Traffic Impact Study for the Frank Family Benjamin Ranch Winery Project

Prepared for the County of Napa

Submitted by
W-Trans

February 4, 2020

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Executive Summary

The proposed Frank Family Benjamin Ranch Winery would produce up to 475,000 gallons of wine annually, with a tasting room open to the public seven days a week. The project is proposing an annual event allowance that would include 152 dinnertime wine marketing events with up to 24 attendees, 180 lunchtime wine marketing events with up to 16 attendees, and eight large agriculture promotional events with up to 150 attendees. Events would be scheduled to avoid generating trips during the evening peak period between 4:00 and 6:00 p.m. The winery is expected to have 46 full-time and 15 part-time employees on a typical daily basis. Access to the site would occur via a new driveway on Conn Creek Road.

Based on standard trip generation rates, the proposed project would be expected to generate an average of 144 daily trips, including 23 trips during the weekday p.m. peak hour and 115 trips during the weekend peak hour.

The study area included the three intersections of Silverado Trail/Conn Creek Road, Rutherford Road/ Conn Creek Road, and SR 29/Rutherford Road. The intersection of Rutherford Road/Conn Creek Road currently operates acceptably at LOS A overall and on the minor street approach during both peak hours; however, Silverado Trail/Conn Creek Road and SR 29/Rutherford Road currently operate at unacceptable service levels during both peaks.

The study intersection of Silverado Trail/Conn Creek Road operates at an unacceptable LOS F on the minor street approach during both peak hours and would be expected to continue operating unacceptably with the addition of project traffic. Under anticipated future volumes, the intersection would operate unacceptably at LOS F overall and on the Conn Creek Road approach during both peak periods and continue doing so with the project. Because the project adds more than five seconds of delay to the Conn Creek Road approach under existing and future conditions during both peaks, the project would have an adverse impact on the intersections' operation. It is noted that County policy eliminates the potential for that signalizing intersection, though this would achieve acceptable operation. Therefore, to mitigate the project's impact at the intersection, the project should include paving the existing gravel shoulder along southbound Silverado Trail to create a separate deceleration lane for traffic turning right onto Conn Creek Road while maintaining the existing bicycle lane.

Rutherford Road/SR 29 currently operates unacceptably at LOS E or F overall and at LOS F on the Rutherford Road approach during both peak hours under all scenarios evaluated. The project-related increase in overall delay at the intersection and on the minor road approach during the weekday and weekend peak periods exceed the County's level of significance for future conditions. Again, signalization would achieve acceptable operation; however, under County policy this option is not recommended. Because there are no feasible measures accepted by the County to increase capacity at SR 29/Rutherford Road, a Transportation Demand Management Plan should be implemented to reduce the project's impacts.

It is recommended that the applicant establish a TDM plan to reduce trips during peak periods. Trip reduction measures could include such measures as promoting employee carpooling and providing lunch on-site for employees. Additionally, winery staff should encourage carpooling or the use of a shuttle/van when groups call to reserve tastings or tours.

While the study area lacks pedestrian facilities and transit service, there is not expected to be a demand, and therefore, the lack of facilities is considered acceptable. Existing bicycle facilities on Silverado Trail,

in addition to planned future facilities on Conn Creek Road and SR 29, would provide adequate bicycle access. To accommodate cyclists, the project should provide ten bicycle parking spaces on-site.

On-site circulation is expected to operate acceptably. Sight lines along Conn Creek Road from the proposed project driveway are adequate. A left-turn pocket is proposed to be constructed on Conn Creek Road at the project driveway.

The proposed 94-space parking supply is insufficient to accommodate the anticipated parking demand for proposed events as well as the daily parking demand. To satisfy typical daily parking demand, three additional permanent on-site parking spaces should be provided. The project applicant should make arrangements for guests to park off-site during the largest 150-person events with transportation to and from the site via shuttles. The applicant should make similar arrangements for the smaller-sized events or provide an additional ten temporary parking spaces on-site.

Introduction

This report presents an analysis of the potential traffic impacts that would be associated with development of a proposed winery to be located at 8895 Conn Creek Road in the County of Napa. The traffic study was completed in accordance with the criteria established by the County of Napa and is consistent with standard traffic engineering techniques.

Prelude

The purpose of a traffic impact study is to provide County staff and policy makers with data they can use to make an informed decision regarding the potential traffic impacts of a proposed project, and any associated improvements that would be required to mitigate these impacts to a level of insignificance as defined by the County's General Plan or other policies. Vehicular traffic impacts are typically evaluated by determining the number of new trips that the proposed use would be expected to generate, distributing these trips to the surrounding street system based on existing travel patterns or anticipated travel patterns specific to the proposed project, then analyzing the impact the new traffic would be expected to have on critical intersections or roadway segments. Impacts relative to access for pedestrians, bicyclists, and to transit are also addressed.

Project Profile

The proposed Frank Family Vineyards – Benjamin Ranch Winery project is a new winery that could produce up to 475,000 gallons of wine annually. The winery would have three tasting rooms, a commercial kitchen, and a lounge as well as administrative space located in the proposed 3,140 square-foot visitor center. The project is proposing an event allowance that would include dinnertime wine marketing events with up to 24 attendees occurring on Fridays and Saturdays plus four additional dinnertime events per month that could occur on days other than Fridays and Saturdays, lunchtime wine marketing events with up to 16 attendees that could occur up to 15 times per month, and eight marketing events at up to 150 attendees annually. Typical winery visitation would occur during scheduled events; however, the winery would limit the daily visitation to a maximum of 400 guests even on event days. The winery would operate seven days a week from 8:00 a.m. to 6:00 p.m. A new paved driveway on Conn Creek Road would provide employee and visitor access to the site. The project site is located at 8895 Conn Creek Road, as shown in Figure 1.

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Traffic Impact Study for the Frank Family Benjamin Ranch Winery Project

Figure 1 – Study Area and Existing Lane Configurations

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Transportation Setting

Operational Analysis

Study Area and Periods

The study area consists of the following intersections:

1. Silverado Trail/Conn Creek Road (SR 128)
2. Rutherford Road (SR 128)/Conn Creek Road (SR 128)
3. SR 29/Rutherford Road (SR 128)

Operating conditions during the Friday p.m. and Saturday p.m. peak periods were evaluated as these time periods reflect the highest traffic volumes areawide and for the proposed project. The evening peak hour occurs between 4:00 and 6:00 p.m. and typically reflects the highest level of congestion of the day during the homeward bound commute, while the weekend midday peak occurs between 12:00 and 5:00 p.m.

Study Intersections

Silverado Trail/Conn Creek Road (SR 128) is a four-legged intersection stop-controlled at the northbound Conn Creek Road (SR 128) approach. The northbound approach includes a flared right-turn lane and the southbound approach is a private driveway to the Rutherford Ranch Winery.

Rutherford Road (SR 128)/Conn Creek Road (SR 128) is a tee-intersection where the northbound Conn Creek Road approach is stop-controlled. The eastbound Rutherford Road approach includes a channelized right turn allowing free right-turn movements. The northbound left-turn and southbound through movements are channelized and stop-controlled.

SR 29/Rutherford Road (SR 128) is a four-legged intersection with stop controls at the westbound and eastbound approaches. The westbound Rutherford Road (SR 128) approach has a flared right-turn lane. The eastbound approach is a private road serving the Rutherford Fire Department and the Inglenook Winery and Bistro.

The locations of the study intersections and the existing lane configurations and controls are shown in Figure 1.

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 April 1, 2014 through March 31, 2019.

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 *2014 Collision Data on California State Highways*, California Department of Transportation (Caltrans). The three study intersections had a higher

collision rate than the Statewide average for similar facilities. The collision rate calculations are provided in Appendix A.

Table 1 – Collision Rates at the Study Intersections

Study Intersection	Number of Collisions (2014-2019)	Calculated Collision Rate (c/mve)	Statewide Average Collision Rate (c/mve)
1. Silverado Trail/Conn Creek Rd (SR 128)	9	**0.27**	0.23
2. Rutherford Rd (SR 128)/Conn Creek Rd (SR 128)	2	**0.34**	0.16
3. SR 29/Rutherford Rd (SR 128)	15	**0.36**	0.23

Note: c/mve = collisions per million vehicles entering; **Bold** text indicates an above-average collision rate

Because the collision rates for the three study intersections were higher than the statewide averages, the crashes at these locations were reviewed in greater detail.

Of the nine collisions that occurred at the intersection of Silverado Trail/Conn Creek Road (SR 128), four were broadside collisions, which were attributed to either improper turning or right-of-way violations. The congestion that occurs during peak periods likely contributes to many of these crashes, and the high approach speed may contribute to crashes off-peak. Further, it is noted that none of the collisions at the intersection resulted in injuries; therefore, the incidence of injuries indicates that this intersection does not have a specific safety problem despite the above-average collision rate.

Rutherford Road/Conn Creek Road experienced two collisions over the five-year study period, which translates to a collision rate of 0.34 collisions per million vehicles entering (c/mve) the intersection. While this is higher than the statewide average of 0.16 c/mve for similar facilities, given the very low volumes it takes only two collision to exceed the statewide average rate. The limited number of collisions that have occurred in five years at the study intersection does not appear to indicate a safety concern; therefore, the above-average collision rate is not considered a safety concern.

A review of the records for SR 29/Rutherford Road (SR 128) indicates that nine of the 15 collisions were broadside crashes where eight were attributed to right-of-way violations and one case where the driver was under the influence. The remaining collisions included hit-object, head-on, rear-end, and sideswipe crashes, though there were not enough of any of these types of crashes to indicate a trend. It is noted that the injury rate of 46.7 percent also exceeds the Statewide average of 40.4 percent. While a traffic signal would be expected to address the type of crashes occurring at this location, it is understood that the County of Napa has adopted a policy not to install signals along SR 29.

Alternative Modes

Pedestrian Facilities

As might be expected given the rural location of the project site, there are no pedestrian facilities in the project vicinity.

Bicycle Facilities

The *Highway Design Manual*, Caltrans, 2018, 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.

There are existing Class II bike lanes on Silverado Trail and Conn Creek Road near the project site and future facilities are planned along several streets in the project vicinity. There are plans to construct Class II bike lanes along SR 29 and the planned extension of the Vine Trail would parallel SR 29. Bicyclists currently ride in the roadway shoulder along SR 29 and share the travel lane with vehicles on other roads within the project study area. Table 2 summarizes the planned bicycle facilities in the project vicinity, as contained in the *Napa County Bicycle Plan*.

Table 2 – Planned Bicycle Facilities in the Project Vicinity

Facility	Class	Length (miles)	Begin Point	End Point
Existing				
Conn Creek Rd	II	0.94	Skellenger Ln	SR 128
Silverado Trail	II	25.9	SE Calistoga City Limit	Trancas St
Skellenger Ln	III	0.91	Conn Creek Rd	Silverado Trail
Planned				
Conn Creek Path	I	0.92	Oakville Cross Rd	Skellenger Ln
Vine Trail	I	7.67	Madison St	Chaix Ln
SR 128 (Conn Creek Rd)	II	1.32	Conn Creek	Silverado Trail
SR 128 (Rutherford Rd)	II	1.52	SR 29 (St. Helena Hwy)	Conn Creek Rd
SR 128 (Sage Canyon Rd)	II	3.80	Silverado Trail	Chiles Pope Valley Rd
SR 29	II	7.63	Madison St	Chaix Ln

Source: *Napa County Bicycle Plan,* W-Trans, 2012

Transit Facilities

There are no existing bus stops within an acceptable walking distance (one-half mile) of the project site.

Capacity Analysis

Intersection Level of Service Methodologies

Level of Service (LOS) is used to rank traffic operation on various types of facilities based on traffic volumes and roadway capacity using a series of letter designations ranging from A to F. Generally, Level of Service A represents free flow conditions and Level of Service F represents forced flow or breakdown conditions. A unit of measure that indicates a level of delay generally accompanies the LOS designation.

The study intersections were analyzed using methodologies published in the *Highway Capacity Manual* (HCM), Transportation Research Board, 2010. This source contains methodologies for various types of intersection control, all of which are related to a measurement of delay in average number of seconds per vehicle.

The Levels of Service for the study intersections, which have side-street stop controls, or are unsignalized and have one or two approaches stop controlled, were analyzed using the "Two-Way Stop-Controlled" intersection capacity method from the HCM. This methodology determines a level of service for each minor turning movement by estimating the level of average delay in seconds per vehicle. Results are presented for individual movements together with the weighted overall average delay for the intersection.

The ranges of delay associated with the various levels of service are indicated in Table 3.

Table 3 – Two-Way Stop-Controlled Intersection Level of Service Criteria	
LOS A	Delay of 0 to 10 seconds. Gaps in traffic are readily available for drivers exiting the minor street.
LOS B	Delay of 10 to 15 seconds. Gaps in traffic are somewhat less readily available than with LOS A, but no queuing occurs on the minor street.
LOS C	Delay of 15 to 25 seconds. Acceptable gaps in traffic are less frequent, and drivers may approach while another vehicle is already waiting to exit the side street.
LOS D	Delay of 25 to 35 seconds. There are fewer acceptable gaps in traffic, and drivers may enter a queue of one or two vehicles on the side street.
LOS E	Delay of 35 to 50 seconds. Few acceptable gaps in traffic are available, and longer queues may form on the side street.
LOS F	Delay of more than 50 seconds. Drivers may wait for long periods before there is an acceptable gap in traffic for exiting the side streets, creating long queues.

Reference: *Highway Capacity Manual*, Transportation Research Board, 2010

Traffic Operation Standards

In the Circulation Element of the *Napa County General Plan*, the following policies have been adopted:

- **Policy CIR-31** – *The County seeks to provide a roadway system that maintains current roadway capacities in most locations and is efficient in providing local access.*

- **Policy CIR-38** – *The County seeks to maintain operations of roads and intersections in the unincorporated County area that minimize travel delays and promote safe access for all users. Operational analysis shall be conducted according to the latest version of the Highway Capacity Manual and as described in the current version of the County's Transportation Impact Study Guidelines. In general, the County seeks to maintain Level of Service (LOS) D on arterial roadways and at signalized intersections, as the service level that best aligns with the County's desire to balance its rural character with the needs of supporting economic vitality and growth.*

  In situations where the County determines that achieving LOS D would cause an unacceptable conflict with other goals and objectives, minimizing collisions and the adequacy of local access will be the County's priorities. Mitigating operational impacts should first focus on reducing the project's vehicular trips through modifying the project definition, applying TDM strategies, and/or applying new technologies that could reduce vehicular travel and associated delays; then secondarily should consider physical infrastructure changes. Proposed mitigations will be evaluated for their effect on collisions and local access, and for their effectiveness in achieving the maximum potential reduction in the project's operational impacts (see the County's Transportation Impact Study Guidelines for a list of potential mitigation measures).

  The following roadway segments are exceptions to the LOS D standard described above:
  - *State Route 29 in the unincorporated areas between Yountville and Calistoga: LOS F is acceptable.*
  - *Silverado Trail between State Route 128 and Yountville Cross Road: LOS E is acceptable.*
  - *State Route 12/121 between the Napa/Sonoma county line and Carneros Junction: LOS F is acceptable.*
  - *American Canyon Road from I-80 to American Canyon City Limit: LOS E is acceptable.*

To provide a more quantitative method of adhering to the above standards, the County has recently updated the significance thresholds for intersections as summarized below:

- If an unsignalized intersection is operating acceptably (LOS A though LOS D), and the project would cause the intersection to fall to LOS E or LOS F, the applicant must mitigate the impact to restore to LOS D at a minimum, or the project is considered to adversely impact the intersection.

- If an intersection is already operating at LOS E or F, and the project would increase delay at the intersection by five or more seconds, the applicant must mitigate the impact to lower the increase in delay, or else the project would be considered to adversely impact the intersection. The same standards apply to the analysis of minor approaches to unsignalized intersections.

Existing Conditions

The Existing Conditions scenario provides an evaluation of current operation based on existing traffic volumes during the p.m. peak period. This condition does not include project-generated traffic volumes. Volume data was collected in October 2017 while local schools were in session. Turning movements

counts were conducted by All Traffic Data, as directed by Crane Transportation Group (CTG). These count days occurred just before the Napa County fires and are therefore representative of typical harvest season peak activity in the region.

Intersection Levels of Service

Under existing conditions, Silverado Trail/Conn Creek Road and Rutherford Road/Conn Creek Road operate acceptably at LOS C or better overall during the weekday and weekend p.m. peak hours; however, Silverado Trail/Conn Creek Road operates unacceptably at LOS F on the stop-controlled approach during both peaks. The intersection of Rutherford Road/SR 29 is operating unacceptably at LOS E or F overall and on the minor street approach during both peak periods. The existing traffic volumes are shown in Figure 2. A summary of the intersection level of service calculations is contained in Table 4, and copies of the Level of Service calculations are provided in Appendix B.

Table 4 – Existing Peak Hour Intersection Levels of Service

Study Intersection ***Approach***	Weekday PM Peak		Weekend PM Peak	
	Delay	**LOS**	**Delay**	**LOS**
1. Silverado Trail/Conn Creek Rd (SR 128)	16.1	C	22.8	C
Northbound (Conn Creek Rd) Approach	***242.1***	***F***	***229.3***	***F***
2. Rutherford Rd (SR 128)/Conn Creek Rd (SR 128)	3.3	A	1.6	A
Northbound (Conn Creek Rd) Approach	*9.7*	*A*	*9.7*	*A*
3. SR 29/Rutherford Rd (SR 128)	**73.6**	**F**	**44.5**	**E**
Westbound (Rutherford Rd) Approach	***1,000***	***F***	***691.5***	***F***

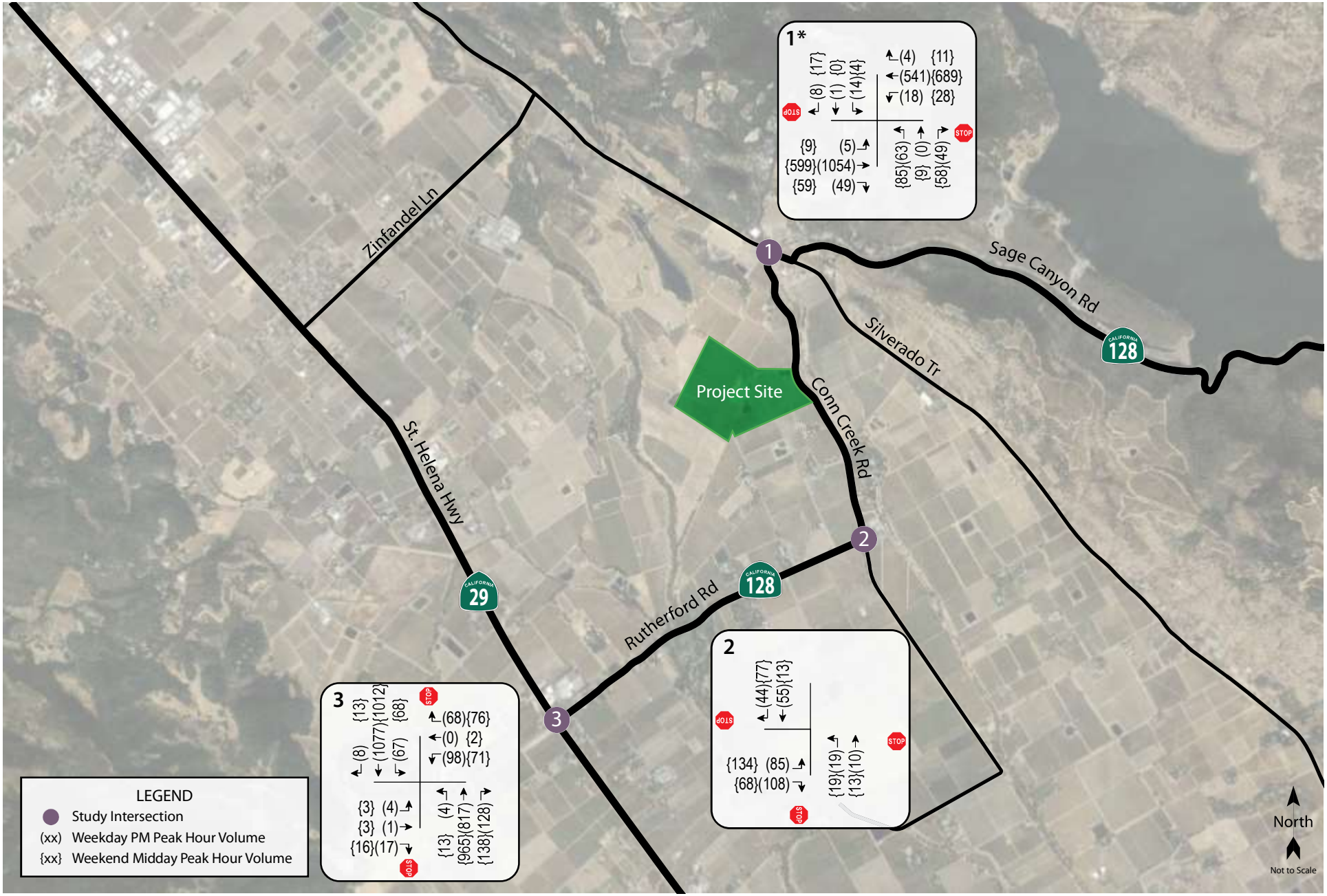
Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics;* **Bold** text = deficient operation

Although installation of traffic signals would be expected to address the deficient operation at both Silverado Trail/Conn Creek Road and SR 29/Rutherford Road, the County has taken the position that no new traffic signals are to be installed along these two-lane highways. Because this potential capacity improvement is not an option, other potential improvements, such as turn lanes and/or acceleration/deceleration lanes, were considered. Following is a discussion of the potential improvement options at both study intersections that are operating unacceptably.

Silverado Trail/Conn Creek Road (SR 128)

- Turn Lanes: there are currently left-turn lanes in both directions on Silverado Trail. There is not currently a separate left-turn lane on the northbound Conn Creek Road approach, though the lane is wide enough that there are two stop legends, indicating that drivers are expected to queue up side-by-side. Given the proximity to a creek, additional widening appears infeasible within the existing right-of-way.

- Acceleration/Deceleration Lanes: the existing gravel shoulder along the southbound lane on Silverado Trail provides some space for vehicles to decelerate prior to turning right onto Conn Creek Road and some space for vehicles to accelerate onto Silverado Trail southbound. However, the existing bridge



* Silverado Trail is considered to run East-West at this intersection.

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Figure 2 – Existing Traffic Volumes

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structure limits the potential for providing additional acceleration space. As there are left-turn lanes in both directions, there is no space for acceleration when turning left onto Silverado Trail.

SR 29/Rutherford Road

- Turn Lanes: there are currently left-turn lanes in both directions on SR 29 and there is a flared right-turn lane on Rutherford Road along with 75 feet of red curb on the approach; this reduces delays for right-turning vehicles by allowing them to queue up side-by-side with vehicles that are queued waiting to turn left onto SR 29. Because the existing geometrics function as if there were a separate right-turn lane, no operational benefit would be derived from marking separate turn lanes.

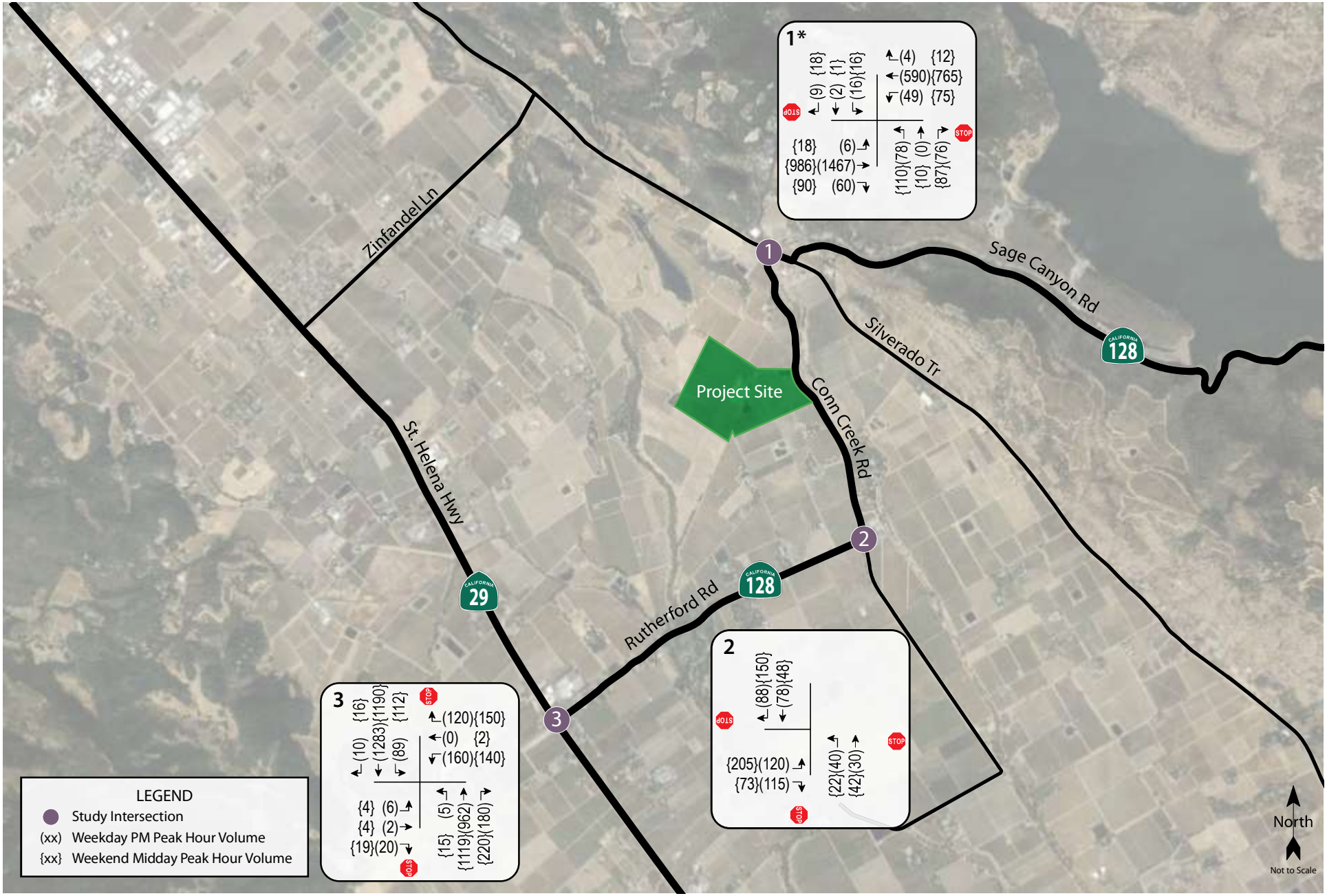
- Acceleration/Deceleration Lanes: bike lanes on the east side of the highway are approximately ten feet wide, providing sufficient space for acceleration/deceleration. Drivers turning left onto SR 29 do not have an acceleration lane due to the presence of left-turn lanes in both directions.

Future Conditions

Future volumes as developed by CTG for the 2030 horizon year were used to evaluate future operating conditions. Traffic projections were developed by CTG for a list of new or expanding winery projects that have been approved, but not built, in the vicinity of the project site and compared to projections from the County model. Traffic projections for specific winery projects from the following traffic studies were considered:

Caymus Winery – Amended Caymus Winery Traffic Impact Study by W-Trans, April 2015
Opus One Winery – Focused Traffic Analysis for the Proposed Opus One Use Modification Project by Omni Means, February 2016
Frogs Leap Winery – Focused Traffic Analysis for the Proposed Frogs Leap Winery Modifications Project by Omni Means, July 2016
Scarlett Winery – No Traffic Study Available
Swanson Winery – Traffic Impact Study by George Nicholson, May 2008
LMR Rutherford Estate Winery – Traffic Impact Study by Crane Transportation Group, January 2014
BV Winery – Frank Family Vineyards Traffic Impact Study by Crane Transportation Group, 2018
Matthew Bruno Wines Tasting Room – No Traffic Study Available

Where appropriate, the projected future volumes derived from the model were increased to ensure that volumes associated with the approved projects were included. Under the anticipated Future volumes, the study intersections of Silverado Trail/Conn Creek Road and Rutherford Road/SR 29 are expected to operate unacceptably at LOS F overall and LOS F on the stop-controlled approaches during both peak periods. Future volumes are shown in Figure 3 and operating conditions are summarized in Table 5.



* Silverado Trail is considered to run East-West at this intersection.

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Figure 3 – Future Traffic Volumes

Table 5 – Future Peak Hour Intersection Levels of Service					
Study Intersection ***Approach***		**Weekday PM Peak**		**Weekend PM Peak**	
		Delay	**LOS**	**Delay**	**LOS**
1.	Silverado Trail/Conn Creek Rd (SR 128)	**85.1**	**F**	**119.1**	**F**
	Northbound (Conn Creek Rd) Approach	***1,207***	***F***	***1,219***	***F***
2.	Rutherford Rd (SR 128)/Conn Creek Rd (SR 128)	3.7	A	2.2	A
	Northbound (Conn Creek Rd) Approach	*10.4*	*B*	*10.3*	*B*
3.	Rutherford Rd (SR 128)/SR 29	***259.0***	***F***	***324.6***	***F***
	Westbound (Rutherford Rd) Approach	***2,591***	***F***	***3,263***	***F***

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics;* **Bold** text = deficient operation

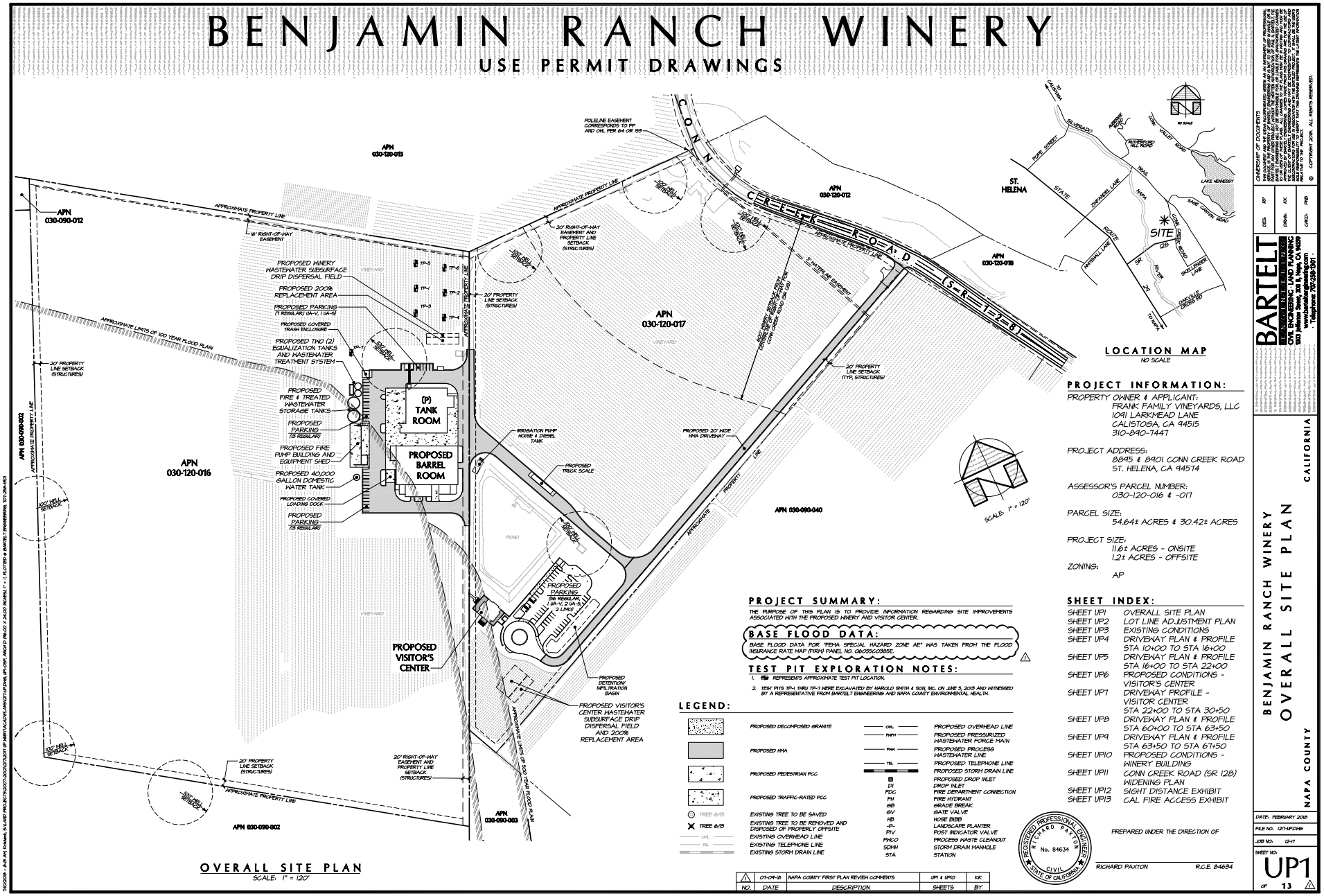
As might be expected with no changes to the intersections' geometries or controls, the operation of Silverado Trail/Conn Creek Road and Rutherford Road/SR 29 is anticipated to deteriorate substantially with the increase in traffic projected over the next eleven years. As previously noted, the County has indicated that signalization is not an option for achieving better operation, but it is noted that, if signalized, both intersections would be expected to operate at LOS D or better.

Project Description

The Frank Family Benjamin Ranch Winery would produce up to 475,000 gallons of wine annually. The winery would have a tasting room open to the public seven days a week and is proposing an annual event allowance that would include 152 dinnertime wine marketing events with up to 24 attendees, 180 lunchtime wine marketing events with up to 16 attendees, and eight large events with up to 150 attendees for a total annual event visitation allowance of up to 7,728 guests. The daily combined tours and tastings and event visitation would not exceed 400 persons per day. Events would be scheduled to avoid generating trips between the 4:00 to 6:00 p.m. weekday peak hours. Staffing levels would include 46 full-time and 15 part-time employees on a typical daily basis and the winery production facility would operate seven days a week from 8:00 a.m. to 6:00 p.m. The tasting room visitation hours would begin at 10:00 a.m. and end at 6:00 p.m. The proposed project site plan is shown in Figure 4.

Trip Generation

The anticipated trip generation for the proposed project was estimated using standard rates published by the Institute of Transportation Engineers (ITE) in *Trip Generation Manual*, 10th Edition, 2017. This publication has a new land use for "Winery" (LU# 970), and these rates were applied to the 2,124 square-foot portion of the winery that would house the tasting room, as indicated for the independent variable, as shown in Table 6. It is noted that a deduction was not included for trips made to and from the existing vineyard at the site as these trips are expected to be minimal. The proposed project is expected to generate an average of 144 trips per day, including 23 trips during the p.m. peak hour and 115 during the Saturday peak hour.



Source: Bartelt Engineering 2/18

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Figure 4 – Site Plan

Table 6 – Trip Generation Summary											
Land Use	**Units**	**Daily**		**Weekday PM Peak Hour**				**Weekend PM Peak Hour**			
		Rate	**Trips**	**Rate**	**Trips**	**In**	**Out**	**Rate**	**Trips**	**In**	**Out**
Proposed											
Winery	3.14 ksf	45.96	144	7.31	23	11	12	36.5	115	54	61

Note: ksf = 1,000 square feet

Trip Distribution

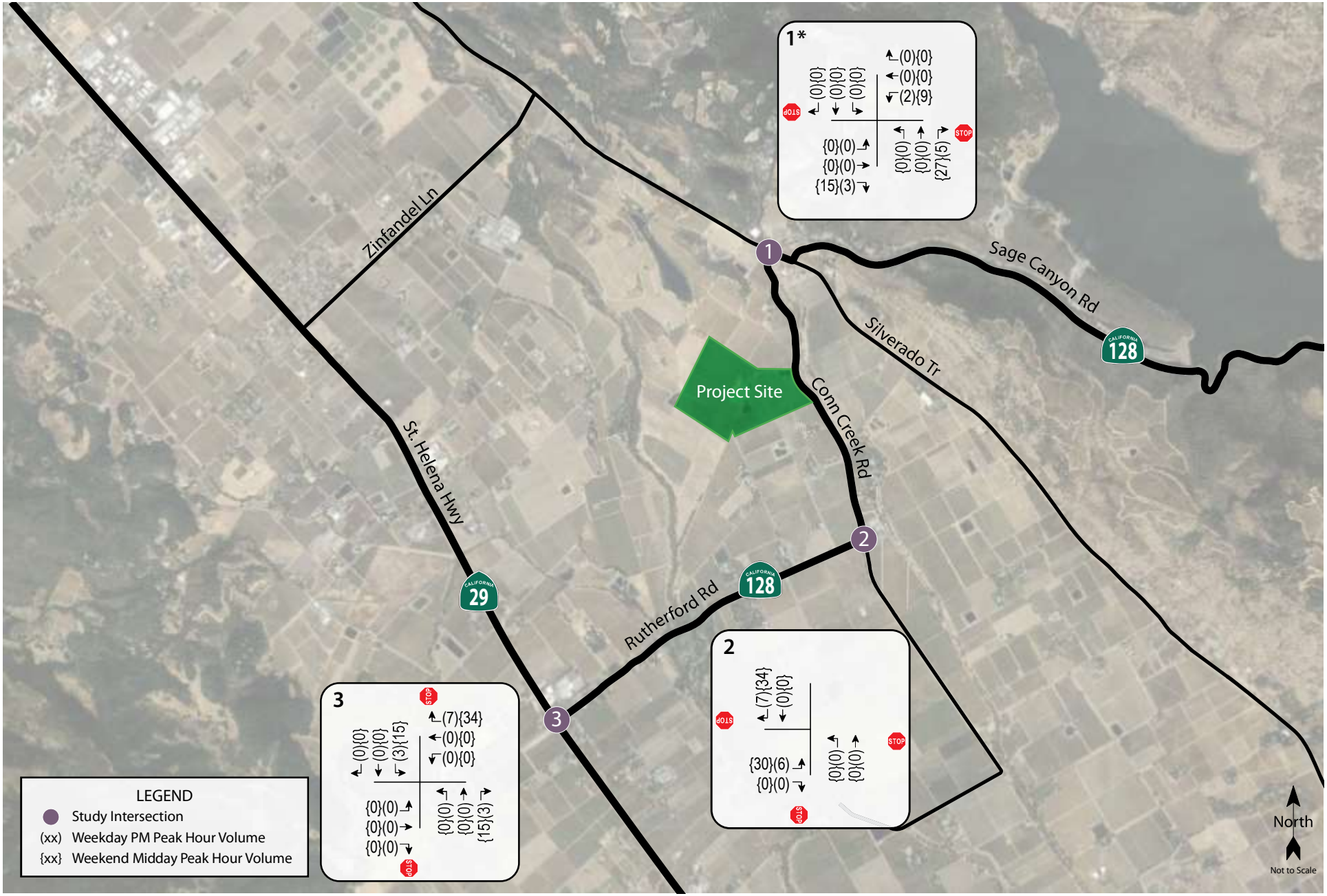
The pattern used to allocate new project trips to the street network was based on the site's location and proximity to adjacent wineries communities. Per traffic data obtained by CTG, trips on the Conn Creek Road and Rutherford Road corridor traveling to and from SR 29 and Silverado Trail exhibit a roughly even split (i.e. 55 percent westbound toward SR 29 and 45 percent eastbound toward Silverado Trail). The applied distribution assumptions and resulting trips are shown in Table 7.

Table 7 – Trip Distribution Assumptions			
Route	**Percent**	**Weekday PM Trips**	**Weekend PM Trips**
Inbound			
From the north via SR 29	27%	3	15
From the north via Silverado Trail	28%	3	15
From the south via SR 29	28%	3	15
From the south via Silverado Trail	17%	2	9
Subtotal	*100%*	*11*	*54*
Outbound			
To the north via SR 29	55%	7	34
To the south via Silverado Trail	45%	5	27
Subtotal	*100%*	*12*	*61*
TOTAL		**23**	**115**

Intersection Operation

Existing plus Project Conditions

Upon the addition of project-related traffic to the Existing volumes, Silverado Trail/Conn Creek Road and Rutherford Road/SR 29 are expected to continue operating unacceptably overall and on the minor street approaches during both peak hours. Project traffic volumes are shown in Figure 5 and Existing plus Project volumes in Figure 6. These results are summarized in Table 8.



* Silverado Trail is considered to run East-West at this intersection.

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Figure 5 – Project Traffic Volumes

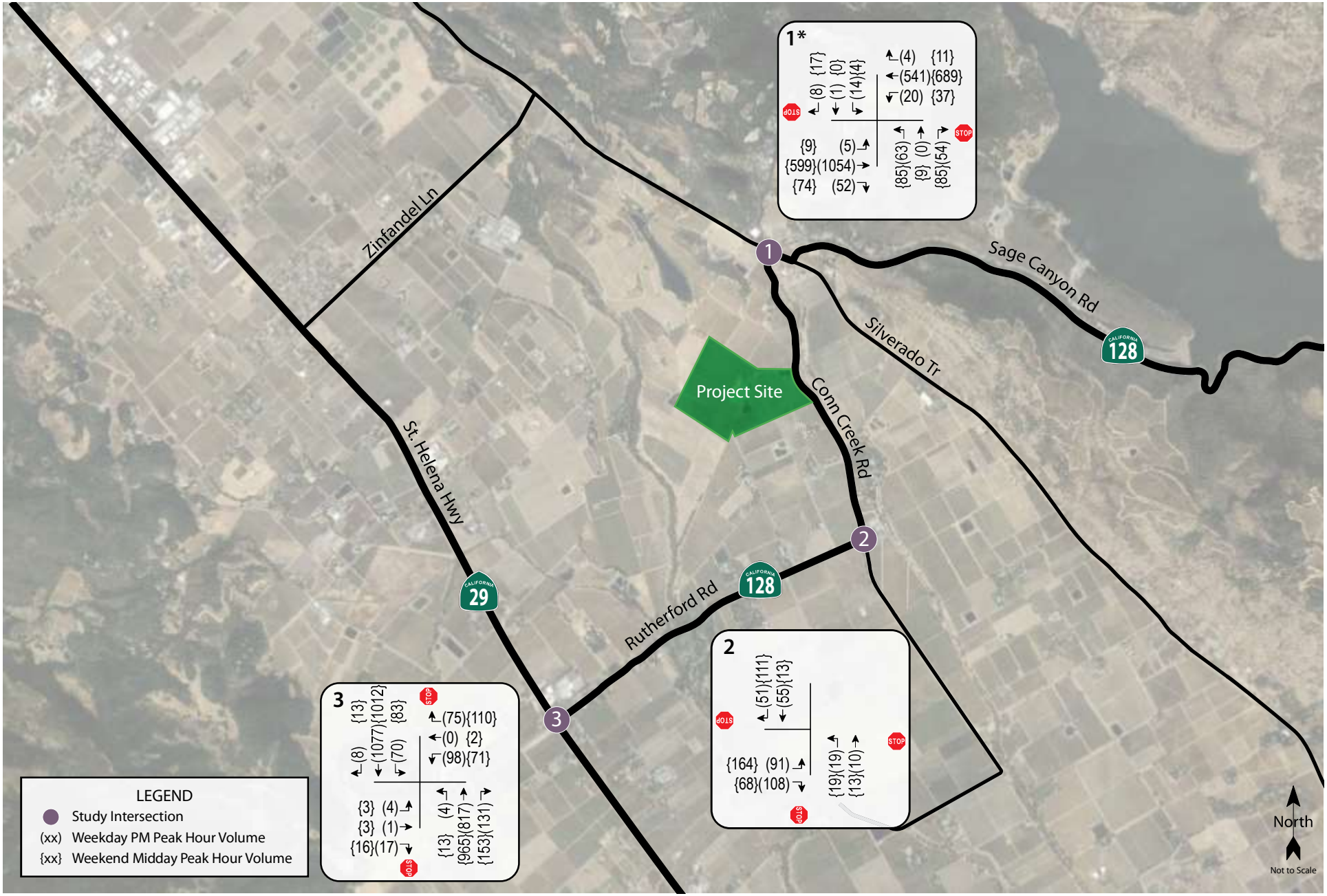

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Figure 6 – Existing plus Project Traffic Volumes

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Table 8 – Existing and Existing plus Project Peak Hour Intersection Levels of Service								
Study Intersection ***Approach***	**Existing Conditions**				**Existing plus Project**			
	Weekday PM Peak		**Weekend PM Peak**		**Weekday PM Peak**		**Weekend PM Peak**	
	Delay	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
1. Silverado Tr/Conn Creek Rd (SR 128)	16.1	C	22.8	C	17.2	C	30.3	D
NB (Conn Creek Rd) Approach	***242.1***	***F***	***229.3***	***F***	***250.1***	***F***	***268.2***	***F***
With SB Deceleration Lane	-	-	-	-	15.8	C	26.6	D
NB (Conn Creek Rd) Approach	-	-	-	-	***228.7***	***F***	***235.6***	***F***
2. Rutherford Rd (SR 128)/Conn Creek Rd (SR 128)	3.3	A	1.6	A	3.1	A	1.3	A
NB (Conn Creek Rd) Approach	*9.7*	*A*	*9.7*	*A*	*9.8*	*A*	*10.0*	*B*
3. SR 29/Rutherford Rd (SR 128)	**73.6**	**F**	**44.5**	**E**	**73.3**	**F**	**46.5**	**E**
WB (Rutherford Rd) Approach	***1,000***	***F***	***691.5***	***F***	***960.5***	***F***	***601.1***	***F***

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics;* **Bold** text = deficient operation; Shaded cells = conditions with recommended improvements

It should be noted that with the addition of project-related traffic volumes, average delay at the intersections of Rutherford Road/Conn Creek Road and Rutherford Road/SR 29 decreases during one or both peak hours. While this is counter-intuitive, this condition occurs when a project adds trips to movements that are currently underutilized or have delays that are below the intersection average, resulting in a better balance between approaches and lower overall average delay. The project adds traffic predominantly to the through movement at Rutherford Road/Conn Creek Road and to the right-turn movements at Rutherford Road/SR 29, which have average delays that are lower than the averages for the intersections as a whole, resulting in a slight reduction in the overall average delays. The conclusion could incorrectly be drawn that the project actually improves operation based on this data alone; however, it is more appropriate to conclude that the project trips are expected to make use of excess capacity, so drivers will experience little, if any, change in conditions as a result of the project.

Findings –Rutherford Road/Conn Creek Road currently operates at an acceptable service level during both peaks and would continue doing so upon adding project-generated traffic. The remaining two study intersections would continue to operate unacceptably.

- Traffic delays on the stop-controlled northbound Conn Creek Road approach to Silverado Trail would be expected to increase with the addition of project-related traffic by eight and 38.9 seconds during the weekday and weekend peak hours, respectively. This exceeds the County's five second threshold, which is considered an adverse impact under the County standards. However, it is noted that the County has established LOS E operation on Silverado Trail as being acceptable and has indicated that signalization is not an option, though this would achieve acceptable operation. Given that signalization was not an option, the addition of a deceleration lane was considered as a project mitigation measure. It is noted that with the addition of a deceleration lane on Silverado Trail at Conn Creek Road, the intersection would continue to operate at the same levels of service; however, the

increase in delay on the minor road approach would decrease by 21.4 and 32.6 seconds during the weekday and weekend peak periods, respectively. Because the addition of a deceleration lane would decrease the overall increase in delay associated with the project, this improvement would mitigate the impact per the County's standard. The Silverado Trail approaches would continue to operate above the County's LOS E standard.

- Similarly, average delay on the Rutherford Road approach to SR 29 is anticipated to increase during the weekend peak period upon adding project-generated traffic, with LOS E or F operation without or with the project. The increase in delay would not exceed the County's five second threshold; therefore, the project's impact to this intersection would be considered acceptable. It is noted that per the County's standards, LOS F operation is considered acceptable on SR 29.

A spreadsheet indicating how the County of Napa significance criteria were evaluated is provided in Appendix C.

Recommendation – The project applicant should pave the existing gravel shoulder to provide a deceleration lane on Silverado Trail at Conn Creek Road.

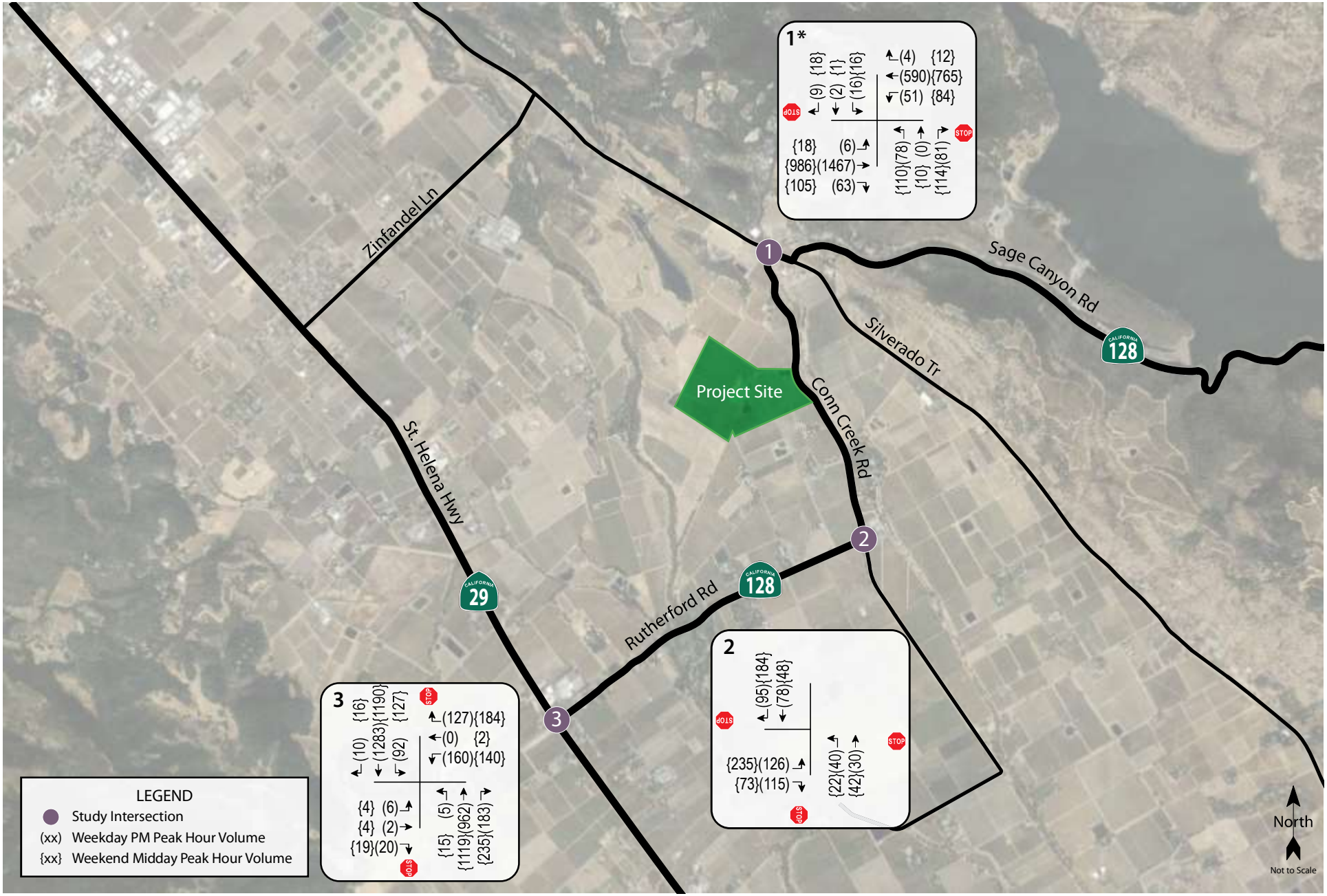
Future plus Project Conditions

Upon the addition of project-generated traffic to the anticipated Future volumes, and with the recommended improvements, Silverado Trail/Conn Creek Road and Rutherford Road/SR 29 are expected to continue operating unacceptably at LOS F overall and on the stop-controlled approaches during both peak periods. The Future plus Project operating conditions are summarized in Table 9 and the volumes for this scenario are presented in Figure 7.

Table 9 – Future and Future plus Project Peak Hour Intersection Levels of Service

	Study Intersection *Approach*	**Future Conditions**				**Future plus Project**			
		Weekday PM Peak		**Weekend PM Peak**		**Weekday PM Peak**		**Weekend PM Peak**	
		Delay	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
1.	Silverado Tr/Conn Creek Rd (SR 128)	**85.1**	**F**	**119.1**	**F**	**93.3**	**F**	**144.1**	**F**
	NB (Conn Creek Rd) Approach	***1,207***	***F***	***1,219***	***F***	***1,290***	***F***	***1,330***	***F***
	With SB Deceleration Lane	**-**	**-**	**-**	**-**	**84.2**	**F**	**130.4**	**F**
	NB (Conn Creek Rd) Approach	***-***	***-***	***-***	***-***	***1,154***	***F***	***1,203***	***F***
2.	Rutherford Rd (SR 128)/Conn Creek Rd (SR 128)	3.7	A	2.2	A	3.6	A	2.0	A
	NB (Conn Creek Rd) Approach	*10.4*	*B*	*10.3*	*B*	*10.4*	*B*	*10.7*	*B*
3.	Rutherford Rd (SR 128)/SR 29	***259.0***	***F***	***324.6***	***F***	***276.5***	***F***	***362.1***	***F***
	WB (Rutherford Rd) Approach	***2,591***	***F***	***3,263***	***F***	***2,712***	***F***	***3,276***	***F***

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; Results for minor approaches to two-way stop-controlled intersections are indicated in *italics;* **Bold** text = deficient operation; Shaded cells = conditions with recommended improvements



* Silverado Trail is considered to run East-West at this intersection.

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Traffic Impact Study for the Frank Family Benjamin Ranch Winery Project

Figure 7 – Future plus Project Traffic Volumes

Findings – Silverado Trail/Conn Creek Road and Rutherford Road/SR 29 will continue operating unacceptably with project traffic added, at the same Levels of Service as without it.

- The study intersection of Silverado Trail/Conn Creek Road would continue to experience unacceptable operation of LOS F overall and on the minor street approach during both peak hours without and with project-related traffic. The project's impact would be considered adverse if it adds five seconds or more to the overall delay or to the delay at the minor road approach. The project would add 8.2 seconds to the overall delay (83 seconds to the delay on the northbound approach) during the weekday p.m. peak hour and 25 seconds to the overall delay (111 seconds to the delay on the northbound approach) during the weekend peak hour. This is considered an adverse impact under the County's standards. It is noted that signalization would achieve acceptable operation; however, given that this is not an option, alternative feasible mitigation measures were evaluated. With the addition of a deceleration lane on Silverado Trail, delay during the weekday p.m. peak period would improve to levels better than conditions without the project and the increase in delay during the weekend peak hour would decrease by 13.7 seconds overall and 127 seconds on the minor road approach.

- Similarly, the intersection of Rutherford Road/SR 29 would operate unacceptably at LOS F during both peak hours, without and with project-generated trips added. The project would add 17.5 and 37.5 seconds to the overall delay during the weekday and weekend peak hours respectively, exceeding the five second threshold. This is considered an adverse impact under the County's standards.

Recommendation – To mitigate the project's impacts, the project should pave the existing gravel shoulder to provide a deceleration lane on southbound Silverado Trail at Conn Creek Road. Because there are no feasible improvements to increase capacity at SR 29/ Rutherford Road besides signalization, the applicant should implement a Transportation Demand Management Plan to reduce the project's impact.

Queuing

Unsignalized Intersection

Under each scenario, the projected maximum queues in dedicated turn pockets at the study intersections were determined using a methodology contained in "Estimating Maximum Queue Length at Unsignalized Intersections," John T. Gard, *ITE Journal*, November 2001. Summarized in Table 10 are the predicted queue lengths in vehicles. A copy of the maximum queue length spreadsheet is provided in Appendix D.

Table 10 – Maximum Queues Exceeding Available Storage									
Study Intersection Approach	**Available Storage (vehs)**	**Maximum Queues**							
		Weekday PM Peak				**Weekend PM Peak**			
		E	**E+P**	**F**	**F+P**	**E**	**E+P**	**F**	**F+P**
Silverado Trail/Conn Creek Rd (SR 128)									
Westbound Left-Turn	7	1	1	2	3	2	2	3	3
Eastbound Left-Turn	3	0	0	0	0	1	1	1	1
Rutherford Rd (SR 128)/SR 29									
Northbound Left-Turn	6	0	0	0	0	1	1	1	1
Southbound Left-Turn	6	3	3	3	3	3	3	3	4

Notes: All distances are measured in feet; E = existing conditions; E+P = existing plus project conditions; F = future conditions; F+P = future plus project conditions

Finding – Existing stacking space for all turn lanes at the study intersections is sufficient to accommodate queues with project traffic added. The project does not cause any queues to exceed available storage.

Travel Demand Analysis

Senate Bill (SB) 743 established a change in the metric to be applied to determining traffic impacts associated with development projects. Rather than the delay-based criteria associated with a Level of Service analysis, the increase in vehicle-miles-travelled (VMT) as a result of a project will be the basis for determining impacts once this new metric is fully vetted and standards of significance have been adopted by the County. While the County has not yet adopted a policy regarding vehicle miles traveled (VMT), the project's contribution was estimated for informational purposes only. Vehicle miles traveled associated with the project were calculated by multiplying the estimated number of employee trips and the average home-to-work trip distance for the Traffic Analysis Zone (TAZ) in which the project is located. Using the daily trips generated for the proposed 46 full-time and 15 part-time employees as determined using the County's winery trip generation form, and an average distance of 16.2 miles traveled per daily trip in the project's location as available from the Caltrans Statewide Travel Demand Model, the estimated VMT for the project is 2,738 vehicle miles traveled. These results are shown in Table 11.

Table 11 – VMT Summary			
Land Use	**Daily Employee Trips**	**Average Trip Length**	**Calculated Daily VMT**
Winery	169	16.2 mi	2,738

Again, as VMT thresholds have not yet been established by the County of Napa there is no standard against which to measure the significance of this information.

Vehicle Trip Reduction

The site is located north of the City of Napa in an area that contains numerous other wineries and tasting rooms, so the project is likely to attract a substantial amount of linked traffic from guests visiting multiple tasting rooms in the area rather than generating new trips associated with the project itself. As is typical

with existing wineries in the area, visitors in large groups often arrange for their own private van or shuttle transportation, resulting in fewer trips to and from the site than might otherwise occur. This is a transportation demand measure that is a common means of transportation as most visitors intend to drink wine, which can impair driving abilities. While it is not recommended that the project site require the use of shuttles for large groups, it is recommended that when a large group makes a reservation, they should be encouraged to use private vans or a shuttle.

The project should also promote carpooling of employees by adjusting work schedules, assisting with ride-matching, preferential parking, etc. The County has adopted several measures in the General Plan to reduce vehicle trips through Transportation Demand Management (TDM) strategies: "The project should support programs to reduce single occupant vehicle use and encourage alternative travel modes." The winery has the ability to reduce the dependence on single vehicle occupancy trips to reduce peak hour trips. Additionally, the project could provide lunch on-site to reduce off-site lunch related trips. It should be noted that the Napa Valley Transportation Authority (NVTA) provides a Guaranteed Ride Home (GRH) program available to persons who work in Napa County; it can be used four times per year.

Given the proposed carpooling incentives and GRH measure, and the likely number of employees to participate in the program, it is anticipated that vehicle trips would be reduced by 2 percent based on metrics published in *Quantifying Greenhouse Gas Mitigation Measures* by the California Air Pollution Control Officers Association (CAPCOA). This equates to a reduction of two peak hour trips daily. In addition, the on-site lunch program would reduce trips during the midday peak hour. Assuming half the 30 employees leave the site for lunch, the lunch program would reduce midday trips by 50 percent. This translates to a reduction of 30 midday trips as a result of the lunch program.

Recommendation – It is recommended that when reservations are made for a group, staff encourage the guests to carpool or use a shuttle or van. Additionally, it is recommended that the winery implement a TDM plan that may reduce peak-hour vehicle trips by promoting employee carpooling, and potentially providing lunch on-site to reduce VMT.

Alternative Modes

Pedestrian Facilities

Consistent with expectations for a rural area, there are no existing pedestrian facilities in the project vicinity.

Finding – While there are no pedestrian facilities serving the project site, pedestrian trips to and from the site are not expected, so this condition is acceptable.

Bicycle Facilities

Existing bike lanes on Silverado Trail, together with planned future facilities and the shared use of minor streets, provide adequate access for bicyclists.

Finding – Bicycle facilities serving the project site will be adequate upon completion of planned facilities.

Recommendation – The applicant should dedicate the necessary frontage along the west side of Conn Creek Road to implement planned bicycle facilities for this roadway.

Bicycle Storage

The County does not have specific bicycle parking requirements for wineries; however, the project should provide bicycle parking consistent with the requirements outlined in Chapter 18.110.040 of the Napa County Code of Ordinances which states that ten bicycle parking spaces should be provided for all nonresidential uses where ten or more automobile parking spaces are required. With a proposed supply of 75 permanent vehicle parking spaces, the project would need to provide ten bicycle spaces on-site.

Recommendation – The applicant should ensure that parking for a minimum of ten bicycles is provided on-site, preferably near the tasting room.

Transit

While there are no transit facilities serving the project site, there is also no anticipated need for such service.

Finding – The lack of transit access does not result in an impact given the limited potential for any demand.

Access and Circulation

Site Access

The winery would be accessed via a new paved driveway on Conn Creek Road, which would be stop-controlled on its approach to Conn Creek Road. As proposed, the project would also construct a left-turn lane on Conn Creek Road at the location of the new driveway.

Delay for drivers exiting the site from the driveway was reviewed for the highest volume and therefore "worst-case" future scenarios during the p.m. weekday peak as well as the Saturday peak to determine the potential on-site delay. During the weekday p.m. peak period, the project driveway is anticipated to have an average delay of 9.5 seconds. For the Saturday peak period, the delay leaving the site would average 11.2 seconds. Given the minimal delay expected at the driveway, the driveway is expected to operate acceptably.

Sight Distance

At unsignalized intersections a substantially clear line of sight should be maintained between the driver of a vehicle waiting at the crossroad and the driver of an approaching vehicle. Adequate time must be provided for the waiting vehicle to either cross, turn left, or turn right, without requiring the through traffic to radically alter their speed.

Sight distance along Conn Creek Road at the project driveway was evaluated based on sight distance criteria contained in the *Highway Design Manual* published by Caltrans. The recommended sight distance for minor street approaches that are either a private road or a driveway is based on stopping sight distance for the approach travel speeds. Additionally, the stopping sight distance needed for a following driver to stop if there is a vehicle waiting to turn into a side street or driveway is evaluated based on the stopping sight distance criterion and the approach speed on the major street.

Sight lines along Conn Creek Road from the edge of traveled way in both directions from the driveway are clear for more than 500 feet, which exceeds the minimum sight distance required for vehicles traveling at 55 mph. Similarly, drivers on Conn Creek Road will have visibility of a vehicle stopped to turn left into the driveway for more than 500 feet.

Finding – Stopping sight distance at the project driveway is adequate to meet the applied criteria for both entering and exiting movements.

Recommendation – Because landscaping and signs can impede clear sight lines, any new plantings or signs should be designed to ensure that adequate sight lines will be maintained.

Access Analysis

Left-Turn Lane Warrants

The addition of a left-turn lane at the location of the proposed project driveway is a planned project improvement. Therefore, the need for a left-turn lane on Conn Creek Road at the project driveway was not evaluated.

Site Circulation

The AutoTURN application of AutoCAD was used to evaluate the adequacy of on-site circulation for fire trucks and commercial trucks. As designed, there would be no anticipated issues with either of these types of vehicles accessing or circulating through the project site. Exhibits showing the expected travel paths are provided in Appendix E.

Finding – On-site circulation is expected to operate acceptably.

Parking

The project was analyzed to determine whether the proposed parking supply would be sufficient for the anticipated daily demand during harvest conditions as well as during events. The project site, as proposed, would have 89 standard parking spaces and five accessible parking spaces for a total of 94 parking spaces. It is understood that rideshare services such as Uber and Lyft as well as shuttles would be used to transport guests to the site during events.

To accommodate the daily parking demand for the tasting room, there should be at least one space provided for every employee on-site, as well as parking stalls for about 25 percent of the expected daily tasting room visitors. During typical daily operations there would be 46 full-time and 15 part-time employees and a maximum of 400 visitors per day to the tasting room. Assuming the County's standard occupancy rate of 2.8 guests per vehicle, a total o143 guest vehicles would visit the site over the course of the day. Therefore, the proposed project would need at least 97 parking spaces, 61 for employees and 36 for guests assuming one-quarter of the guests would be there at any one time. The proposed supply of 94 spaces would insufficient to accommodate the approximate day-to-day peak demand of 97 spaces, experiencing a deficit of three spaces.

The maximum number of parking spaces that would be needed on-site to accommodate employees and visitors during a 150-person marketing event was also estimated using the County's standard vehicle occupancies of one employee or 2.8 visitors per vehicle. It is noted that tastings would be scheduled during events; however, the daily combined tours and tasting and marketing event visitation shall not exceed 400 persons. Based on these operational parameters, during a 150-person event, a total of 135 parking spaces would be needed, including 54 for event guests, 20 for typical winery tasting guests, and 61 for winery employees. Therefore, the total parking supply at the winery is insufficient to meet the anticipated parking demand for the largest event, experiencing a shortfall of 41 spaces.

The second largest event would be a 24-person event. Assuming staffing levels are maintained at the typical daily levels, the parking required for a 24-person event would be 104 spaces, including nine for event guests, 34 for guests visiting the winery tasting room, and 61 for winery employees. Therefore, the proposed supply is deficient by ten spaces to meet the anticipated demand for 24-person events.

Finding – The proposed permanent parking supply is inadequate for the anticipated demand during typical harvest operation and for the anticipated peak demand during events.

Recommendation – The applicant should ensure an additional three on-site permanent parking spaces are provided to satisfy the parking demand during typical daily operations.

Recommendation – As proposed, the applicant should provide a shuttle service and arrange for guests to park off-site during events with 150 guests. Similarly, the applicant should either provide a shuttle service for 24-person events or provide ten additional on-site temporary parking spaces.

Conclusions and Recommendations

Conclusions

- The project is expected to generate a 144 new trips per day, including 23 trips during the p.m. peak hour and 115 trips during the weekend peak hour.
- Silverado Trail/Conn Creek Road is currently operating unacceptably at LOS F on the minor street approach during both peak periods. The project adds more than five seconds of delay to the stop-controlled northbound approach for existing and future conditions during the weekday and weekend peak hours, which is considered an adverse impact.
- The intersection of Rutherford Road/SR 29 is currently operating at LOS E or F overall and at LOS F on the stop-controlled Rutherford Road approach during the two peak hours evaluated and would be expected to operate with higher delays during both peak hours in the future and with project traffic added. The project adds more than five seconds of delay overall and to the minor approach for future conditions during the weekday and weekend peak periods; therefore, the impact is considered adverse under the County's criteria.
- The project would not cause any turn pocket queues at the study intersections to exceed available storage.
- The lack of pedestrian facilities serving the project site does not result in an impact given the rural location and type of project.
- Similarly, the lack of transit service does not result in an impact due to the lack of demand for such services.
- Fire truck and commercial vehicle access are expected to operate acceptably.
- Sight distances along Conn Creek Road at the location of the proposed project driveway are adequate.

Recommendations

- The project should include paving the existing gravel shoulder along southbound Silverado Trail to create a separate deceleration lane at Conn Creek Road while maintaining the existing bicycle lane.
- The project should include construction of a left-turn lane at the project driveway, as proposed.
- It is recommended that when groups call to make a reservation for a tasting or tour, staff should encourage the guests to carpool or use a shuttle or van.
- The applicant should establish a TDM plan to reduce peak hour trips. Trip reduction measures could include promoting employee carpooling and potentially providing lunch on-site for employees.

- The applicant should dedicate right-of-way along the project frontage if necessary to accommodate the planned future bicycle facilities on Conn Creek Road.

- Secure parking facilities for at least ten bicycles should be provided on-site.

- Because landscaping and signs can impede clear sight lines, any new plantings or signs should be designed to ensure that adequate sight lines will be maintained.

- An additional three permanent on-site vehicular parking spaces should be provided as part of the project to satisfy typical daily parking demand.

- As proposed, the applicant should provide a shuttle service and arrange for guests to park off-site during the largest 150-person events. For the proposed 24-person events, the applicant should either provide an additional ten temporary on-site parking spaces or provide a shuttle service.

Study Participants and References

Study Participants

Principal in Charge	Dalene J. Whitlock, PE, PTOE
Assistant Engineer	Kevin Rangel, EIT
Graphics	Katia Wolfe
Editing/Formatting	Alex Scrobonia
Quality Control	Dalene J. Whitlock, PE, PTOE

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Appendix A

Collision Rate Calculations

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Intersection Collision Rate Calculations

TIS for the Frank Family Benjamin Ranch Winery

Intersection # 1: Silverado Trail & Conn Creek Road (SR 128)
Date of Count: Friday, October 6, 2017

Number of Collisions: 9
Number of Injuries: 0
Number of Fatalities: 0
ADT: 18100
Start Date: April 1, 2014
End Date: March 31, 2019
Number of Years: 5

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

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{9 \times 1{,}000{,}000}{18{,}100 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.27 c/mve**	**0.0%**	**0.0%**
Statewide Average*	**0.23 c/mve**	**2.0%**	**40.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 2: Rutherford Road (SR 128) & Conn Creek Road (SR 128)
Date of Count: Friday, October 6, 2017

Number of Collisions: 2
Number of Injuries: 1
Number of Fatalities: 0
ADT: 3200
Start Date: April 1, 2014
End Date: March 31, 2019
Number of Years: 5

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

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{2 \times 1{,}000{,}000}{3{,}200 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.34 c/mve**	**0.0%**	**50.0%**
Statewide Average*	**0.16 c/mve**	**1.7%**	**39.2%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Calculaions

TIS for the Frank Family Benjamin Ranch Winery

Intersection # 3: SR 29 & Rutherford Road (SR 128)
Date of Count: Friday, October 6, 2017

Number of Collisions: 15
Number of Injuries: 7
Number of Fatalities: 0
ADT: 22900
Start Date: April 1, 2014
End Date: March 31, 2019
Number of Years: 5

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

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{15 \times 1{,}000{,}000}{22{,}900 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.36 c/mve**	**0.0%**	**46.7%**
Statewide Average*	**0.23 c/mve**	**2.0%**	**40.4%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Appendix B

Intersection Level of Service Calculations

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Intersection	
Int Delay, s/veh	16.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	1054	49	18	541	4	63	0	49	14	1	8
Future Vol, veh/h	5	1054	49	18	541	4	63	0	49	14	1	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	70	-	-	155	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	5	1098	51	19	564	4	66	0	51	15	1	8

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	568	0	0	1149	0	0	1743	1740	1124	1763	1763	566
Stage 1	-	-	-	-	-	-	1134	1134	-	604	604	-
Stage 2	-	-	-	-	-	-	609	606	-	1159	1159	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1014	-	-	615	-	-	69	88	252	66	85	528
Stage 1	-	-	-	-	-	-	249	280	-	489	491	-
Stage 2	-	-	-	-	-	-	486	490	-	241	272	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1014	-	-	615	-	-	~ 65	85	252	51	82	528
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 65	85	-	51	82	-
Stage 1	-	-	-	-	-	-	248	279	-	487	476	-
Stage 2	-	-	-	-	-	-	463	475	-	191	271	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.4	242.1	72.8
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	96	1014	-	-	615	-	-	76
HCM Lane V/C Ratio	1.215	0.005	-	-	0.03	-	-	0.315
HCM Control Delay (s)	242.1	8.6	-	-	11	-	-	72.8
HCM Lane LOS	F	A	-	-	B	-	-	F
HCM 95th %tile Q(veh)	8	0	-	-	0.1	-	-	1.2

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	3.3

Movement	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	19	10	85	108	55	44
Future Vol, veh/h	19	10	85	108	55	44
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	Free	-	None
Storage Length	100	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	2	0	0	2
Mvmt Flow	21	11	92	117	60	48

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	260	92	0	-	92	0
Stage 1	92	-	-	-	-	-
Stage 2	168	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	733	971	-	0	1515	-
Stage 1	937	-	-	0	-	-
Stage 2	867	-	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	703	971	-	-	1515	-
Mov Cap-2 Maneuver	703	-	-	-	-	-
Stage 1	899	-	-	-	-	-
Stage 2	867	-	-	-	-	-

Approach	NB	NE	SW
HCM Control Delay, s	9.7	0	4.2
HCM LOS	A		

Minor Lane/Major Mvmt	NET	NBLn1	NBLn2	SWL	SWT
Capacity (veh/h)	-	703	971	1515	-
HCM Lane V/C Ratio	-	0.029	0.011	0.039	-
HCM Control Delay (s)	-	10.3	8.7	7.5	0
HCM Lane LOS	-	B	A	A	A
HCM 95th %tile Q(veh)	-	0.1	0	0.1	-

HCM 6th TWSC
3: SR 29 & Driveway/Rutherford Rd 06/10/2019

Intersection												
Int Delay, s/veh	73.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↰	↱	↰	↑	↱	↰	↦	
Traffic Vol, veh/h	4	1	17	98	0	68	4	817	128	67	1077	8
Future Vol, veh/h	4	1	17	98	0	68	4	817	128	67	1077	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	100	-	130	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	2	1	0	0	1	2	0	1	0
Mvmt Flow	4	1	18	105	0	73	4	878	138	72	1158	9

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2299	2331	1163	2202	2197	878	1167	0	0	1016	0	0
Stage 1	1307	1307	-	886	886	-	-	-	-	-	-	-
Stage 2	992	1024	-	1316	1311	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.12	6.51	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.12	5.51	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.12	5.51	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.518	4.009	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	28	37	239	~ 32	45	350	606	-	-	691	-	-
Stage 1	198	232	-	339	364	-	-	-	-	-	-	-
Stage 2	299	315	-	194	230	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	20	33	239	~ 26	40	350	606	-	-	691	-	-
Mov Cap-2 Maneuver	20	33	-	~ 26	40	-	-	-	-	-	-	-
Stage 1	197	208	-	337	361	-	-	-	-	-	-	-
Stage 2	235	313	-	160	206	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	76.4	$ 1000.1	0	0.6
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	606	-	-	73	26	350	691	-	-
HCM Lane V/C Ratio	0.007	-	-	0.324	4.053	0.209	0.104	-	-
HCM Control Delay (s)	11	-	-	76.8	$ 1681.5	18	10.8	-	-
HCM Lane LOS	B	-	-	F	F	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	1.2	13	0.8	0.3	-	-

Notes
~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM 6th TWSC
1: Conn Creek Rd/Driveway & Silverado Trail 10/03/2019

Intersection												
Int Delay, s/veh	22.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↦		↰	↦			↕			↕	
Traffic Vol, veh/h	9	599	59	28	689	11	85	9	58	4	0	17
Future Vol, veh/h	9	599	59	28	689	11	85	9	58	4	0	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	70	-	-	155	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	10	651	64	30	749	12	92	10	63	4	0	18

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	761	0	0	715	0	0	1527	1524	683	1555	1550	755
Stage 1	-	-	-	-	-	-	703	703	-	815	815	-
Stage 2	-	-	-	-	-	-	824	821	-	740	735	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	860	-	-	895	-	-	97	119	453	93	115	412
Stage 1	-	-	-	-	-	-	431	443	-	374	394	-
Stage 2	-	-	-	-	-	-	370	391	-	412	428	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	860	-	-	895	-	-	~ 89	114	453	72	110	412
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 89	114	-	72	110	-
Stage 1	-	-	-	-	-	-	426	438	-	370	381	-
Stage 2	-	-	-	-	-	-	342	378	-	343	423	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.4	229.3	23.5
HCM LOS			F	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	131	860	-	-	895	-	-	217
HCM Lane V/C Ratio	1.261	0.011	-	-	0.034	-	-	0.105
HCM Control Delay (s)	229.3	9.2	-	-	9.2	-	-	23.5
HCM Lane LOS	F	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	10.3	0	-	-	0.1	-	-	0.3

Notes
~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM 6th TWSC
2: Rutherford Rd & Conn Creek Rd 10/03/2019

Intersection	
Int Delay, s/veh	1.6

Movement	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	19	13	134	68	13	77
Future Vol, veh/h	19	13	134	68	13	77
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	Free	-	None
Storage Length	100	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	2	0	0	2
Mvmt Flow	21	14	146	74	14	84

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	258	146	0	-	146	0
Stage 1	146	-	-	-	-	-
Stage 2	112	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	735	906	-	0	1448	-
Stage 1	886	-	-	0	-	-
Stage 2	918	-	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	728	906	-	-	1448	-
Mov Cap-2 Maneuver	728	-	-	-	-	-
Stage 1	877	-	-	-	-	-
Stage 2	918	-	-	-	-	-

Approach	NB	NE	SW
HCM Control Delay, s	9.7	0	1.1
HCM LOS	A		

Minor Lane/Major Mvmt	NET	NBLn1	NBLn2	SWL	SWT
Capacity (veh/h)	-	728	906	1448	-
HCM Lane V/C Ratio	-	0.028	0.016	0.01	-
HCM Control Delay (s)	-	10.1	9	7.5	0
HCM Lane LOS	-	B	A	A	A
HCM 95th %tile Q(veh)	-	0.1	0	0	-

HCM 6th TWSC
3: SR 29 & Driveway/Rutherford Rd 09/24/2019

Intersection	
Int Delay, s/veh	44.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	3	16	71	2	76	13	965	138	68	1012	13
Future Vol, veh/h	3	3	16	71	2	76	13	965	138	68	1012	13
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	100	-	130	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	0	0	0	0	0	0	0	1	1	0	1	0
Mvmt Flow	3	3	17	74	2	79	14	1005	144	71	1054	14

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2349	2380	1061	2246	2243	1005	1068	0	0	1149	0	0
Stage 1	1203	1203	-	1033	1033	-	-	-	-	-	-	-
Stage 2	1146	1177	-	1213	1210	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	25	35	274	~ 30	43	296	660	-	-	615	-	-
Stage 1	227	260	-	283	312	-	-	-	-	-	-	-
Stage 2	245	267	-	224	258	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	16	30	274	~ 23	37	296	660	-	-	615	-	-
Mov Cap-2 Maneuver	16	30	-	~ 23	37	-	-	-	-	-	-	-
Stage 1	222	230	-	277	305	-	-	-	-	-	-	-
Stage 2	174	261	-	184	228	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	89.8	$ 691.5	0.1	0.7
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	660	-	-	64	23	296	615	-	-
HCM Lane V/C Ratio	0.021	-	-	0.358	3.306	0.267	0.115	-	-
HCM Control Delay (s)	10.6	-	-	89.8	$ 1389	21.5	11.6	-	-
HCM Lane LOS	B	-	-	F	F	C	B	-	-
HCM 95th %tile Q(veh)	0.1	-	-	1.3	9.6	1.1	0.4	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	85.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	1467	60	49	590	4	78	0	76	16	2	9
Future Vol, veh/h	6	1467	60	49	590	4	78	0	76	16	2	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	70	-	-	155	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	6	1467	60	49	590	4	78	0	76	16	2	9

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	594	0	0	1527	0	0	2205	2201	1497	2237	2229	592
Stage 1	-	-	-	-	-	-	1509	1509	-	690	690	-
Stage 2	-	-	-	-	-	-	696	692	-	1547	1539	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	992	-	-	442	-	-	~ 32	45	152	31	43	510
Stage 1	-	-	-	-	-	-	152	185	-	439	449	-
Stage 2	-	-	-	-	-	-	435	448	-	145	179	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	992	-	-	442	-	-	~ 28	40	152	~ 14	38	510
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 28	40	-	~ 14	38	-
Stage 1	-	-	-	-	-	-	151	184	-	436	399	-
Stage 2	-	-	-	-	-	-	378	398	-	72	178	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1.1	$ 1206.5	$ 524.7
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	47	992	-	-	442	-	-	22
HCM Lane V/C Ratio	3.277	0.006	-	-	0.111	-	-	1.227
HCM Control Delay (s)	$ 1206.5	8.7	-	-	14.2	-	-	$ 524.7
HCM Lane LOS	F	A	-	-	B	-	-	F
HCM 95th %tile Q(veh)	16.8	0	-	-	0.4	-	-	3.5

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	3.7

Movement	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	40	30	120	115	78	88
Future Vol, veh/h	40	30	120	115	78	88
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	Free	-	None
Storage Length	100	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	2	0	0	2
Mvmt Flow	40	30	120	115	78	88

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	364	120	0	-	120	0
Stage 1	120	-	-	-	-	-
Stage 2	244	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	639	937	-	0	1480	-
Stage 1	910	-	-	0	-	-
Stage 2	801	-	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	604	937	-	-	1480	-
Mov Cap-2 Maneuver	604	-	-	-	-	-
Stage 1	860	-	-	-	-	-
Stage 2	801	-	-	-	-	-

Approach	NB	NE	SW
HCM Control Delay, s	10.4	0	3.6
HCM LOS	B		

Minor Lane/Major Mvmt	NET	NBLn1	NBLn2	SWL	SWT
Capacity (veh/h)	-	604	937	1480	-
HCM Lane V/C Ratio	-	0.066	0.032	0.053	-
HCM Control Delay (s)	-	11.4	9	7.6	0
HCM Lane LOS	-	B	A	A	A
HCM 95th %tile Q(veh)	-	0.2	0.1	0.2	-

HCM 6th TWSC
3: SR 29 & Driveway/Rutherford Rd 09/23/2019

Intersection													
Int Delay, s/veh	259												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Vol, veh/h	6	2	20	160	0	120	5	962	180	89	1283	10	
Future Vol, veh/h	6	2	20	160	0	120	5	962	180	89	1283	10	
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free	
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	
Storage Length	-	-	-	-	-	75	100	-	130	100	-	-	
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-	
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	0	0	0	2	1	0	0	1	2	0	1	0	
Mvmt Flow	6	2	20	160	0	120	5	962	180	89	1283	10	

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2588	2618	1288	2449	2443	962	1293	0	0	1142	0	0
Stage 1	1466	1466	-	972	972	-	-	-	-	-	-	-
Stage 2	1122	1152	-	1477	1471	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.12	6.51	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.12	5.51	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.12	5.51	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.518	4.009	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	17	25	202	~ 21	32	313	543	-	-	619	-	-
Stage 1	161	194	-	304	332	-	-	-	-	-	-	-
Stage 2	252	275	-	~ 157	192	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	9	21	202	~ 16	27	313	543	-	-	619	-	-
Mov Cap-2 Maneuver	9	21	-	~ 16	27	-	-	-	-	-	-	-
Stage 1	160	166	-	301	329	-	-	-	-	-	-	-
Stage 2	154	273	-	~ 120	164	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	286.9	$ 2590.8	0.1	0.8
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	543	-	-	33	16	313	619	-	-
HCM Lane V/C Ratio	0.009	-	-	0.848	10	0.383	0.144	-	-
HCM Control Delay (s)	11.7	-	-	286.9	4516.2	23.5	11.8	-	-
HCM Lane LOS	B	-	-	F	F	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	2.9	20.9	1.7	0.5	-	-

Notes
~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM 2010 TWSC
1: Conn Creek Rd/Driveway & Silverado Trail 10/03/2019

Intersection													
Int Delay, s/veh	119.1												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Vol, veh/h	18	986	90	75	765	12	110	10	87	16	1	18	
Future Vol, veh/h	18	986	90	75	765	12	110	10	87	16	1	18	
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop	
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	
Storage Length	70	-	-	155	-	-	-	-	-	-	-	-	
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-	
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0	
Mvmt Flow	18	986	90	75	765	12	110	10	87	16	1	18	

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	777	0	0	1076	0	0	1998	1994	1031	2037	2033	771
Stage 1	-	-	-	-	-	-	1067	1067	-	921	921	-
Stage 2	-	-	-	-	-	-	931	927	-	1116	1112	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	848	-	-	656	-	-	~ 45	61	286	43	58	403
Stage 1	-	-	-	-	-	-	271	301	-	327	352	-
Stage 2	-	-	-	-	-	-	323	350	-	254	287	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	848	-	-	656	-	-	~ 38	53	286	23	50	403
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 38	53	-	23	50	-
Stage 1	-	-	-	-	-	-	265	295	-	320	312	-
Stage 2	-	-	-	-	-	-	272	310	-	167	281	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	1	$ 1219.1	201.8
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	61	848	-	-	656	-	-	46
HCM Lane V/C Ratio	3.393	0.021	-	-	0.114	-	-	0.761
HCM Control Delay (s)	$ 1219.1	9.3	-	-	11.2	-	-	201.8
HCM Lane LOS	F	A	-	-	B	-	-	F
HCM 95th %tile Q(veh)	21.8	0.1	-	-	0.4	-	-	3

Notes
~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM 2010 TWSC
2: Rutherford Rd & Conn Creek Rd 10/03/2019

Intersection	
Int Delay, s/veh	2.2

Movement	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	22	42	205	73	48	150
Future Vol, veh/h	22	42	205	73	48	150
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	Free	-	None
Storage Length	100	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	2	0	0	2
Mvmt Flow	22	42	205	73	48	150

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	451	205	0	-	205	0
Stage 1	205	-	-	-	-	-
Stage 2	246	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	570	841	-	0	1378	-
Stage 1	834	-	-	0	-	-
Stage 2	800	-	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	548	841	-	-	1378	-
Mov Cap-2 Maneuver	548	-	-	-	-	-
Stage 1	802	-	-	-	-	-
Stage 2	800	-	-	-	-	-

Approach	NB	NE	SW
HCM Control Delay, s	10.3	0	1.9
HCM LOS	B		

Minor Lane/Major Mvmt	NET	NBLn1	NBLn2	SWL	SWT
Capacity (veh/h)	-	548	841	1378	-
HCM Lane V/C Ratio	-	0.04	0.05	0.035	-
HCM Control Delay (s)	-	11.8	9.5	7.7	0
HCM Lane LOS	-	B	A	A	A
HCM 95th %tile Q(veh)	-	0.1	0.2	0.1	-

HCM 6th TWSC
3: SR 29 & Driveway/Rutherford Rd 09/24/2019

Intersection	
Int Delay, s/veh	324.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	4	19	140	2	150	15	1119	220	112	1190	16
Future Vol, veh/h	4	4	19	140	2	150	15	1119	220	112	1190	16
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	100	-	130	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	0	0	0	0	1	1	0	1	0
Mvmt Flow	4	4	19	140	2	150	15	1119	220	112	1190	16

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2757	2791	1198	2583	2579	1119	1206	0	0	1339	0	0
Stage 1	1422	1422	-	1149	1149	-	-	-	-	-	-	-
Stage 2	1335	1369	-	1434	1430	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	13	19	228	~ 17	26	254	586	-	-	521	-	-
Stage 1	171	204	-	244	275	-	-	-	-	-	-	-
Stage 2	191	216	-	168	202	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	4	15	228	~ 10	20	254	586	-	-	521	-	-
Mov Cap-2 Maneuver	4	15	-	~ 10	20	-	-	-	-	-	-	-
Stage 1	167	160	-	238	268	-	-	-	-	-	-	-
Stage 2	76	210	-	~ 118	159	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	$ 603.7	$ 3262.9	0.1	1.2
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	586	-	-	20	10	254	521	-	-
HCM Lane V/C Ratio	0.026	-	-	1.35	14.2	0.591	0.215	-	-
HCM Control Delay (s)	11.3	-	-	$ 603.7	$ 6669.9	37.7	13.8	-	-
HCM Lane LOS	B	-	-	F	F	E	B	-	-
HCM 95th %tile Q(veh)	0.1	-	-	3.6	19.3	3.4	0.8	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	17.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	1054	52	20	541	4	63	0	54	14	1	8
Future Vol, veh/h	5	1054	52	20	541	4	63	0	54	14	1	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	70	-	-	155	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	5	1098	54	21	564	4	66	0	56	15	1	8

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	568	0	0	1152	0	0	1748	1745	1125	1771	1770	566
Stage 1	-	-	-	-	-	-	1135	1135	-	608	608	-
Stage 2	-	-	-	-	-	-	613	610	-	1163	1162	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1014	-	-	614	-	-	68	87	252	66	84	528
Stage 1	-	-	-	-	-	-	248	280	-	486	489	-
Stage 2	-	-	-	-	-	-	483	488	-	239	272	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1014	-	-	614	-	-	~ 64	84	252	50	81	528
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 64	84	-	50	81	-
Stage 1	-	-	-	-	-	-	247	279	-	484	472	-
Stage 2	-	-	-	-	-	-	458	471	-	185	271	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.4	250.1	74.1
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	98	1014	-	-	614	-	-	75
HCM Lane V/C Ratio	1.244	0.005	-	-	0.034	-	-	0.319
HCM Control Delay (s)	250.1	8.6	-	-	11.1	-	-	74.1
HCM Lane LOS	F	A	-	-	B	-	-	F
HCM 95th %tile Q(veh)	8.4	0	-	-	0.1	-	-	1.2

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	15.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	1054	52	20	541	4	63	0	54	14	1	8
Future Vol, veh/h	5	1054	52	20	541	4	63	0	54	14	1	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	70	-	50	155	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	5	1098	54	21	564	4	66	0	56	15	1	8

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	568	0	0	1152	0	0	1721	1718	1098	1771	1770	566
Stage 1	-	-	-	-	-	-	1108	1108	-	608	608	-
Stage 2	-	-	-	-	-	-	613	610	-	1163	1162	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1014	-	-	614	-	-	71	91	261	66	84	528
Stage 1	-	-	-	-	-	-	257	288	-	486	489	-
Stage 2	-	-	-	-	-	-	483	488	-	239	272	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1014	-	-	614	-	-	67	87	261	50	81	528
Mov Cap-2 Maneuver	-	-	-	-	-	-	67	87	-	50	81	-
Stage 1	-	-	-	-	-	-	256	287	-	484	472	-
Stage 2	-	-	-	-	-	-	458	471	-	187	271	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.4	228.7	74.1
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	102	1014	-	-	614	-	-	75
HCM Lane V/C Ratio	1.195	0.005	-	-	0.034	-	-	0.319
HCM Control Delay (s)	228.7	8.6	-	-	11.1	-	-	74.1
HCM Lane LOS	F	A	-	-	B	-	-	F
HCM 95th %tile Q(veh)	8.1	0	-	-	0.1	-	-	1.2

HCM 6th TWSC
2: Rutherford Rd & Conn Creek Rd 10/03/2019

Intersection	
Int Delay, s/veh	3.1

Movement	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	19	10	91	108	55	51
Future Vol, veh/h	19	10	91	108	55	51
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	Free	-	None
Storage Length	100	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	2	0	0	2
Mvmt Flow	21	11	99	117	60	55

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	274	99	0	-	99	0
Stage 1	99	-	-	-	-	-
Stage 2	175	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	720	962	-	0	1507	-
Stage 1	930	-	-	0	-	-
Stage 2	860	-	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	690	962	-	-	1507	-
Mov Cap-2 Maneuver	690	-	-	-	-	-
Stage 1	892	-	-	-	-	-
Stage 2	860	-	-	-	-	-

Approach	NB	NE	SW
HCM Control Delay, s	9.8	0	3.9
HCM LOS	A		

Minor Lane/Major Mvmt	NET	NBLn1	NBLn2	SWL	SWT
Capacity (veh/h)	-	690	962	1507	-
HCM Lane V/C Ratio	-	0.03	0.011	0.04	-
HCM Control Delay (s)	-	10.4	8.8	7.5	0
HCM Lane LOS	-	B	A	A	A
HCM 95th %tile Q(veh)	-	0.1	0	0.1	-

HCM 6th TWSC
3: SR 29 & Driveway/Rutherford Rd 09/23/2019

Intersection	
Int Delay, s/veh	73.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	1	17	98	0	75	4	817	131	70	1077	8
Future Vol, veh/h	4	1	17	98	0	75	4	817	131	70	1077	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	100	-	130	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	2	1	0	0	1	2	0	1	0
Mvmt Flow	4	1	18	105	0	81	4	878	141	75	1158	9

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2310	2340	1163	2208	2203	878	1167	0	0	1019	0	0
Stage 1	1313	1313	-	886	886	-	-	-	-	-	-	-
Stage 2	997	1027	-	1322	1317	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.12	6.51	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.12	5.51	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.12	5.51	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.518	4.009	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	27	37	239	~ 32	45	350	606	-	-	689	-	-
Stage 1	197	230	-	339	364	-	-	-	-	-	-	-
Stage 2	297	314	-	193	228	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	19	33	239	~ 26	40	350	606	-	-	689	-	-
Mov Cap-2 Maneuver	19	33	-	~ 26	40	-	-	-	-	-	-	-
Stage 1	196	205	-	337	361	-	-	-	-	-	-	-
Stage 2	227	312	-	158	203	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	79.2	$ 960.5	0	0.7
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	606	-	-	71	26	350	689	-	-
HCM Lane V/C Ratio	0.007	-	-	0.333	4.053	0.23	0.109	-	-
HCM Control Delay (s)	11	-	-	79.2	$ 1681.5	18.3	10.9	-	-
HCM Lane LOS	B	-	-	F	F	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	1.2	13	0.9	0.4	-	-

Notes
~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Int Delay, s/veh	30.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	599	74	37	689	11	85	9	85	4	0	17
Future Vol, veh/h	9	599	74	37	689	11	85	9	85	4	0	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	70	-	-	155	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	10	651	80	40	749	12	92	10	92	4	0	18

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	761	0	0	731	0	0	1555	1552	691	1597	1586	755
Stage 1	-	-	-	-	-	-	711	711	-	835	835	-
Stage 2	-	-	-	-	-	-	844	841	-	762	751	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	860	-	-	883	-	-	93	115	448	87	109	412
Stage 1	-	-	-	-	-	-	427	439	-	365	386	-
Stage 2	-	-	-	-	-	-	361	383	-	400	421	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	860	-	-	883	-	-	~ 85	109	448	62	103	412
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 85	109	-	62	103	-
Stage 1	-	-	-	-	-	-	422	434	-	361	369	-
Stage 2	-	-	-	-	-	-	329	366	-	307	416	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.5	268.2	25.4
HCM LOS			F	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	141	860	-	-	883	-	-	199
HCM Lane V/C Ratio	1.38	0.011	-	-	0.046	-	-	0.115
HCM Control Delay (s)	268.2	9.2	-	-	9.3	-	-	25.4
HCM Lane LOS	F	A	-	-	A	-	-	D
HCM 95th %tile Q(veh)	12.5	0	-	-	0.1	-	-	0.4

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	26.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	599	74	37	689	11	85	9	85	4	0	17
Future Vol, veh/h	9	599	74	37	689	11	85	9	85	4	0	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	70	-	50	155	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	10	651	80	40	749	12	92	10	92	4	0	18

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	761	0	0	731	0	0	1515	1512	651	1597	1586	755
Stage 1	-	-	-	-	-	-	671	671	-	835	835	-
Stage 2	-	-	-	-	-	-	844	841	-	762	751	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	860	-	-	883	-	-	99	121	472	87	109	412
Stage 1	-	-	-	-	-	-	449	458	-	365	386	-
Stage 2	-	-	-	-	-	-	361	383	-	400	421	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	860	-	-	883	-	-	~ 90	114	472	63	103	412
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 90	114	-	63	103	-
Stage 1	-	-	-	-	-	-	444	453	-	361	369	-
Stage 2	-	-	-	-	-	-	329	366	-	311	416	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.5	235.6	25.3
HCM LOS			F	D

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	149	860	-	-	883	-	-	200
HCM Lane V/C Ratio	1.306	0.011	-	-	0.046	-	-	0.114
HCM Control Delay (s)	235.6	9.2	-	-	9.3	-	-	25.3
HCM Lane LOS	F	A	-	-	A	-	-	D
HCM 95th %tile Q(veh)	11.9	0	-	-	0.1	-	-	0.4

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	1.3

Movement	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	19	13	164	68	13	111
Future Vol, veh/h	19	13	164	68	13	111
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	Free	-	None
Storage Length	100	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	2	0	0	2
Mvmt Flow	21	14	178	74	14	121

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	327	178	0	-	178	0
Stage 1	178	-	-	-	-	-
Stage 2	149	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	671	870	-	0	1410	-
Stage 1	858	-	-	0	-	-
Stage 2	884	-	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	664	870	-	-	1410	-
Mov Cap-2 Maneuver	664	-	-	-	-	-
Stage 1	849	-	-	-	-	-
Stage 2	884	-	-	-	-	-

Approach	NB	NE	SW
HCM Control Delay, s	10	0	0.8
HCM LOS	B		

Minor Lane/Major Mvmt	NET	NBLn1	NBLn2	SWL	SWT
Capacity (veh/h)	-	664	870	1410	-
HCM Lane V/C Ratio	-	0.031	0.016	0.01	-
HCM Control Delay (s)	-	10.6	9.2	7.6	0
HCM Lane LOS	-	B	A	A	A
HCM 95th %tile Q(veh)	-	0.1	0.1	0	-

Intersection	
Int Delay, s/veh	46.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	3	16	71	2	110	13	965	153	83	1012	13
Future Vol, veh/h	3	3	16	71	2	110	13	965	153	83	1012	13
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	100	-	130	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	0	0	0	0	0	0	0	1	1	0	1	0
Mvmt Flow	3	3	17	74	2	115	14	1005	159	86	1054	14

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2404	2425	1061	2276	2273	1005	1068	0	0	1164	0	0
Stage 1	1233	1233	-	1033	1033	-	-	-	-	-	-	-
Stage 2	1171	1192	-	1243	1240	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	23	33	274	~ 29	41	296	660	-	-	607	-	-
Stage 1	219	251	-	283	312	-	-	-	-	-	-	-
Stage 2	237	263	-	216	249	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	12	28	274	~ 22	34	296	660	-	-	607	-	-
Mov Cap-2 Maneuver	12	28	-	~ 22	34	-	-	-	-	-	-	-
Stage 1	214	215	-	277	305	-	-	-	-	-	-	-
Stage 2	141	257	-	172	214	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	117	$ 601.1	0.1	0.9
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	660	-	-	53	22	296	607	-	-
HCM Lane V/C Ratio	0.021	-	-	0.432	3.456	0.387	0.142	-	-
HCM Control Delay (s)	10.6	-	-	113	$ 469.7	24.6	11.9	-	-
HCM Lane LOS	B	-	-	F	F	C	B	-	-
HCM 95th %tile Q(veh)	0.1	-	-	1.6	9.7	1.8	0.5	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	93.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	1467	63	51	590	4	78	0	81	16	2	9
Future Vol, veh/h	6	1467	63	51	590	4	78	0	81	16	2	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	70	-	-	155	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	6	1467	63	51	590	4	78	0	81	16	2	9

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	594	0	0	1530	0	0	2211	2207	1499	2245	2236	592
Stage 1	-	-	-	-	-	-	1511	1511	-	694	694	-
Stage 2	-	-	-	-	-	-	700	696	-	1551	1542	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	992	-	-	441	-	-	~ 32	45	152	30	43	510
Stage 1	-	-	-	-	-	-	152	185	-	436	447	-
Stage 2	-	-	-	-	-	-	433	446	-	144	178	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	992	-	-	441	-	-	~ 27	40	152	~ 13	38	510
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 27	40	-	~ 13	38	-
Stage 1	-	-	-	-	-	-	151	184	-	433	395	-
Stage 2	-	-	-	-	-	-	374	394	-	67	177	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1.1	$ 1289.6	$ 562.1
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	46	992	-	-	441	-	-	21
HCM Lane V/C Ratio	3.457	0.006	-	-	0.116	-	-	1.286
HCM Control Delay (s)	$ 1289.6	8.7	-	-	14.2	-	-	$ 562.1
HCM Lane LOS	F	A	-	-	B	-	-	F
HCM 95th %tile Q(veh)	17.5	0	-	-	0.4	-	-	3.6

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	84.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	1467	63	51	590	4	78	0	81	16	2	9
Future Vol, veh/h	6	1467	63	51	590	4	78	0	81	16	2	9
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	70	-	50	155	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	6	1467	63	51	590	4	78	0	81	16	2	9

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	594	0	0	1530	0	0	2179	2175	1467	2245	2236	592
Stage 1	-	-	-	-	-	-	1479	1479	-	694	694	-
Stage 2	-	-	-	-	-	-	700	696	-	1551	1542	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	992	-	-	441	-	-	~ 34	47	159	30	43	510
Stage 1	-	-	-	-	-	-	158	191	-	436	447	-
Stage 2	-	-	-	-	-	-	433	446	-	144	178	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	992	-	-	441	-	-	~ 29	41	159	~ 13	38	510
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 29	41	-	~ 13	38	-
Stage 1	-	-	-	-	-	-	157	190	-	433	395	-
Stage 2	-	-	-	-	-	-	374	394	-	70	177	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	1.1	$ 1153.7	$ 562.1
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	50	992	-	-	441	-	-	21
HCM Lane V/C Ratio	3.18	0.006	-	-	0.116	-	-	1.286
HCM Control Delay (s)	$ 1153.7	8.7	-	-	14.2	-	-	$ 562.1
HCM Lane LOS	F	A	-	-	B	-	-	F
HCM 95th %tile Q(veh)	17.1	0	-	-	0.4	-	-	3.6

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

HCM 6th TWSC
2: Rutherford Rd & Conn Creek Rd 10/03/2019

Intersection	
Int Delay, s/veh	3.6

Movement	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	40	30	126	115	78	95
Future Vol, veh/h	40	30	126	115	78	95
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	Free	-	None
Storage Length	100	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	2	0	0	2
Mvmt Flow	40	30	126	115	78	95

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	377	126	0	-	126	0
Stage 1	126	-	-	-	-	-
Stage 2	251	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	629	930	-	0	1473	-
Stage 1	905	-	-	0	-	-
Stage 2	795	-	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	594	930	-	-	1473	-
Mov Cap-2 Maneuver	594	-	-	-	-	-
Stage 1	854	-	-	-	-	-
Stage 2	795	-	-	-	-	-

Approach	NB	NE	SW
HCM Control Delay, s	10.4	0	3.4
HCM LOS	B		

Minor Lane/Major Mvmt	NET	NBLn1	NBLn2	SWL	SWT
Capacity (veh/h)	-	594	930	1473	-
HCM Lane V/C Ratio	-	0.067	0.032	0.053	-
HCM Control Delay (s)	-	11.5	9	7.6	0
HCM Lane LOS	-	B	A	A	A
HCM 95th %tile Q(veh)	-	0.2	0.1	0.2	-

HCM 6th TWSC
3: SR 29 & Driveway/Rutherford Rd 09/24/2019

Intersection	
Int Delay, s/veh	276.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	2	20	160	0	127	5	962	183	92	1283	10
Future Vol, veh/h	6	2	20	160	0	127	5	962	183	92	1283	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	100	-	130	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	2	1	0	0	1	2	0	1	0
Mvmt Flow	6	2	20	160	0	127	5	962	183	92	1283	10

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2599	2627	1288	2455	2449	962	1293	0	0	1145	0	0
Stage 1	1472	1472	-	972	972	-	-	-	-	-	-	-
Stage 2	1127	1155	-	1483	1477	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.12	6.51	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.12	5.51	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.12	5.51	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.518	4.009	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	17	24	202	~ 21	31	313	543	-	-	618	-	-
Stage 1	160	193	-	304	332	-	-	-	-	-	-	-
Stage 2	251	274	-	~ 156	191	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	9	20	202	~ 15	26	313	543	-	-	618	-	-
Mov Cap-2 Maneuver	9	20	-	~ 15	26	-	-	-	-	-	-	-
Stage 1	159	164	-	301	329	-	-	-	-	-	-	-
Stage 2	148	272	-	~ 118	163	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	$ 301.7	$ 2711.9	0.1	0.8
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	543	-	-	32	15	313	618	-	-
HCM Lane V/C Ratio	0.009	-	-	0.875	10.667	0.406	0.149	-	-
HCM Control Delay (s)	11.7	-	-	$ 301.3	$ 4845.4	24.1	11.8	-	-
HCM Lane LOS	B	-	-	F	F	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	3	21	1.9	0.5	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

HCM 6th TWSC
16: Conn Creek Rd & Project Driveway 01/16/2020

Intersection						
Int Delay, s/veh	0.6					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	5	7	6	150	111	5
Future Vol, veh/h	5	7	6	150	111	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	8	7	163	121	5

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	301	124	126	0	-	0
Stage 1	124	-	-	-	-	-
Stage 2	177	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	691	927	1460	-	-	-
Stage 1	902	-	-	-	-	-
Stage 2	854	-	-	-	-	-
Platoon blocked, %					-	-
Mov Cap-1 Maneuver	688	927	1460	-	-	-
Mov Cap-2 Maneuver	688	-	-	-	-	-
Stage 1	897	-	-	-	-	-
Stage 2	854	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.5	0.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1460	-	810	-	-
HCM Lane V/C Ratio	0.004	-	0.016	-	-
HCM Control Delay (s)	7.5	-	9.5	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

HCM 2010 TWSC
1: Conn Creek Rd/Driveway & Silverado Trail 10/03/2019

Intersection												
Int Delay, s/veh	144.1											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	986	105	84	765	12	110	10	114	16	1	18
Future Vol, veh/h	18	986	105	84	765	12	110	10	114	16	1	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	70	-	-	155	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	18	986	105	84	765	12	110	10	114	16	1	18

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	777	0	0	1091	0	0	2024	2020	1039	2076	2066	771
Stage 1	-	-	-	-	-	-	1075	1075	-	939	939	-
Stage 2	-	-	-	-	-	-	949	945	-	1137	1127	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	848	-	-	647	-	-	~ 43	59	283	40	55	403
Stage 1	-	-	-	-	-	-	268	298	-	320	345	-
Stage 2	-	-	-	-	-	-	315	343	-	248	282	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	848	-	-	647	-	-	~ 36	50	283	18	47	403
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 36	50	-	18	47	-
Stage 1	-	-	-	-	-	-	262	292	-	313	300	-
Stage 2	-	-	-	-	-	-	261	298	-	140	276	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	1.1	$ 1329.5	294
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	64	848	-	-	647	-	-	37
HCM Lane V/C Ratio	3.656	0.021	-	-	0.13	-	-	0.946
HCM Control Delay (s)	$ 1329.5	9.3	-	-	11.4	-	-	294
HCM Lane LOS	F	A	-	-	B	-	-	F
HCM 95th %tile Q(veh)	24.8	0.1	-	-	0.4	-	-	3.5

Notes
~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Int Delay, s/veh	130.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	986	105	84	765	12	110	10	114	16	1	18
Future Vol, veh/h	18	986	105	84	765	12	110	10	114	16	1	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	70	-	50	155	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	18	986	105	84	765	12	110	10	114	16	1	18

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	777	0	0	1091	0	0	1971	1967	986	2076	2066	771
Stage 1	-	-	-	-	-	-	1022	1022	-	939	939	-
Stage 2	-	-	-	-	-	-	949	945	-	1137	1127	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	848	-	-	647	-	-	~ 47	64	303	40	55	403
Stage 1	-	-	-	-	-	-	287	316	-	320	345	-
Stage 2	-	-	-	-	-	-	315	343	-	248	282	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	848	-	-	647	-	-	~ 39	55	303	19	47	403
Mov Cap-2 Maneuver	-	-	-	-	-	-	~ 39	55	-	19	47	-
Stage 1	-	-	-	-	-	-	281	309	-	313	300	-
Stage 2	-	-	-	-	-	-	261	298	-	147	276	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	1.1	$ 1202.8	268.7
HCM LOS			F	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	69	848	-	-	647	-	-	39
HCM Lane V/C Ratio	3.391	0.021	-	-	0.13	-	-	0.897
HCM Control Delay (s)	$ 1202.8	9.3	-	-	11.4	-	-	268.7
HCM Lane LOS	F	A	-	-	B	-	-	F
HCM 95th %tile Q(veh)	24.2	0.1	-	-	0.4	-	-	3.4

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	2

Movement	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	22	42	235	73	48	184
Future Vol, veh/h	22	42	235	73	48	184
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	Free	-	None
Storage Length	100	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	2	0	0	2
Mvmt Flow	22	42	235	73	48	184

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	515	235	0	-	235	0
Stage 1	235	-	-	-	-	-
Stage 2	280	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	523	809	-	0	1344	-
Stage 1	809	-	-	0	-	-
Stage 2	772	-	-	0	-	-
Platoon blocked, %			-			-
Mov Cap-1 Maneuver	502	809	-	-	1344	-
Mov Cap-2 Maneuver	502	-	-	-	-	-
Stage 1	777	-	-	-	-	-
Stage 2	772	-	-	-	-	-

Approach	NB	NE	SW
HCM Control Delay, s	10.7	0	1.6
HCM LOS	B		

Minor Lane/Major Mvmt	NET	NBLn1	NBLn2	SWL	SWT
Capacity (veh/h)	-	502	809	1344	-
HCM Lane V/C Ratio	-	0.044	0.052	0.036	-
HCM Control Delay (s)	-	12.5	9.7	7.8	0
HCM Lane LOS	-	B	A	A	A
HCM 95th %tile Q(veh)	-	0.1	0.2	0.1	-

HCM 6th TWSC
3: SR 29 & Driveway/Rutherford Rd 09/24/2019

Intersection	
Int Delay, s/veh	362.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	4	19	140	2	184	15	1119	235	127	1190	16
Future Vol, veh/h	4	4	19	140	2	184	15	1119	235	127	1190	16
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	75	100	-	130	100	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	0	0	0	0	0	0	1	1	0	1	0
Mvmt Flow	4	4	19	140	2	184	15	1119	235	127	1190	16

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2812	2836	1198	2613	2609	1119	1206	0	0	1354	0	0
Stage 1	1452	1452	-	1149	1149	-	-	-	-	-	-	-
Stage 2	1360	1384	-	1464	1460	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	12	18	228	~ 16	25	254	586	-	-	515	-	-
Stage 1	164	197	-	244	275	-	-	-	-	-	-	-
Stage 2	185	213	-	161	196	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	~ 2	13	228	~ 9	18	254	586	-	-	515	-	-
Mov Cap-2 Maneuver	~ 2	13	-	~ 9	18	-	-	-	-	-	-	-
Stage 1	160	148	-	238	268	-	-	-	-	-	-	-
Stage 2	49	207	-	~ 108	148	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, $	1344.1	$ 3276.2	0.1	1.4
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	586	-	-	11	9	254	515	-	-
HCM Lane V/C Ratio	0.026	-	-	2.455	15.778	0.724	0.247	-	-
HCM Control Delay (s)	11.3	-	-	$ 1344.1	$ 7457.7	49.2	14.3	-	-
HCM Lane LOS	B	-	-	F	F	E	B	-	-
HCM 95th %tile Q(veh)	0.1	-	-	4.3	19.4	5	1	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

HCM 2010 TWSC
16: Conn Creek Rd & Project Driveway 01/16/2020

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	27	34	30	247	166	24
Future Vol, veh/h	27	34	30	247	166	24
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	100	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	29	37	33	268	180	26

Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	527	193	206	0	-	0
Stage 1	193	-	-	-	-	-
Stage 2	334	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	512	849	1365	-	-	-
Stage 1	840	-	-	-	-	-
Stage 2	725	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	500	849	1365	-	-	-
Mov Cap-2 Maneuver	500	-	-	-	-	-
Stage 1	820	-	-	-	-	-
Stage 2	725	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	11.2	0.8	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1365	-	649	-	-
HCM Lane V/C Ratio	0.024	-	0.102	-	-
HCM Control Delay (s)	7.7	-	11.2	-	-
HCM Lane LOS	A	-	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.3	-	-

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Appendix C

Napa County Significance Criteria

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County of Napa Significance Criteria

UNSIGNALIZED TWO-WAY STOP-CONTROLLED INTERSECTION CRITERIA

PM EXISTING

Int	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1	63	0	49	14	1	8	5	1054	49	18	541	4
3	4	817	128	67	1077	8	4	1	17	98	0	68

PM EXISTING PLUS PROJECT

Int	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1	63	0	54	14	1	8	5	1054	52	20	541	4
3	4	817	131	70	1077	8	4	1	17	98	0	75

	Minor Street Approaches	
	Int 1-NB	Int 3-WB
Project Volume Contribution	4%	4%
Ten Percent Threshold Exceeded?	**NO**	**NO**

WKND EXISTING

Int	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1	85	9	58	4	0	17	9	599	59	28	689	11
3	13	965	138	68	1012	13	3	3	16	71	2	76

WKND EXISTING PLUS PROJECT

Int	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1	85	9	85	4	0	17	9	599	74	37	689	11
3	13	965	153	83	1012	13	3	3	16	71	2	110

	Minor Street Approaches	
	Int 1-NB	Int 3-WB
Project Volume Contribution	15%	19%
Ten Percent Threshold Exceeded?	**YES**	**YES**

FUTURE CRITERIA

PM FUTURE

Int	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1	78	0	76	16	2	9	6	1467	60	49	590	4
3	5	962	180	89	1283	10	6	2	20	160	0	120

PM FUTURE PLUS PROJECT

Int	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1	78	0	81	16	2	9	6	1467	63	51	590	4
3	5	962	183	92	1283	10	6	2	20	160	0	127

	Int 1	Int 3
Project Volume Contribution	1.81%	2.37%
Five Percent Threshold Exceeded?	**NO**	**NO**

MD FUTURE

Int	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1	110	10	87	16	1	18	18	986	90	75	765	12
3	15	1119	220	112	1190	16	4	4	19	140	2	150

WKND FUTURE PLUS PROJECT

Int	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
1	110	10	114	16	1	18	18	986	105	84	765	12
3	15	1119	235	127	1190	16	4	4	19	140	2	184

	Int 1	Int 3
Project Volume Contribution	8.23%	10.47%
Five Percent Threshold Exceeded?	**YES**	**YES**

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Appendix D

Maximum TWSC Queue Calculations

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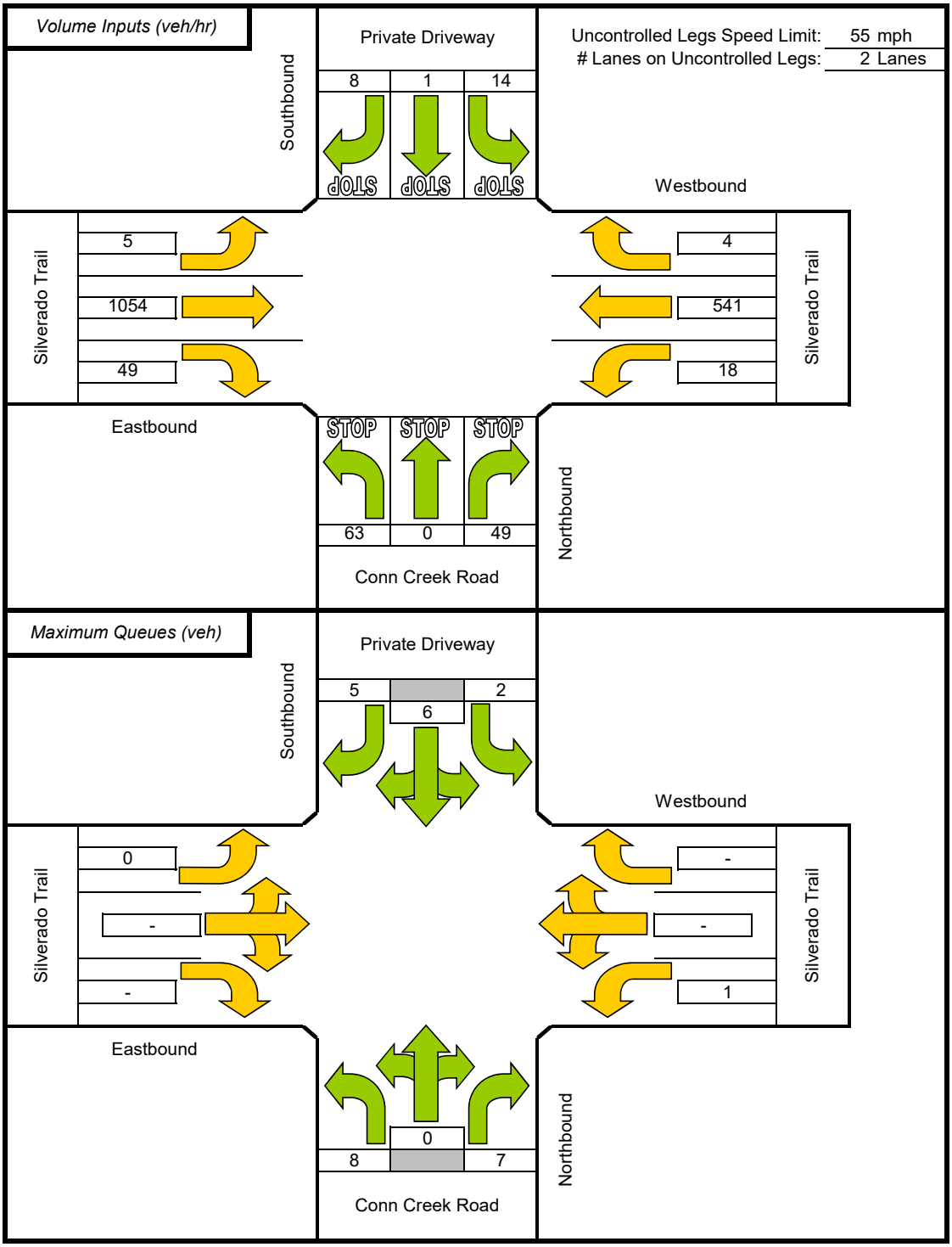
Maximum Queue Length
Two-Way Stop-Controlled Intersections

Through Street: Silverado Trail
Side Street: Conn Creek Road

Scenario: PM Existing
Stop Controlled Legs: North/South

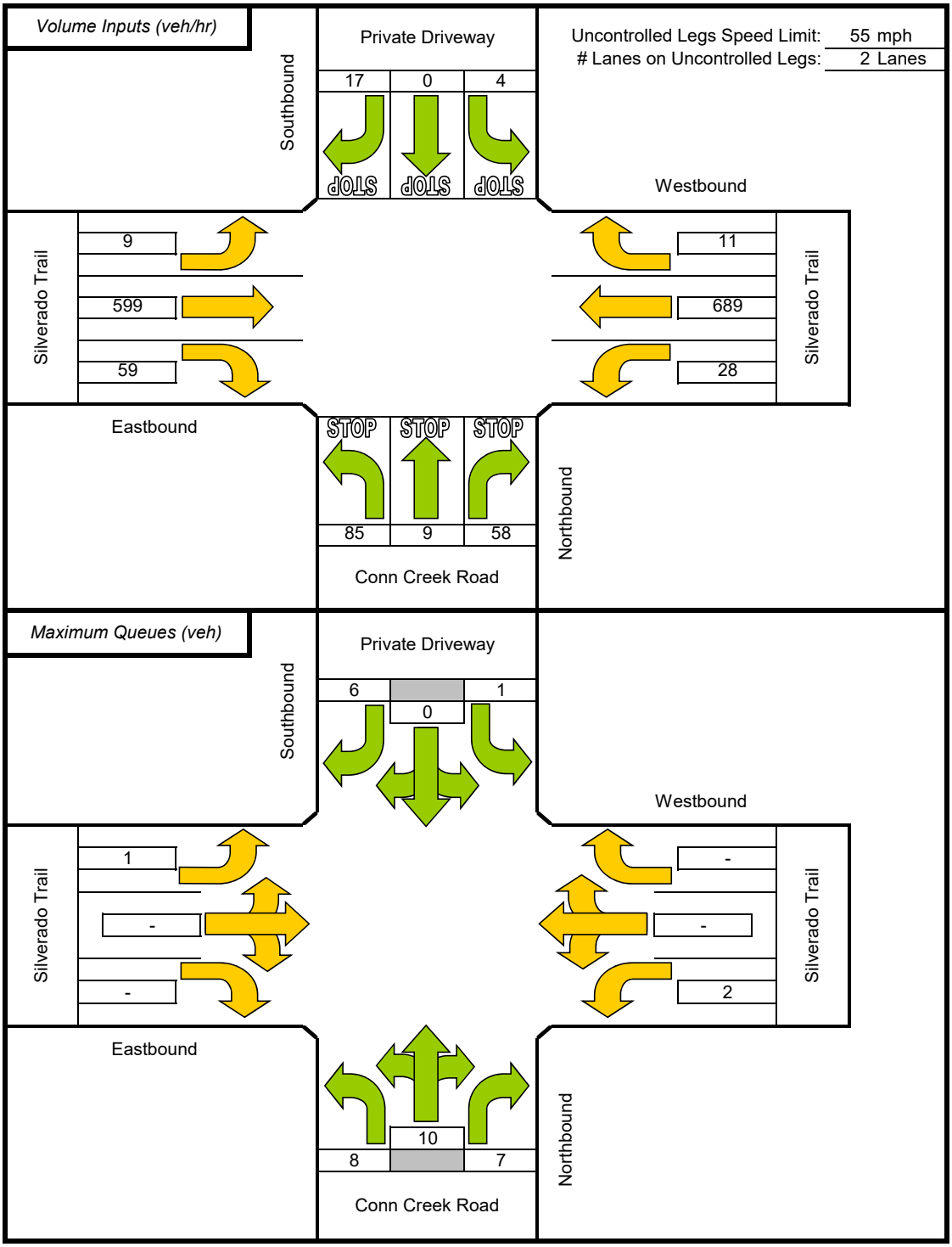


Source: John T. Gard, ITE Journal, November 2001, "Estimating Maximum Queue Length at Unsignalized Intersections"

Maximum Queue Length
Two-Way Stop-Controlled Intersections

Through Street: Silverado Trail
Side Street: Conn Creek Road

Scenario: Wknd Existing
Stop Controlled Legs: North/South



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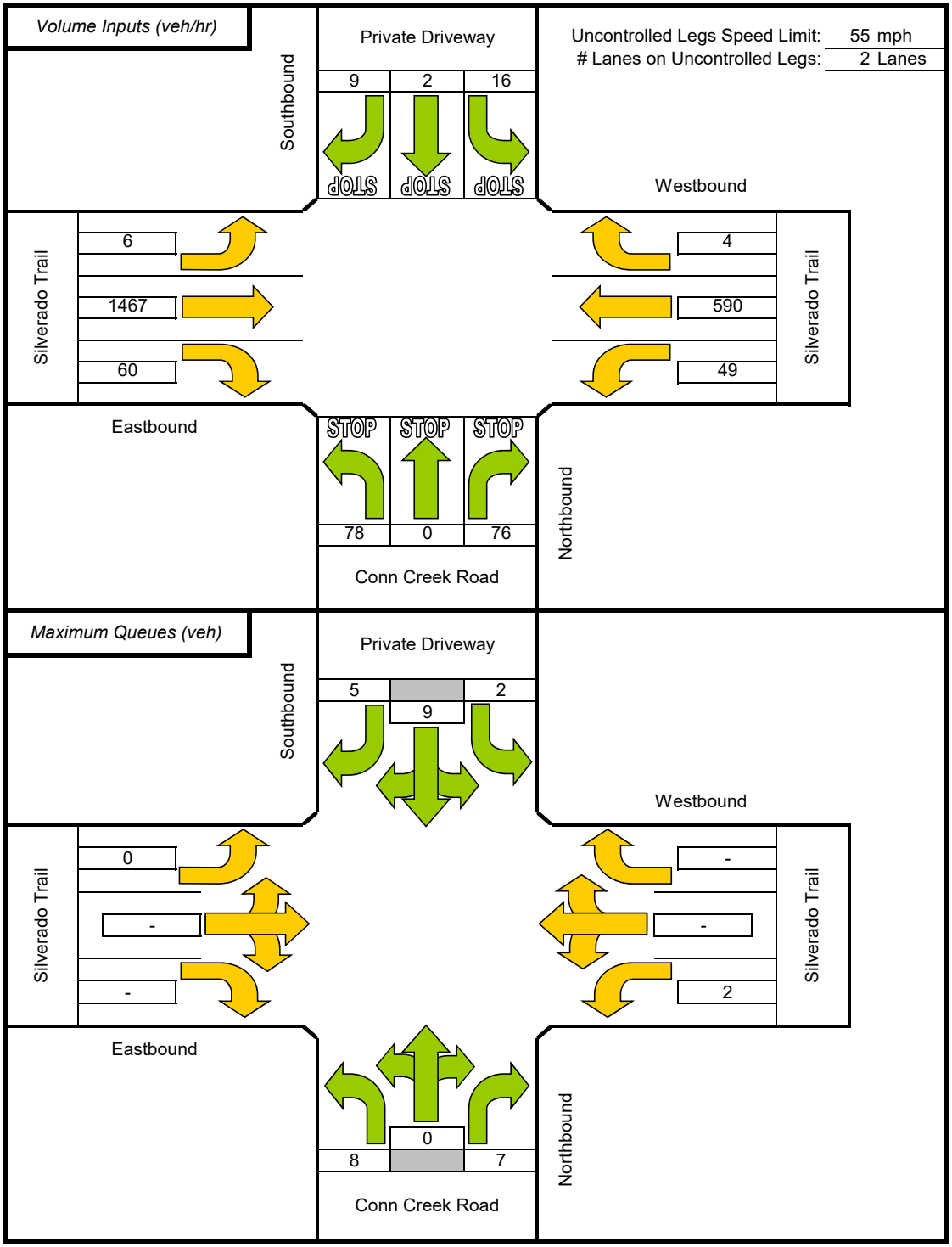
Maximum Queue Length
Two-Way Stop-Controlled Intersections

Through Street: Silverado Trail
Side Street: Conn Creek Road

Scenario: PM Future
Stop Controlled Legs: North/South



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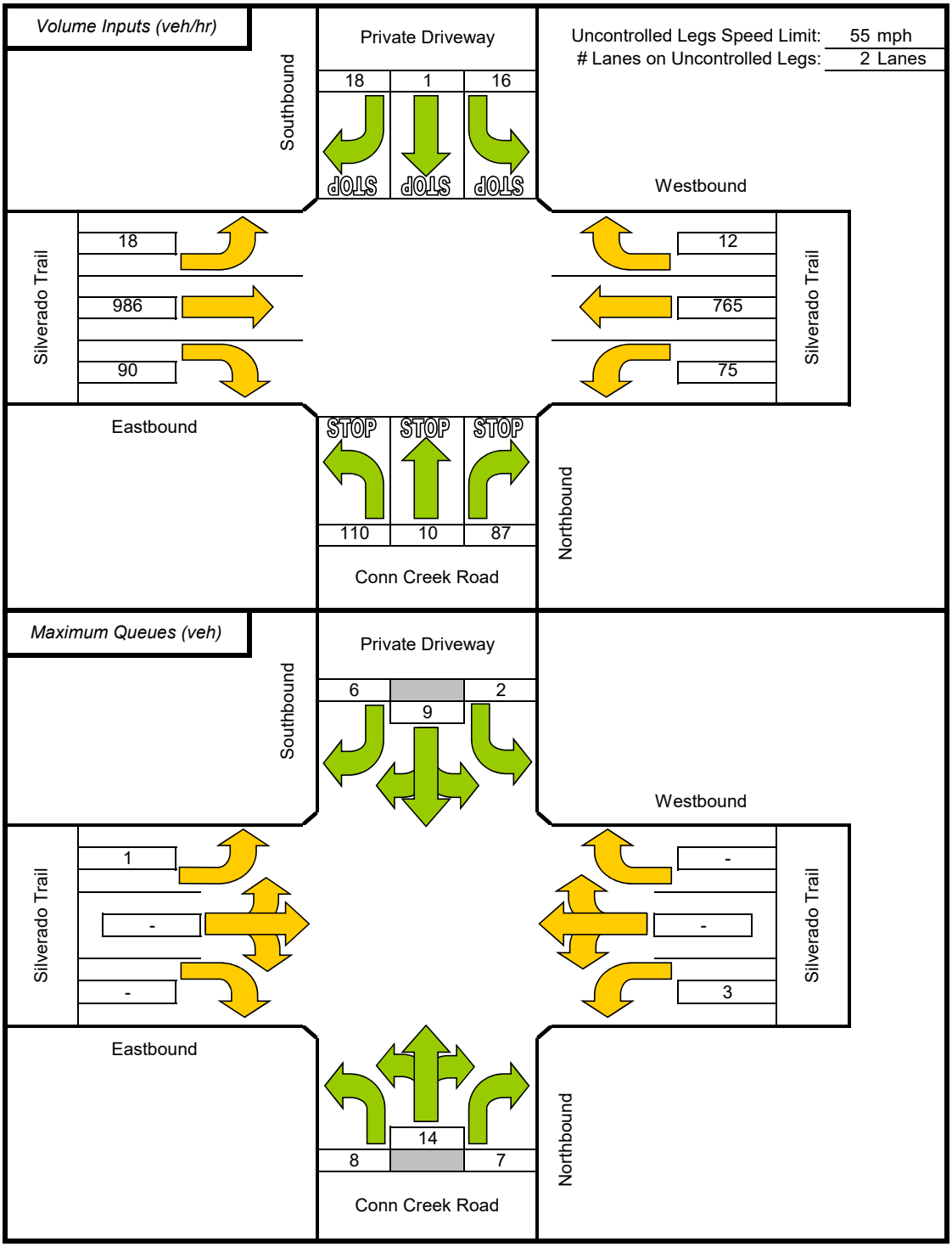
Through Street: Silverado Trail
Side Street: Conn Creek Road

Scenario: Wknd Future
Stop Controlled Legs: North/South



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Maximum Queue Length
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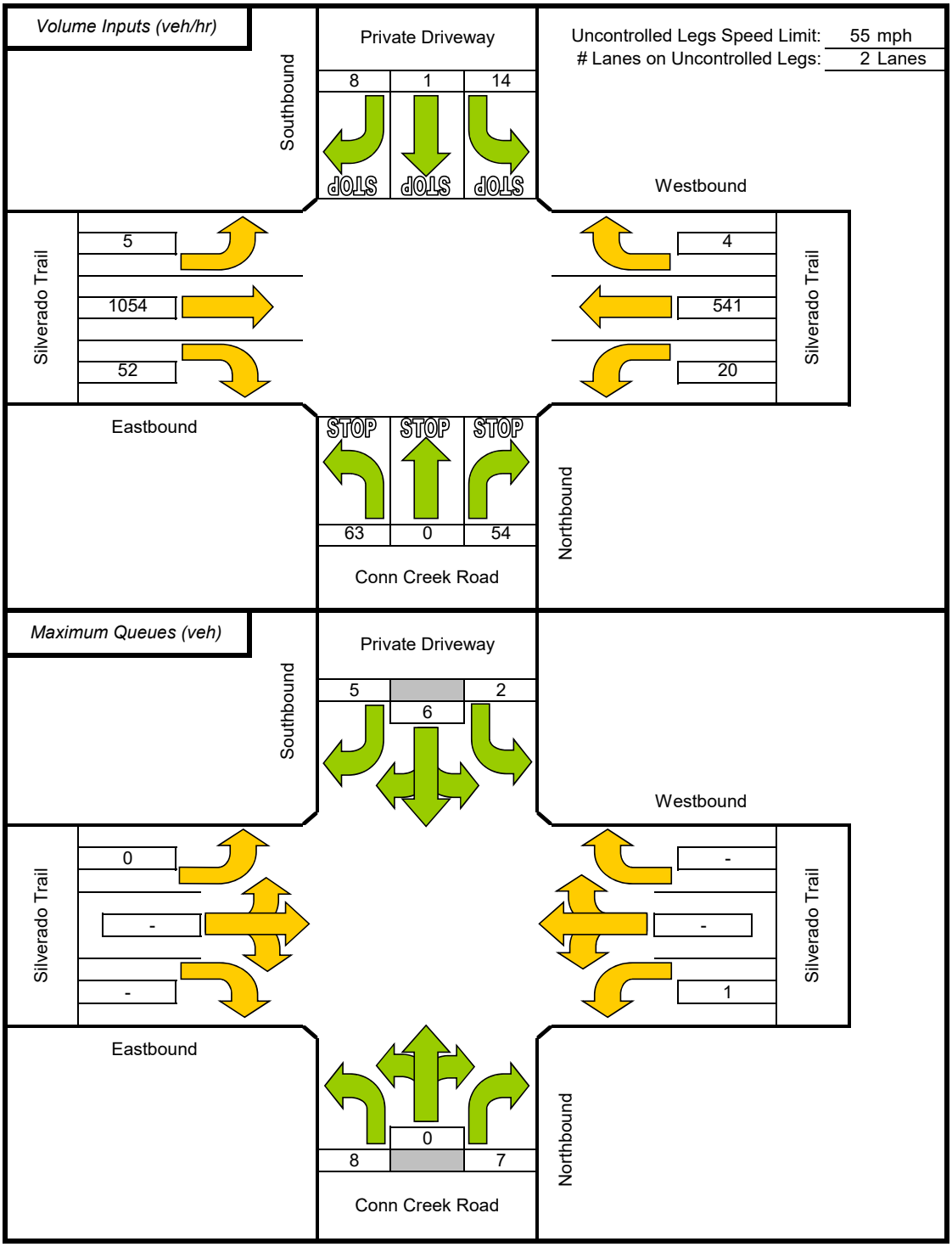
Through Street: Silverado Trail
Side Street: Conn Creek Road

Scenario: PM Existing plus Project
Stop Controlled Legs: North/South



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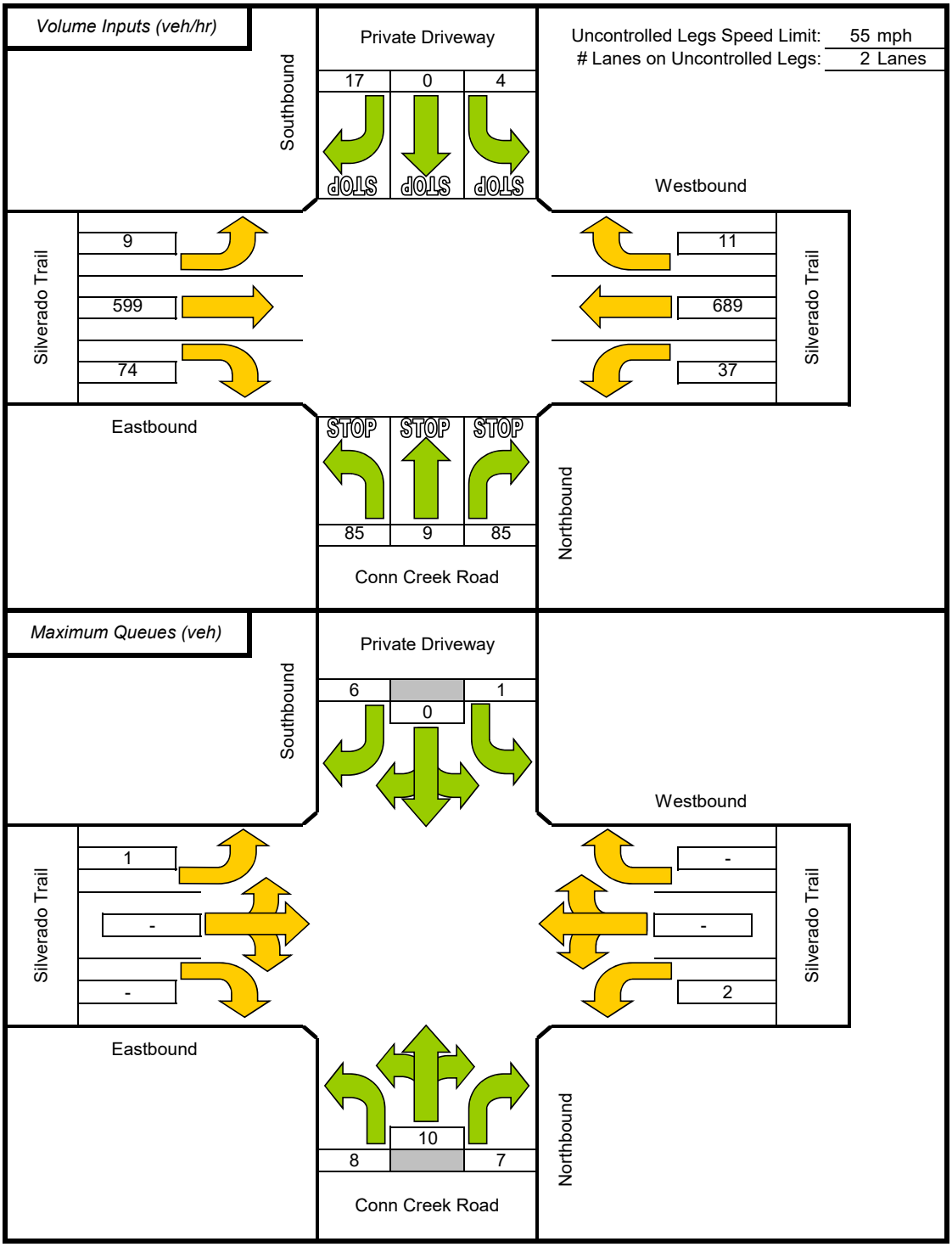

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Through Street: Silverado Trail
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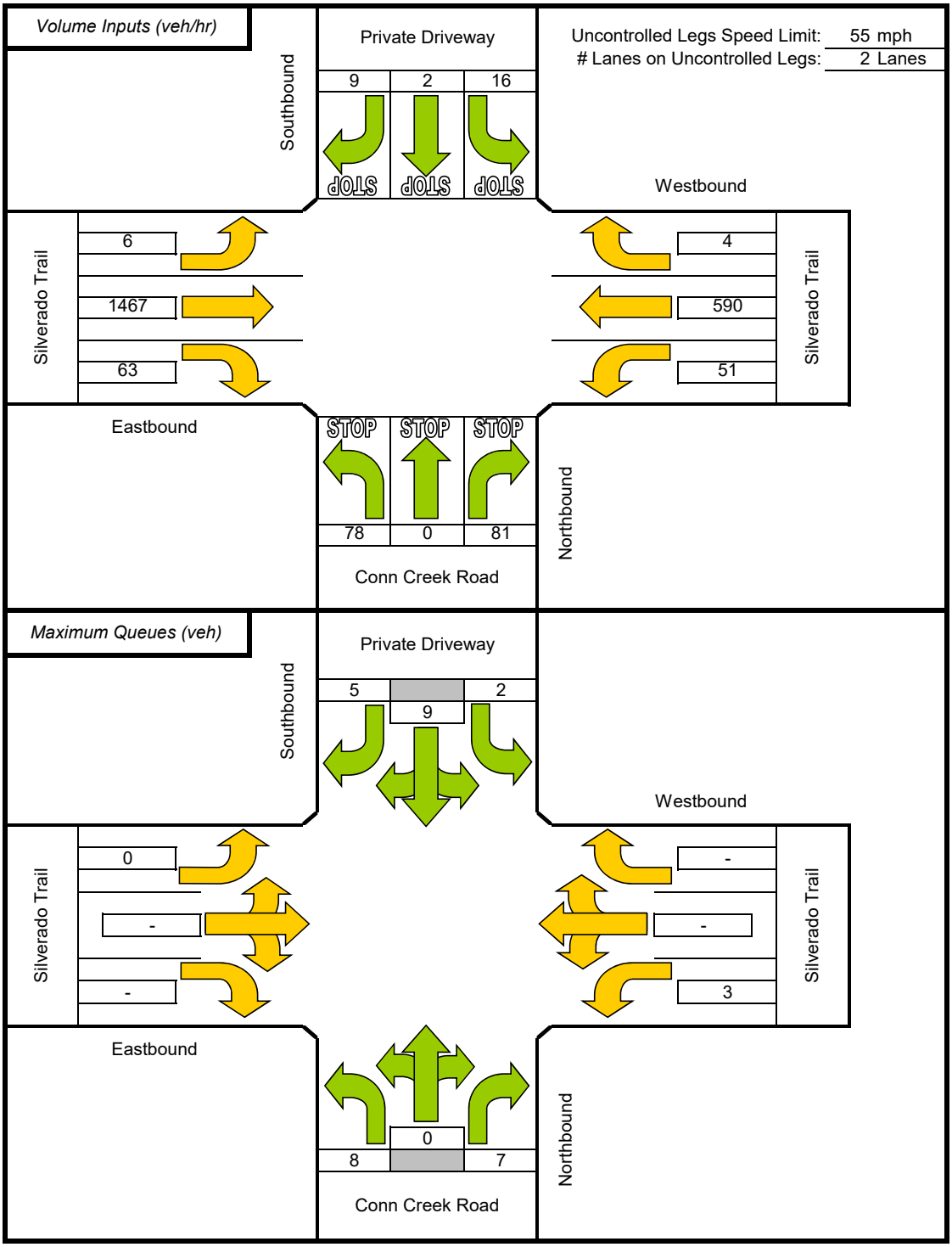

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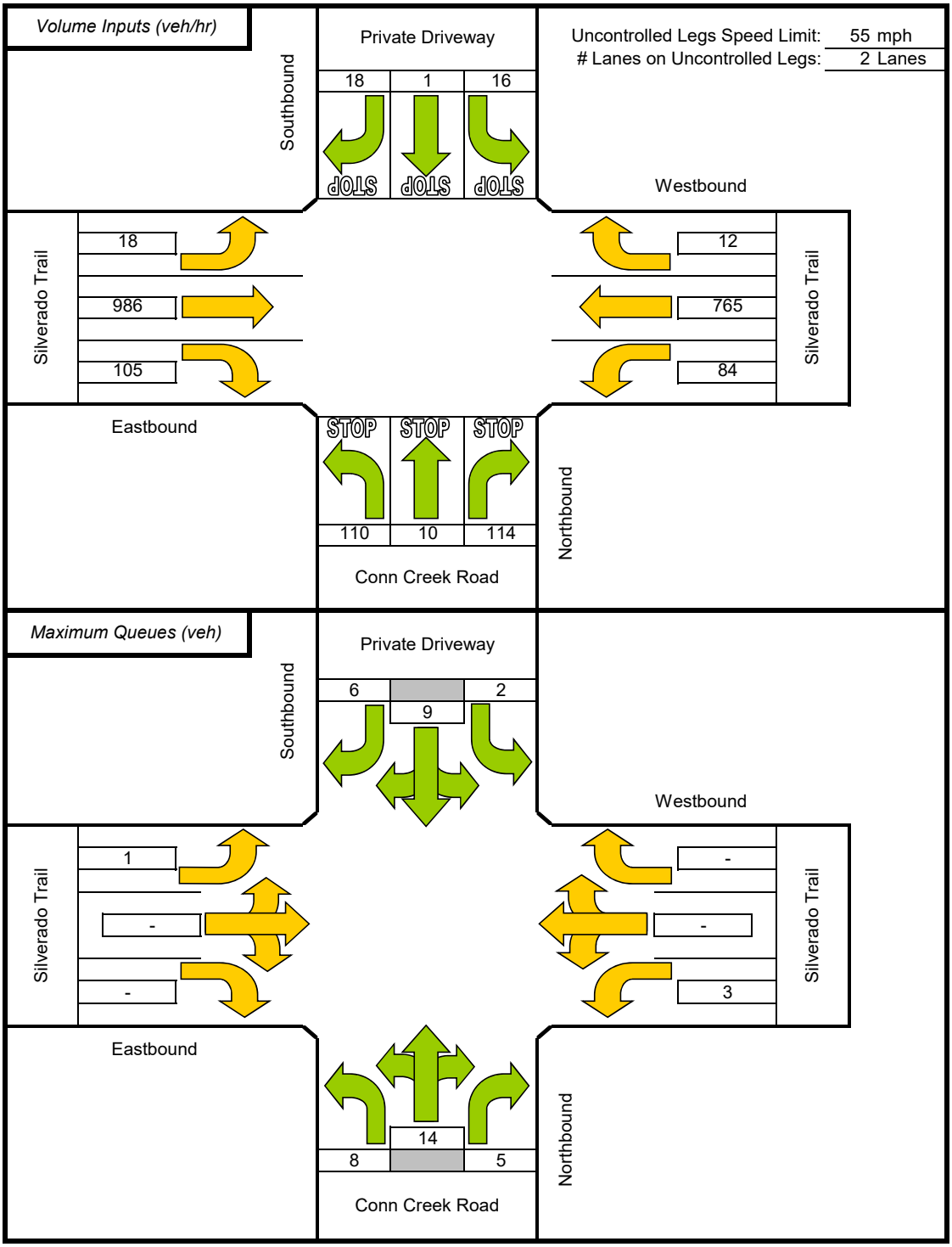
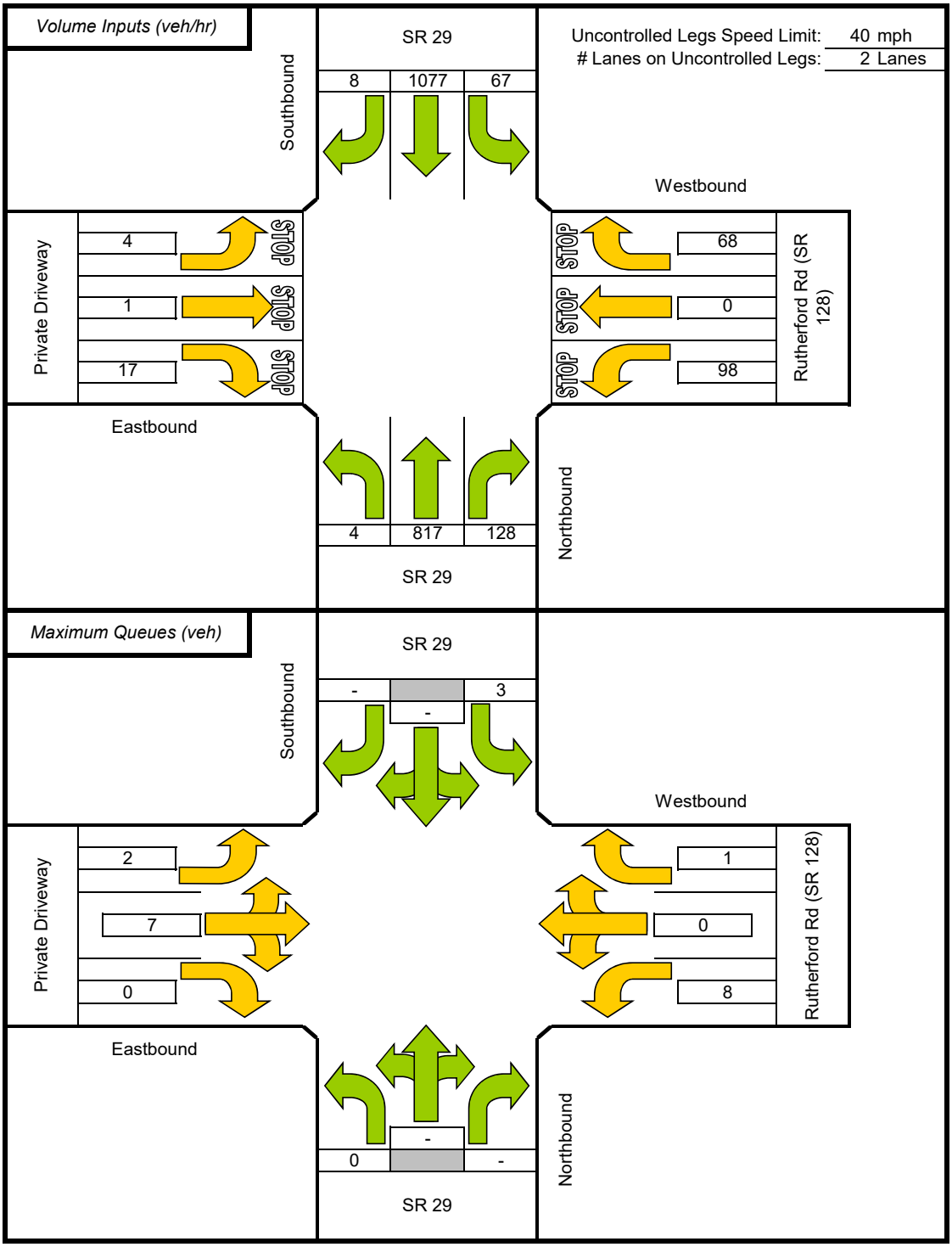


Source: John T. Gard, ITE Journal, November 2001, "Estimating Maximum Queue Length at Unsignalized Intersections"

Maximum Queue Length
Two-Way Stop-Controlled Intersections

Through Street: SR 29
Side Street: Rutherford Rd

Scenario: PM Existing
Stop Controlled Legs: East/West



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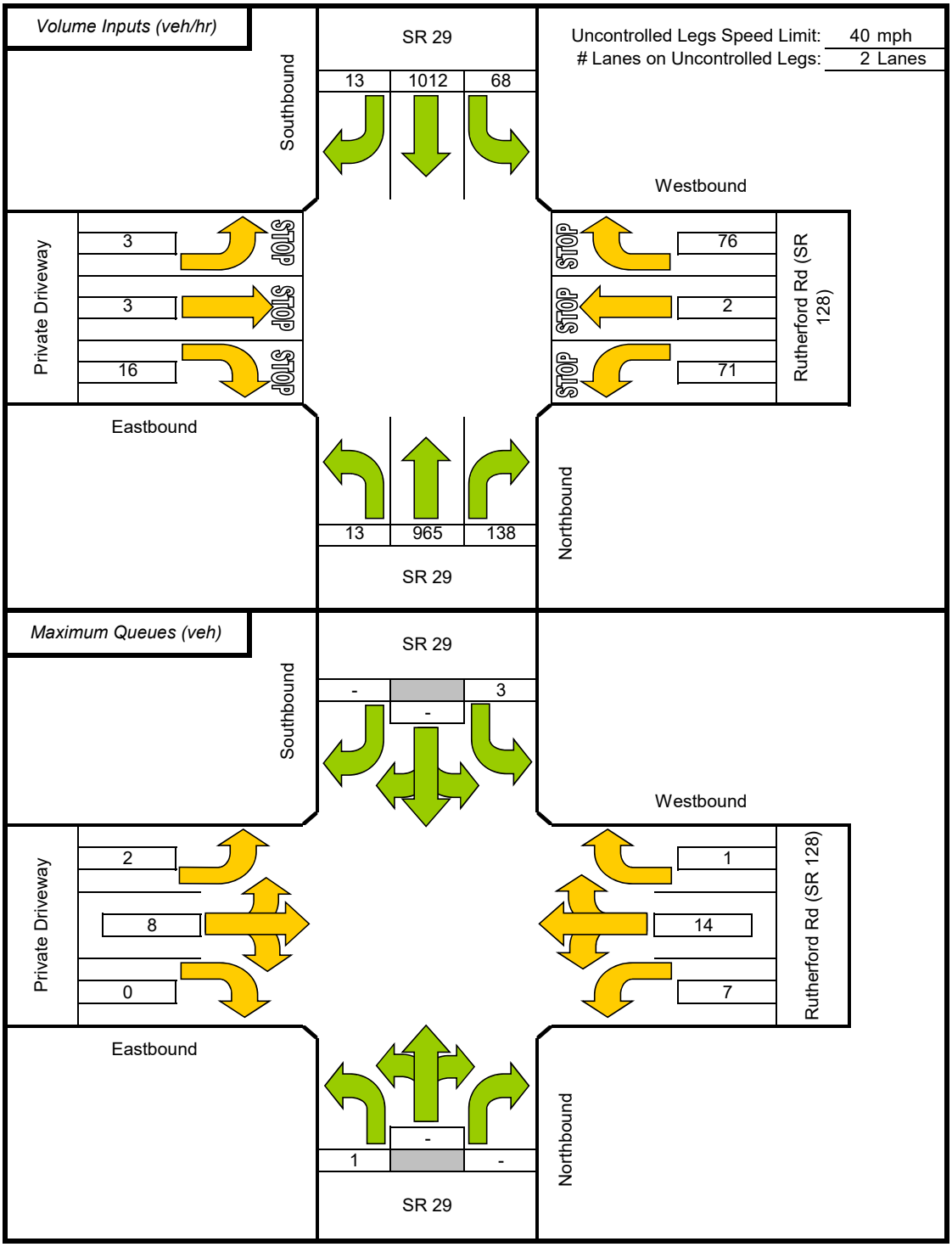

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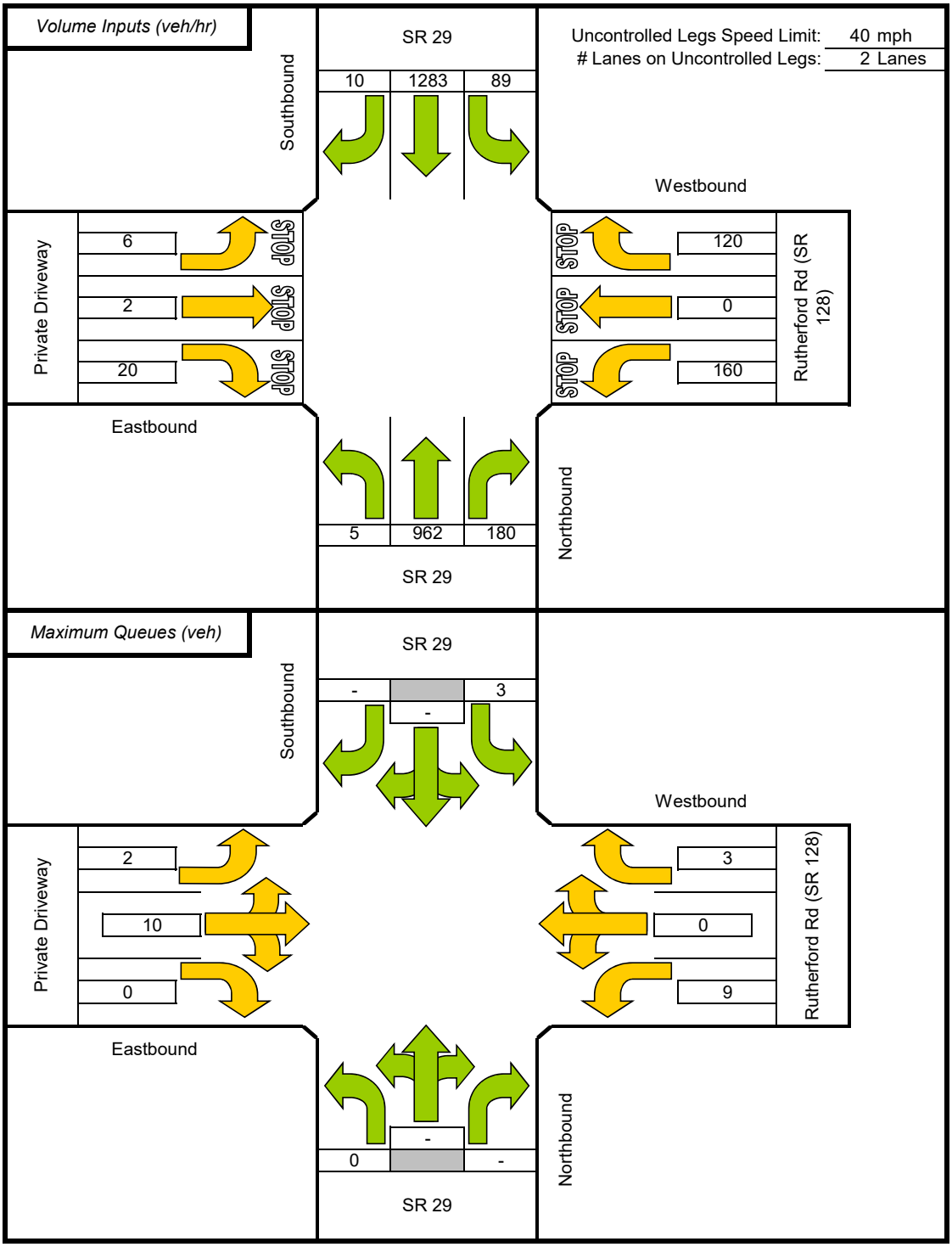
Scenario: PM Future
Stop Controlled Legs: East/West



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Scenario: Wknd Future
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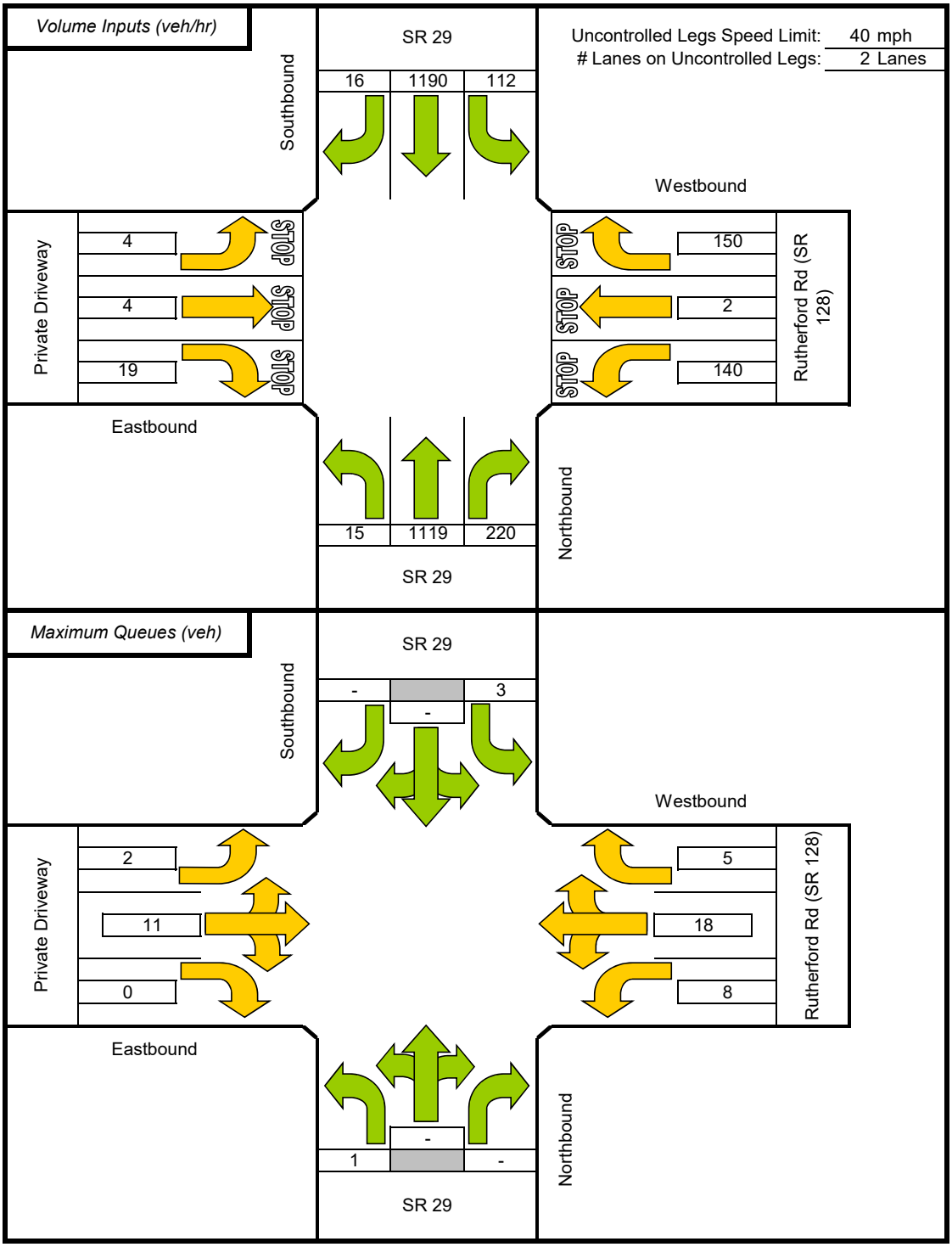

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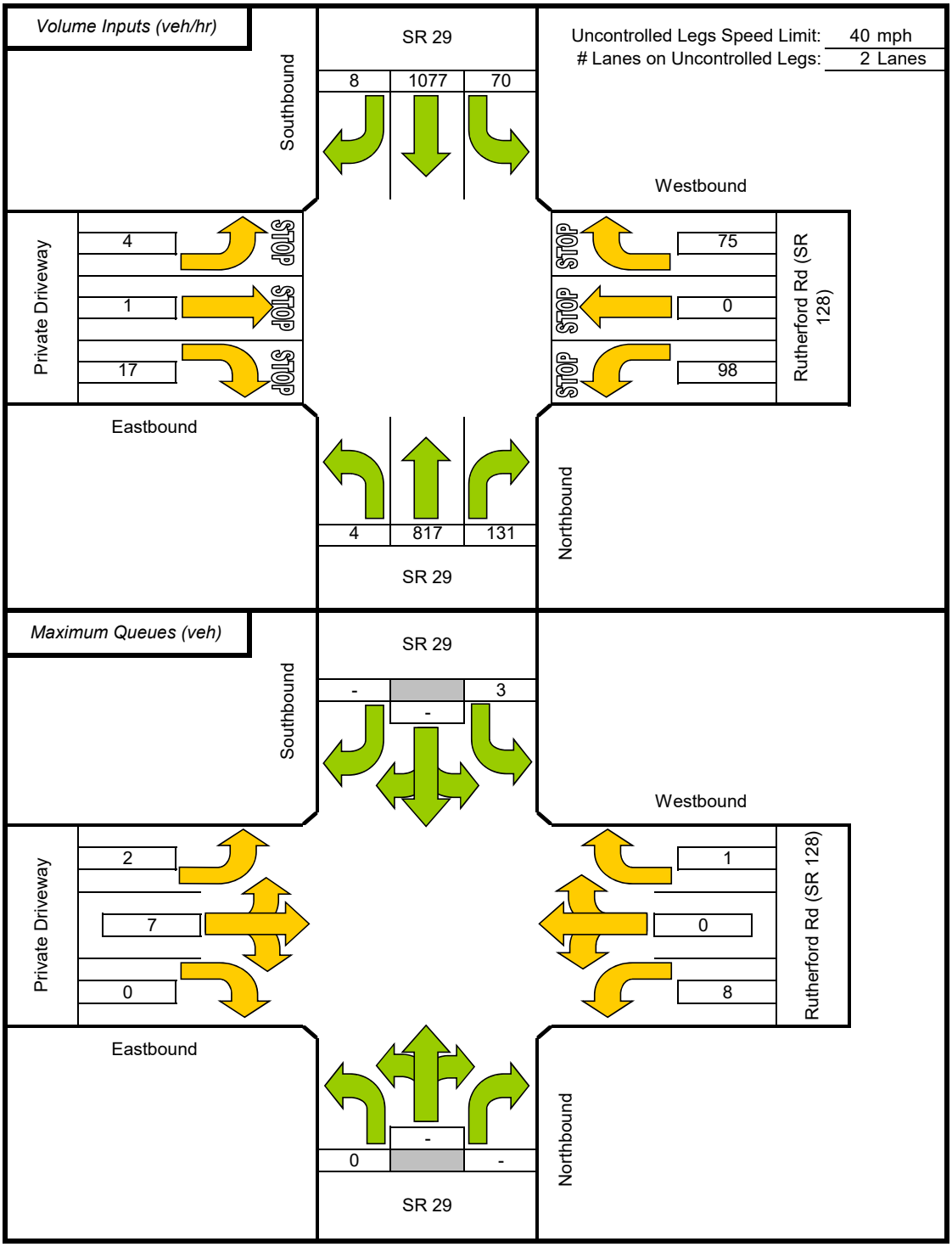
Stop Controlled Legs: East/West



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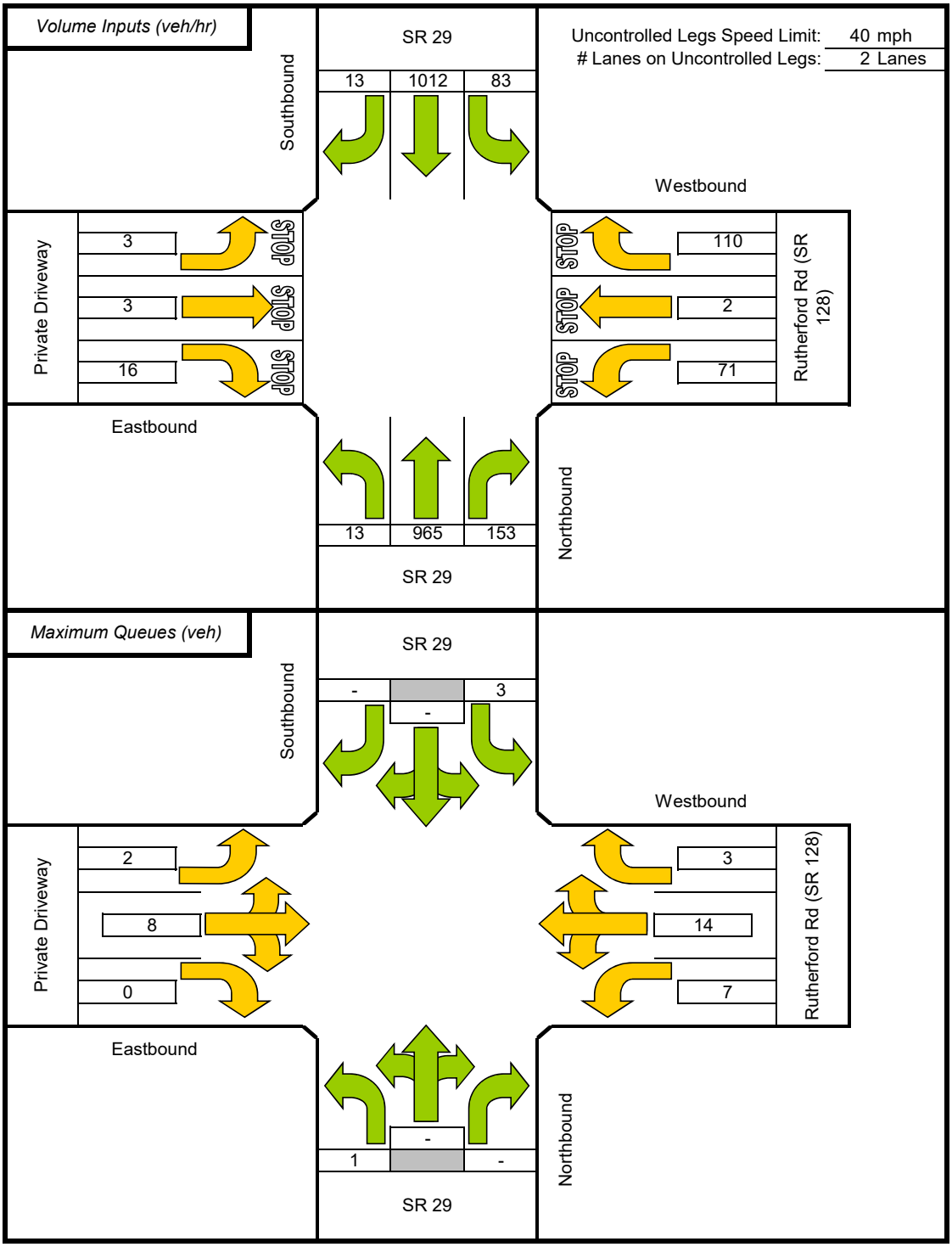

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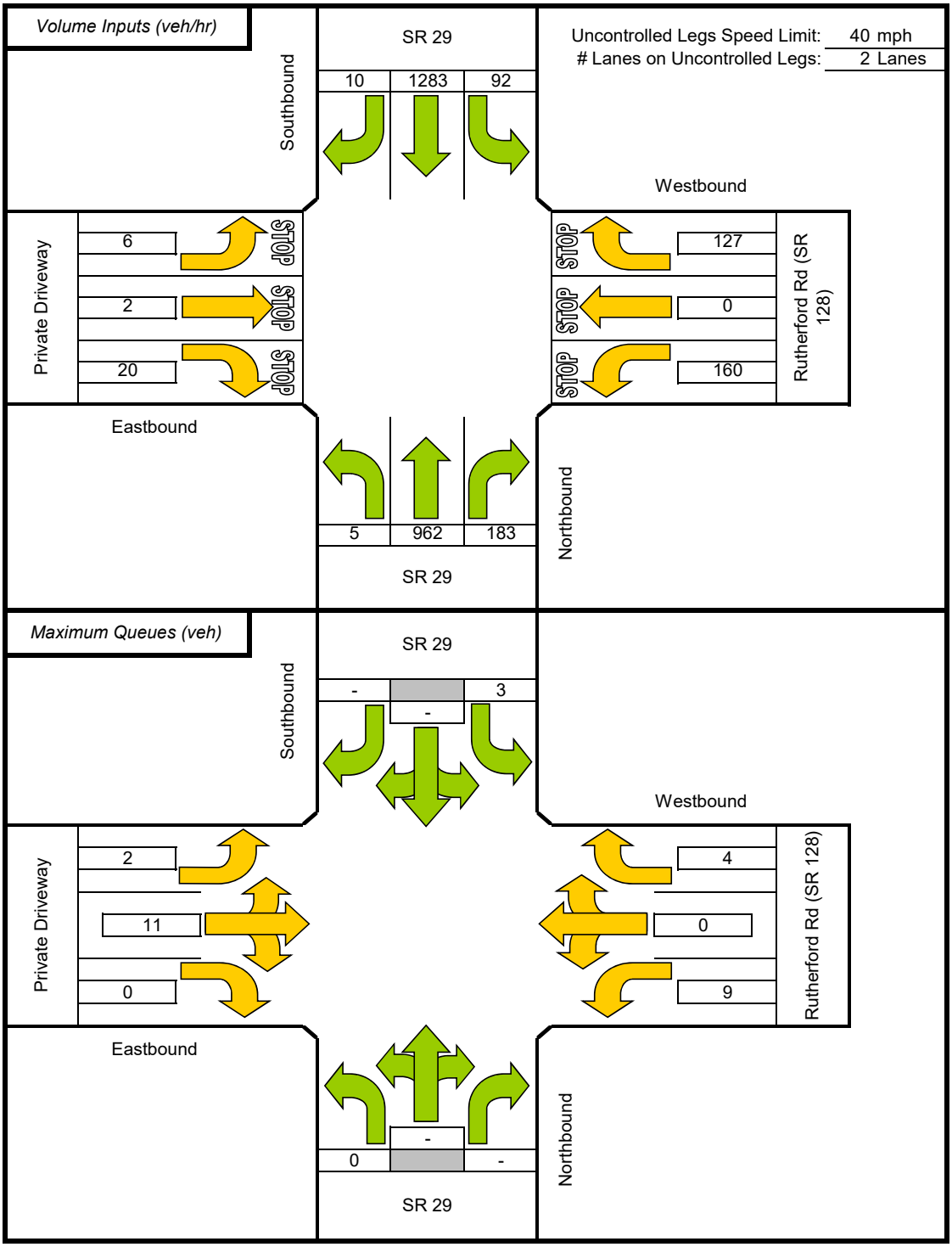

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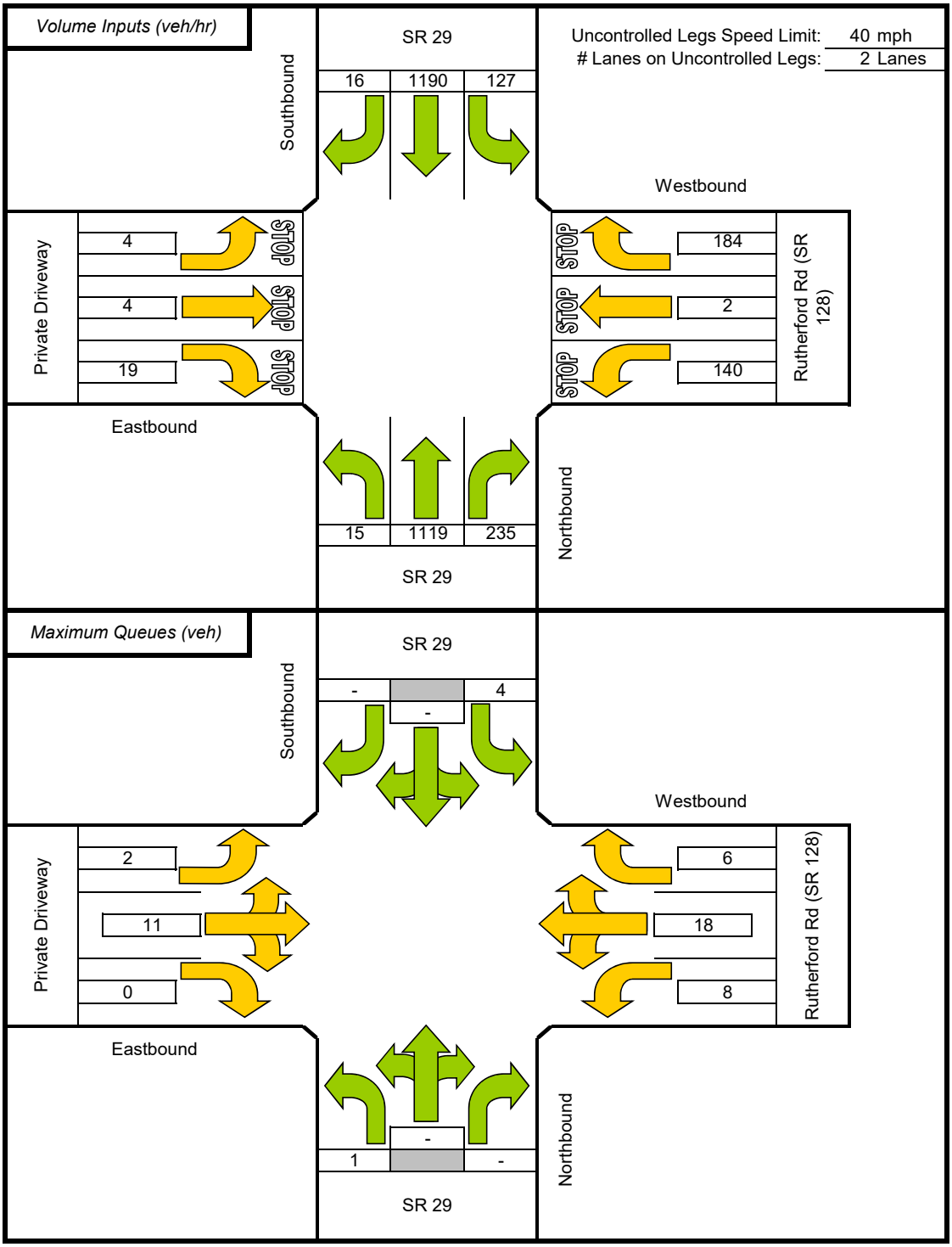

Source: John T. Gard, ITE Journal, November 2001, "Estimating Maximum Queue Length at Unsignalized Intersections"

Appendix E

On-site Circulation

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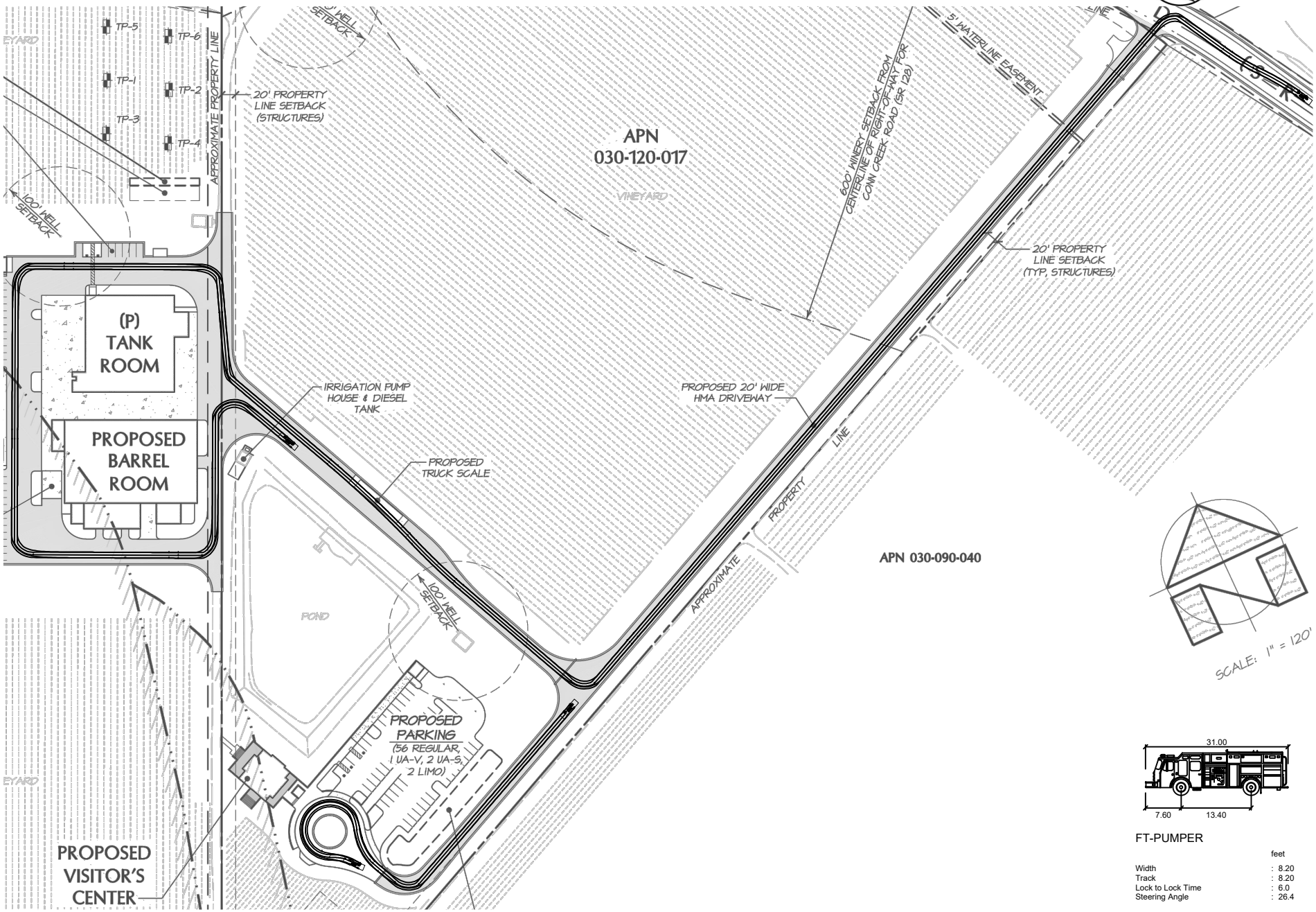
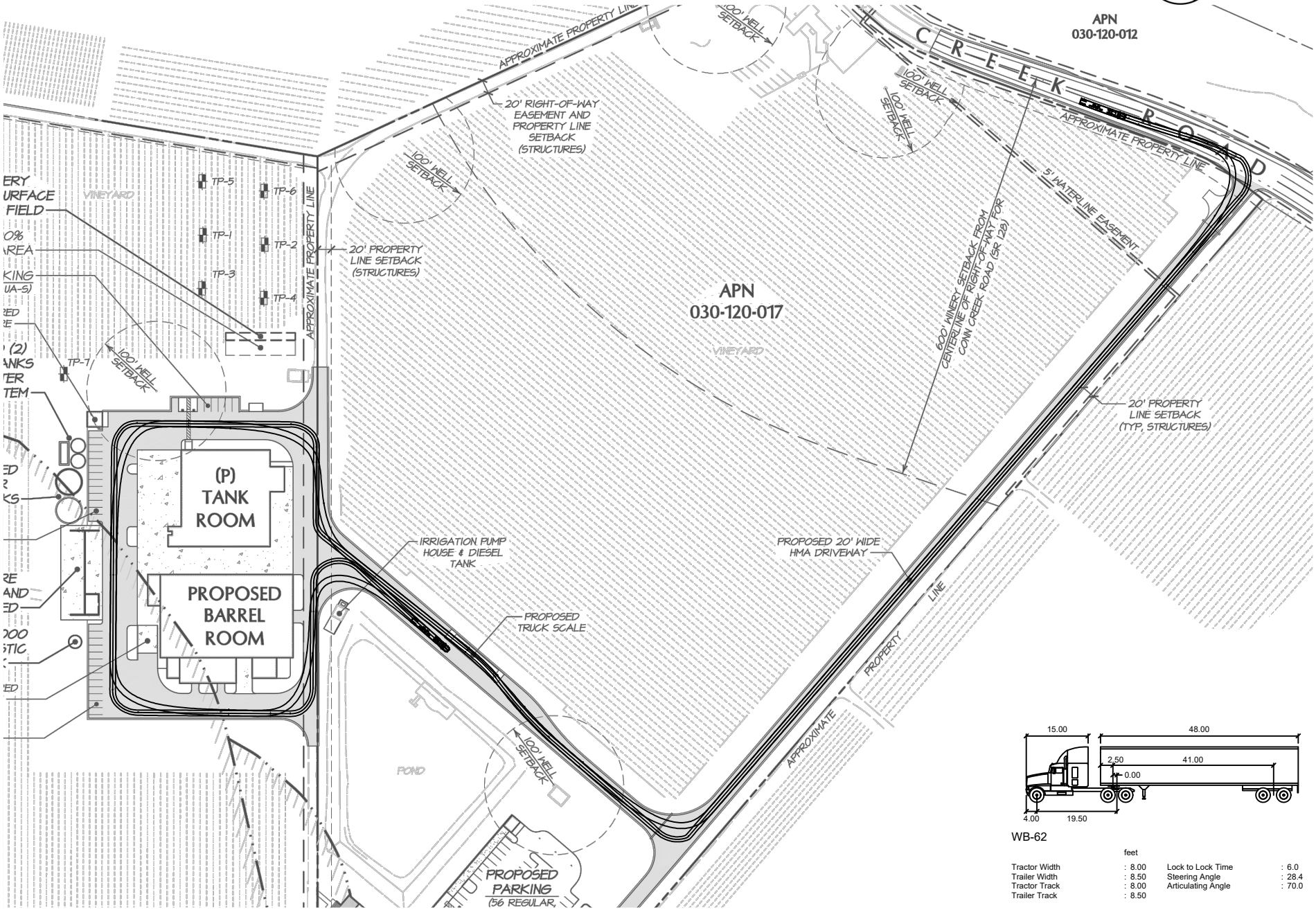


TIS for the Frank Family Benjamin Ranch Winery Project

Firetruck Access

NAX154-1

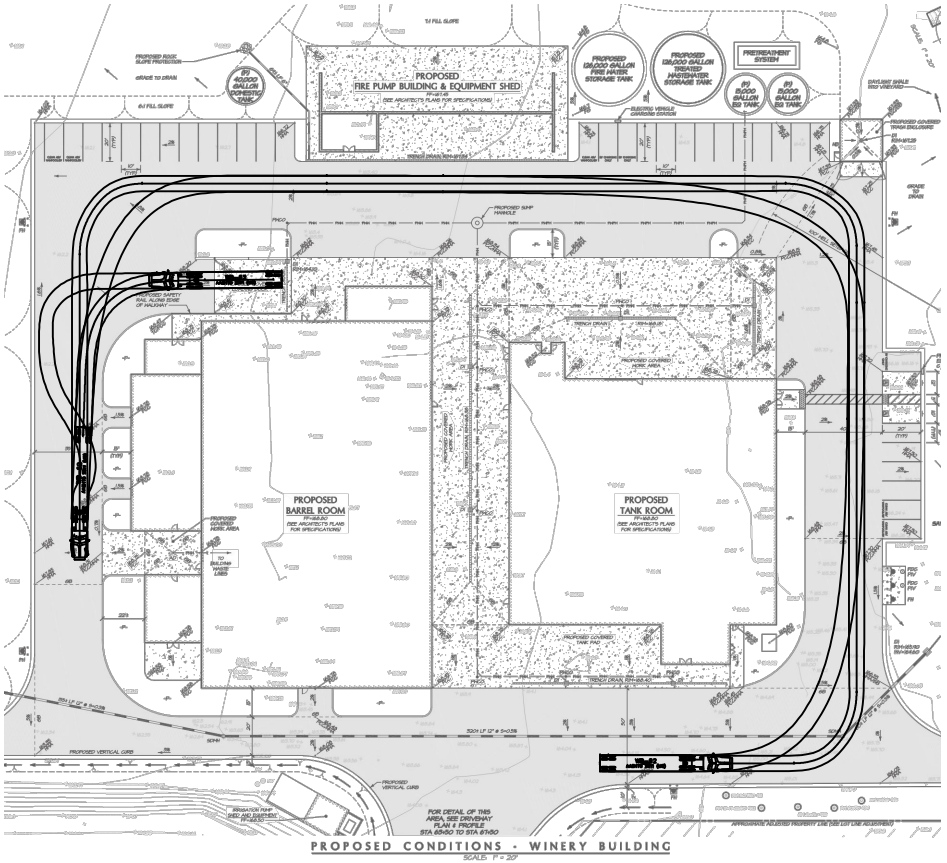
January 2020



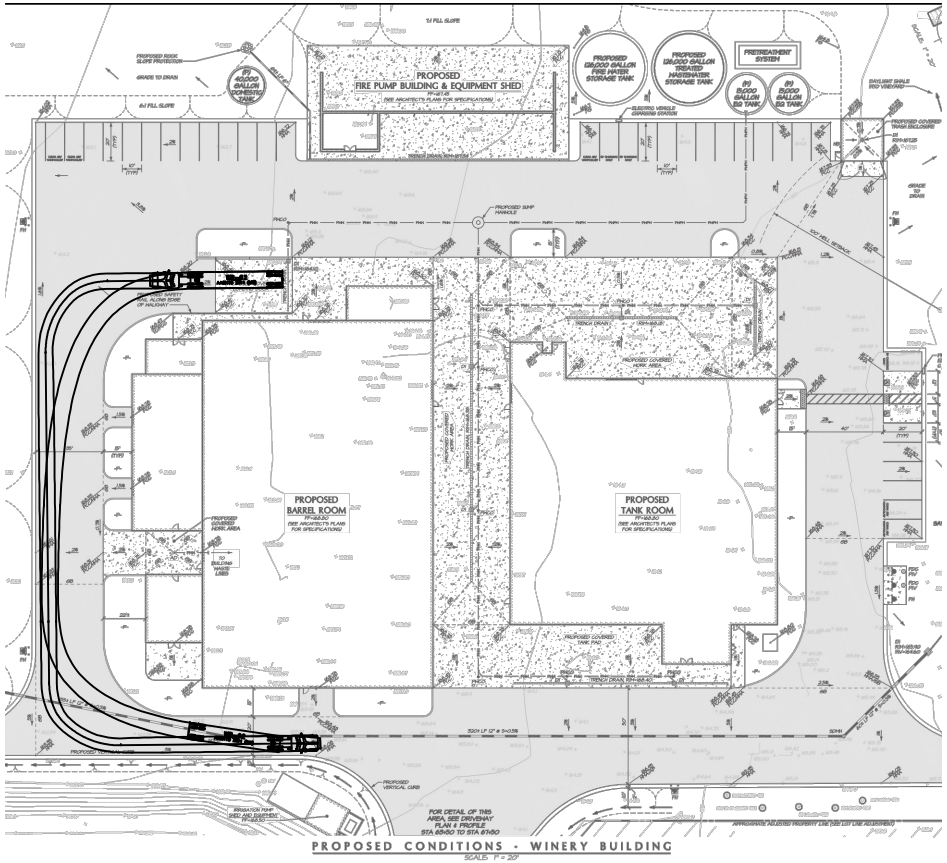
WB-62

feet

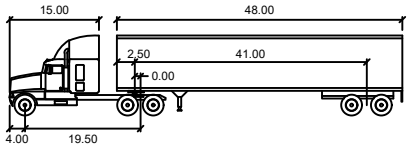
Tractor Width	: 8.00	Lock to Lock Time	: 6.0
Trailer Width	: 8.50	Steering Angle	: 28.4
Tractor Track	: 8.00	Articulating Angle	: 70.0
Trailer Track	: 8.50		



Inbound to Loading Dock



Outbound from Loading Dock



WB-62

feet

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