
Upstream Blk Time (%)	4					4	
Queuing Penalty (veh)	0					29	
Storage Bay Dist (ft)		115		140			95
Storage Blk Time (%)	28	0		8	1	32	2
Queuing Penalty (veh)	58	0		13	2	136	5

Queuing and Blocking Report

11/14/2021

Intersection: 9: Northgate Drive & Las Gallinas Avenue

Movement	EB	EB	EB	B28	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	T	LT	TR	L	T	R	L	T	TR
Maximum Queue (ft)	34	119	232	15	177	167	84	118	40	137	119	75
Average Queue (ft)	9	13	100	1	104	32	34	51	2	47	46	9
95th Queue (ft)	28	64	200	18	172	102	67	92	22	105	97	44
Link Distance (ft)		198	198	791	154	154		338			427	427
Upstream Blk Time (%)				1	3	0						
Queuing Penalty (veh)				3	5	1						
Storage Bay Dist (ft)	135						160		220	210		
Storage Blk Time (%)		0						0		0		
Queuing Penalty (veh)		0						0		0		

Intersection: 10: Mall Entrance/Del Presidio Boulevard & Las Gallinas Avenue

Movement	EB	EB	EB	WB	WB	B29	SB	SB	SB
Directions Served	L	L	TR	T	R	T	L	LT	R
Maximum Queue (ft)	86	158	177	172	92	6	225	169	116
Average Queue (ft)	7	75	50	88	37	0	108	23	53
95th Queue (ft)	43	145	123	154	74	5	190	97	99
Link Distance (ft)	154	154	154	127	127	213	334	334	
Upstream Blk Time (%)	0	1	1	3	0			0	
Queuing Penalty (veh)	0	2	2	4	0			0	
Storage Bay Dist (ft)									100
Storage Blk Time (%)								0	0
Queuing Penalty (veh)								0	1

Intersection: 11: Las Gallinas Avenue & Merrydale Road/Merrydale Overpass

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	L	TR	L	TR	TR	L	TR
Maximum Queue (ft)	39	39	110	90	182	159	170
Average Queue (ft)	10	10	52	40	87	69	45
95th Queue (ft)	32	31	92	71	148	129	109
Link Distance (ft)		376		930	945		975
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)	150		300			150	
Storage Blk Time (%)					2	0	0
Queuing Penalty (veh)					0	1	0

Queuing and Blocking Report

11/14/2021

Intersection: 12: Civic Center Drive & Merrydale Overpass/Merrydale Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB	B165	B165
Directions Served	L	TR	L	TR	L	TR	UL	TR	T	T
Maximum Queue (ft)	161	145	30	75	90	173	57	472	43	127
Average Queue (ft)	80	63	5	25	33	71	18	259	2	8
95th Queue (ft)	139	114	23	58	69	138	46	434	31	70
Link Distance (ft)		930		422		416	387	387	562	562
Upstream Blk Time (%)	4									
Queuing Penalty (veh)	14									
Storage Bay Dist (ft)	310		250		320					
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 13: Northgate Drive/Northgate & Thorndale Drive/Northgate Mall

Movement	EB	NB	B31
Directions Served	LTR	LTR	T
Maximum Queue (ft)	29	35	4
Average Queue (ft)	11	3	0
95th Queue (ft)	30	19	3
Link Distance (ft)	195	419	338
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 14: El Faisan Drive/Project Driveway & Northgate Drive

Movement	EB	WB	NB	NB	SB
Directions Served	TR	LTR	L	TR	LTR
Maximum Queue (ft)	30	48	39	40	60
Average Queue (ft)	2	5	17	12	29
95th Queue (ft)	15	25	42	37	52
Link Distance (ft)	419	198		261	151
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	70				
Storage Blk Time (%)	0				
Queuing Penalty (veh)	0				

Queuing and Blocking Report

11/14/2021

Intersection: 15: Nova Albion Way & Northgate Drive/Northgate

Movement	EB	EB	WB	WB	NB
Directions Served	T	R	UL	T	LR
Maximum Queue (ft)	34	42	60	14	112
Average Queue (ft)	2	4	29	1	54
95th Queue (ft)	18	23	59	10	93
Link Distance (ft)	198			798	230
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	100	100			
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 16: Los Ranchitos Road/Las Gallinas Avenue & Northgate Drive

Movement	EB	EB	NB	NB	SB
Directions Served	L	R	L	TR	LTR
Maximum Queue (ft)	110	91	59	64	145
Average Queue (ft)	55	45	25	18	65
95th Queue (ft)	91	76	50	49	114
Link Distance (ft)				1079	945
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	120	120	100		
Storage Blk Time (%)	0	0		0	
Queuing Penalty (veh)	0	0		0	

Intersection: 17: Los Ranchitos Road & N. San Pedro Road

Movement	EB	EB	WB	SB	SB
Directions Served	L	T	TR	L	R
Maximum Queue (ft)	134	412	182	384	100
Average Queue (ft)	110	167	81	157	66
95th Queue (ft)	156	343	147	326	139
Link Distance (ft)		807	514	421	
Upstream Blk Time (%)	1				
Queuing Penalty (veh)	0				
Storage Bay Dist (ft)	110			75	
Storage Blk Time (%)	10	8		19	1
Queuing Penalty (veh)	37	24		57	2

Network Summary

Network wide Queuing Penalty: 1065

Queuing and Blocking Report

11/14/2021

Intersection: 1: Las Gallinas Avenue & Freitas Parkway

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	NB	SB
Directions Served	UL	T	T	R	UL	T	T	R	L	T	R	L	
Maximum Queue (ft)	200	523	568	185	475	1146	1169	135	134	328	134	145	
Average Queue (ft)	67	311	347	123	475	1113	862	8	45	119	79	116	
95th Queue (ft)	188	622	658	250	475	1226	1582	77	106	254	149	171	
Link Distance (ft)		928	928			1110	1110			461			
Upstream Blk Time (%)		3	4			55	13			0			
Queuing Penalty (veh)		0	0			359	85			0			
Storage Bay Dist (ft)	175			160	450			200	110		110	120	
Storage Blk Time (%)	0	36	54	0	99	1	1	0	0	9	2	14	
Queuing Penalty (veh)	0	16	41	1	359	3	2	0	0	22	6	49	

Intersection: 1: Las Gallinas Avenue & Freitas Parkway

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	450	143
Average Queue (ft)	213	30
95th Queue (ft)	460	101
Link Distance (ft)	668	
Upstream Blk Time (%)	4	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		120
Storage Blk Time (%)	15	0
Queuing Penalty (veh)	42	0