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Traffic Study

December 15, 2014 (Revised)

Mr. Jonah Beer, Vice President/General Manager
Frog's Leap Winery
C/o Mr. Leslie Alspach, Pound Management, Inc.
5800 Colby Street
Oakland, CA 94618

Subject: ***Focused Traffic Analysis for the Proposed Frog's Leap Winery Modifications Project – Located on Conn Creek Road (Napa County)***

Dear Mr. Beer:

This report provides a focused traffic analysis for the planned Frog's Leap Winery Modification project located at 8815 Conn Creek Road west of Silverado Trail (see Figure 1 for Project Vicinity Map). This study reflects our discussions with your planning consultant (Mr. Leslie Alspach) regarding the project characteristics and other adjacent approved/pending projects in the study area. In addition, new field reviews, traffic counts, and overall analyses of the project's effect on traffic were conducted based on recent comments received from Napa County Planning, Building, and Environmental Services.[1] Some of the key issues evaluated in this study include the following:

- Existing and future weekday PM and weekend mid-day peak hour operations at Silverado Trail, the Frog's Leap Winery Project Driveway, and Rutherford Road intersections with Conn Creek Road;
- Near-term (Year 2016) traffic conditions reflecting other approved/pending winery projects in the study area including the recent Caymus Vineyards and Frank's Family Vineyards activity;
- Project trip generation relative to the proposed use permit on winery production, employment, and visitor data associated with planned Agricultural Processing Center and Farm Management Center ;
- Project site access at the Conn Creek Road driveway and potential improvements;
- Cumulative year 2030 (no project) conditions along Conn Creek Road, Rutherford Road, and Silverado Trail based on the Napa County General Plan Update EIR.

The following sections outline existing and future traffic conditions with and without the proposed Frog's Leap Winery modifications project based on input from Mr. Alspach and yourself. Where necessary, measures have been recommended to ensure acceptable traffic flow, circulation, and/or fair share contribution to regional cumulative traffic improvements along Conn Creek Road. I trust that this report responds to your needs. Please review this information and call me with any questions or comments.

[1] *Ms. Shaveta Sharma, Planner III, Napa County Planning, Building, and Environmental Services, Comments on Frog's Leap Winery Use Permit-Major Modifications Application No. P14-00054, 8815 Conn Creek Road, September 11, 2014.*

Sincerely,

George W. Nickelson, P.E., OMNI-MEANS Engineers & Planners

Attachments: Appendices

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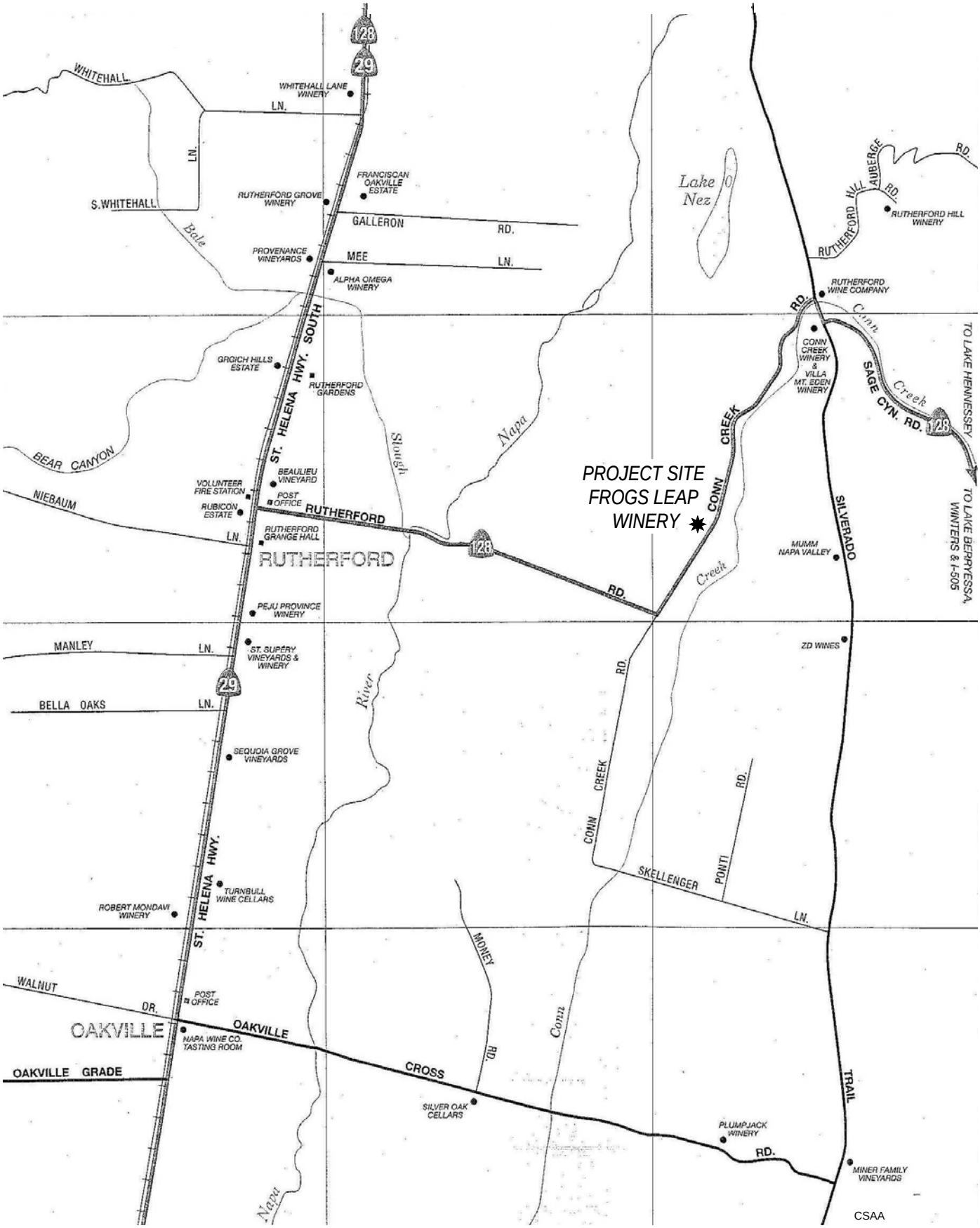

Project Vicinity Map

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figure 1

1. Existing Traffic Conditions

Roadways

Frog's Leap Winery is located at 8815 Conn Creek Road (State Route 128) on the west side of roadway between Rutherford Road (SR-128) and Silverado Trail. Located in Rutherford (Napa County), Conn Creek Road (via Rutherford Road) serves as one of connector roadways extending between State Route 29 and Silverado Trail in the Napa Valley. A brief description of key each roadway follows:

Conn Creek Road extends in a southerly direction from Silverado Trail through Skellenger Lane paralleling Silverado Trail to the west. Providing access to agricultural/vineyard areas, Conn Creek Road is a state highway (State Route 128) between Silverado Trail and Rutherford Road. Conn Creek Road is a rural, two-lane arterial roadway and provides direct access to the Frog's Leap Winery.

Rutherford Road extends for approximately 1.5 miles in an east-west direction between Conn Creek Road and State Route 29. Located south of the project site, Rutherford Road is also designated as State Route 128 and is rural, two-lane arterial roadway.

Silverado Trail extends in a northwest-southeast direction between St. Helena and Napa in the project study area. Located east of the project site, Silverado Trail functions as a two-lane rural highway and has two 12-foot travel lanes with 8-10 foot shoulders (striped each side) at its intersection with Conn Creek Road. The speed limit on Silverado Trail is 55 mph. Napa County defines Silverado Trail as a two-lane, rural arterial roadway.

Existing Intersection Volumes

In order to identify existing peak hour operating conditions, existing peak period traffic counts were conducted at the Frog's Leap Winery driveway and outlying intersections both north and south of the driveway.[2] [3] Vehicle counts were conducted during a weekday PM commute period and a Saturday peak afternoon period at the following intersections:

1. Silverado Trail/Conn Creek Road — Stop-control (Conn Creek Rd.)
2. Frog's Leap Winery Driveway/Conn Creek Road — Stop-control (minor driveway)
3. Rutherford Road/Conn Creek Road — Stop-control (Conn Creek Rd.)

Peak period vehicle counts were conducted on a weekday late afternoon (4:00-6:00 p.m.) and Saturday afternoon (1:00-4:00 p.m.). The resultant "peak hour" of traffic flow on Conn Creek Road occurs during 4:00-5:00 p.m. (Wednesday) and 1:15-2:15 p.m. (Saturday). Peak period counts were conducted during the non- harvest/crush season (November & May) and do not reflect peak traffic conditions on Conn Creek Road. Therefore, peak hour volumes on Conn Creek Road and Silverado Trail were increased by 9% based on Caltrans daily volume counts (peak month vs. non-

[2] *Omni-Means Engineers and Planners, Weekday peak period (4:00-6:00 p.m.) and Weekend (Saturday) peak period (1:00-4:00 p.m) vehicle turning movement counts at the Frog's Leap Winery Driveway/Conn Creek Road intersection November, 13 and 16, 2013.*

[3] *Baymetrics Traffic Resources, Weekday peak period (4:00-6:00 p.m.) and Weekend (Saturday) peak period (1:00-4:00 p.m) vehicle turning movement counts at the Silverado Trail/Conn Creek Road and Rutherford Road/Conn Creek Road intersections, May 1 and 3, 2014.*

peak month).[4] Existing weekday PM peak hour and weekend mid-day peak hour intersection volumes have been shown in Figure 2.

Roadway Volumes

Based on Caltrans daily traffic counts conducted along Conn Creek Road and Rutherford Road west of Silverado Trail, Conn Creek Road has a current average daily traffic (ADT) volume of 1,600 vehicles.[5] Caltrans designates an annual average ADT and a peak month ADT (1,600 ADT and 1,750 ADT). For the purpose of this study, the average annual ADT will be used for analysis. Based on Napa County's designation of Conn Creek Road as a two-lane rural arterial, an ADT of 1,600 reflects operations of LOS A.[6] Silverado Trail is currently carrying 10,548 ADT in the vicinity of SR-128 based on Napa County traffic volume records. Based on the same roadway designation this capacity would reflect LOS D operations.

Existing Intersection Operation

Intersection operation is one of the primary factors in evaluating the carrying capacity of a roadway network. Traffic conditions are measured by Level of Service (LOS), which applies a letter ranking to successive levels of intersection performance. LOS 'A' represents optimum conditions with free-flow travel and no congestion. LOS 'F' represents severe congestion with long delays at the approaches. For intersections with minor street stop control, the LOS reflects the delays experienced by the minor street approach. (LOS definitions and calculation worksheets are provided in the Appendix).

Conn Creek Road is stop-sign controlled at Silverado Trail. At this intersection, the roadway (Conn Creek Road) flairs to provide separate left-through and right-turn lanes. A winery driveway (Rutherford Ranch Winery) forms the north leg of the intersection opposite Conn Creek Road. Northbound and southbound left-turn lanes exist on Silverado Trail at this intersection to provide access to Conn Creek Road and the Rutherford Ranch Winery driveway.

The existing project driveway location at Conn Creek Road is a minor-street, stop-controlled intersection. Located at the east side of the parcel, the driveway consists of single lane approach that widens out considerably (large radius shoulders) at Conn Creek Road to provide for the eastbound right and left-turn movements onto the roadway. (The actual driveway entrance spans 120-feet along Conn Creek Road). This type of intersection is classified as three-way or (T-type) intersection. There is no northbound left-turn lane or southbound right-turn lane on Conn Creek Road at the existing project driveway.

At the Rutherford Road/Conn Creek Road intersection, Conn Creek Road is stop-sign controlled for both the northbound and westbound movements. Extending in an east-west direction, Rutherford Road intersects north-south Conn Creek Road where the roadway extends north towards Silverado Trail. Both roadways have two travel lanes.

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[4] Caltrans, 2012 Traffic Volumes Book, Average and Peak Daily Traffic Volumes, State Route 128 west of Silverado Trail.
[5] Caltrans, 2012 Traffic Volumes Book, Average Daily Traffic (ADT) volumes, SR-128 west of Silverado Trail.
[6] Napa County Baseline Data Report, Transportation and Circulation, Table 11-1, Napa County Roadway Segment Daily LOS Volume Thresholds, 2005.

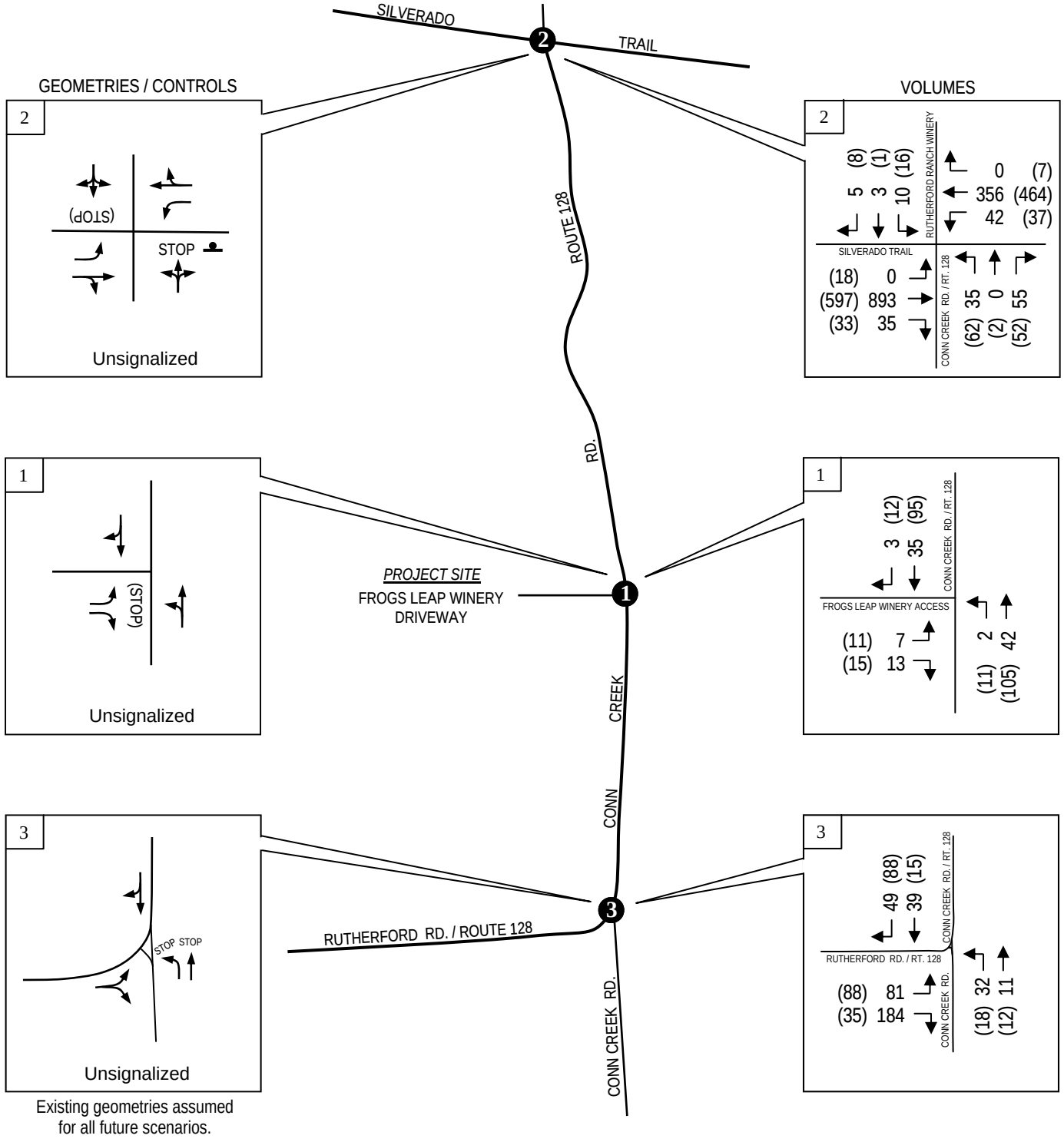
SILVERADO TRAIL
ROUTE 128
RD.
CREEK
CONN
CONN CREEK RD.
RUTHERFORD RD. / ROUTE 128
PROJECT SITE
FROGS LEAP WINERY DRIVEWAY
GEOMETRIES / CONTROLS
VOLUMES
Unsignalized
STOP
RUTHERFORD RANCH WINERY
SILVERADO TRAIL
CONN CREEK RD. / RT. 128
FROGS LEAP WINERY ACCESS
RUTHERFORD RD. / RT. 128
Existing geometries assumed for all future scenarios.
NOT TO SCALE
Existing Weekday PM and (Weekend) Peak Hour Volumes
North
omni-means
figure 2

TABLE 1
EXISTING AND NEAR-TERM (NO PROJECT) CONDITIONS: INTERSECTION LEVELS-OF-SERVICE
WEEKDAY PM PEAK AND WEEKEND MID-DAY PEAK HOUR

#	Intersection	Control Type	Wkdy. PM LOS/Delay		Wknd. Mid-Day LOS/Delay	
			Existing (No Project)	Near-Term (No Project)	Existing (No Project)	Near-Term (No Project)
1	Frog's Leap Driveway/Conn Creek Rd.	Stop	A 8.7	A 8.9	A 9.3	A 9.8
2	Silverado Trail/Conn Creek Rd.	Stop	E 43.9	F 85.8	E 43.8	F 110.2
3	Rutherford Rd./Conn Creek Rd.	Stop	B 10.6	B 12.0	A 9.7	B 10.4

Based on Highway Capacity Manual (HCM) 2000, Operations methodology for stop-sign controlled (unsignalized) intersections using Synchro-Simtraffic software. Intersection calculation yields an LOS and vehicle delay in seconds. Stated LOS refers to the minor street (stop-sign) controlled movement.

Based on the Highway Capacity Manual (*HCM 2000*) operations methodology for unsignalized intersections, existing weekday PM peak and weekend mid-day peak hour existing (no project) level-of-service has been shown in Table 1. As calculated during the weekday PM peak hour, the Frog's Leap Driveway /Conn Creek Road intersection is operating at LOS A (8.7 seconds) for the stop-sign controlled eastbound driveway turning movements onto Conn Creek Road. During the weekend (Saturday) mid-day peak hour, through-volumes on Conn Creek Road are slightly higher than weekday volumes. However, overall intersection operation is still very acceptable at LOS A (9.3 seconds). The Silverado Trail/Conn Creek Road intersection is operating at LOS E (43.9 seconds) during the weekday PM peak hour and LOS E (43.8 seconds) during the weekend mid-day peak hour. This LOS applies to the stop-sign controlled movements from Conn Creek Road and Rutherford Ranch Winery driveway onto Silverado Trail. The Rutherford Road/Conn Creek Road intersection is operating at LOS B (10.6 seconds) during the weekday PM peak hour and LOS A (9.7 seconds) during the weekend mid-day peak hour.

Based on the California Manual on Uniform Traffic Control Devices (CAMUTCD) peak hour signal warrant criteria, the three unsignalized study intersections were evaluated for signalization.[7] The peak hour warrant(s) are one of several standards to help determine if installation of a traffic signal is appropriate. Qualifying for signalization using the peak hour warrants does not necessarily mean a signal should be installed. The decision to install a traffic signal should be based on further studies utilizing additional warrants as presented in the California MUTCD. At this time, the Rutherford Road/Conn Creek Road and Frog's Leap Project Driveway/Conn Creek Road intersections would not qualify for signalization under the peak hour warrant. The Silverado Trail/Conn Creek Road intersection would just exceed the minimum peak hour volumes for signalization during the weekday PM peak hour and clearly exceeds the warrant during the weekend mid-day peak hour (the warrant graphs are provided in the Appendix).

2. Near-Term (No Project) Conditions

Near-Term Methodology

Both near-term (no project) and cumulative (year 2030) volume projections for Conn Creek Road and Rutherford Road (SR-128) and Silverado Trail were derived from the Napa County

[7] *California Manual on Uniform Traffic Control Devices (CAMUTCD), Chapter 4C, Peak hour signal warrant (#3), 2012.*

Transportation and Planning Agency's traffic volume forecasts found in the Napa County General Plan Update EIR.[8] The forecast increase in volume-to-capacity (v/c) ratio from Year 2003 to Year 2030 on SR-128 between SR-29 and the Napa River was applied to the Year 2003 peak hour two-way volumes (313 vehicles). This yielded a future volume of 867weekday PM peak hour vehicles on Conn Creek Road and Rutherford Road in the Year 2030. This would equate to an increase in traffic volumes of 3.9% per year to the Year 2030 on the roadways. Similarly, the increase in v/c ratio from Year 2003 to Year 2030 on Silverado Trail between Sage Creek Road and Yountville Cross Road was applied to the Year 2003 peak hour two-way volumes (1,352 vehicles). This yielded a future volume of 2,052weekday PM peak hour vehicles on Silverado Trail at Sage Creek Road (adjacent to Conn Creek Road). This would equate to an increase in traffic volumes of 1.56% per year to the Year 2030 on the roadway.

With regard to near-term (no project) conditions, the project applicant indicates a two-year window to the Year 2016 would allow for proposed project completion (construction of buildings, movement of staff). Based on this time period, weekday PM peak hour vehicle traffic would increase by 7.8% on Conn Creek Road and Rutherford Road and 3.12% on Silverado Trail. It is noted that no future volume projections are provided for the weekend (Saturday) mid-day peak hour. Therefore, weekend mid-day peak hour volumes on Conn Creek Road-Rutherford Road and Silverado Trial were increased uniformly by the same annual growth rate.

In addition to near-term background growth on Conn Creek Road, Rutherford Road, and Silverado Trail, other approved/pending projects in the immediate study area have been included in overall traffic growth at the request of County Planning staff.[9] Specifically, use modifications for the existing Caymus Vineyards winery and a new proposed winery facility for Frank's Family Vineyard (Wood Ranch). The Caymus Vineyard winery is located south of Frog's Leap Winery off Conn Creek Road whereas the Frank's Family Vineyard winery project would be located to the north off the same roadway. The proposed uses could be described as follows:

Caymus Vineyards Winery:
Production: 1.8 million gallons
Visitation: 346 weekday, 589 weekend
Employment: not available

Frank's Family Vineyards Winery:
Production: 475,000 gallons
Visitation: 50/day
Employment: 14 full-time, 8 part-time

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Daily and peak hour weekday and weekend peak hour volumes have been based on actual traffic analyses performed for the project (Caymus Vineyards) and/or established trip generation weekday and weekend factors established by Napa County.[10] Based on these sources, the two adjacent projects would be expected to generate 457 daily trips and 162 PM peak hour trips during the weekday period. On weekends, the projects would generate 426 daily trips with 261 mid-day peak hour trips.

Near-term (no project) volumes for weekday PM peak hour and weekend mid-day peak hour have been shown in Figure 3.

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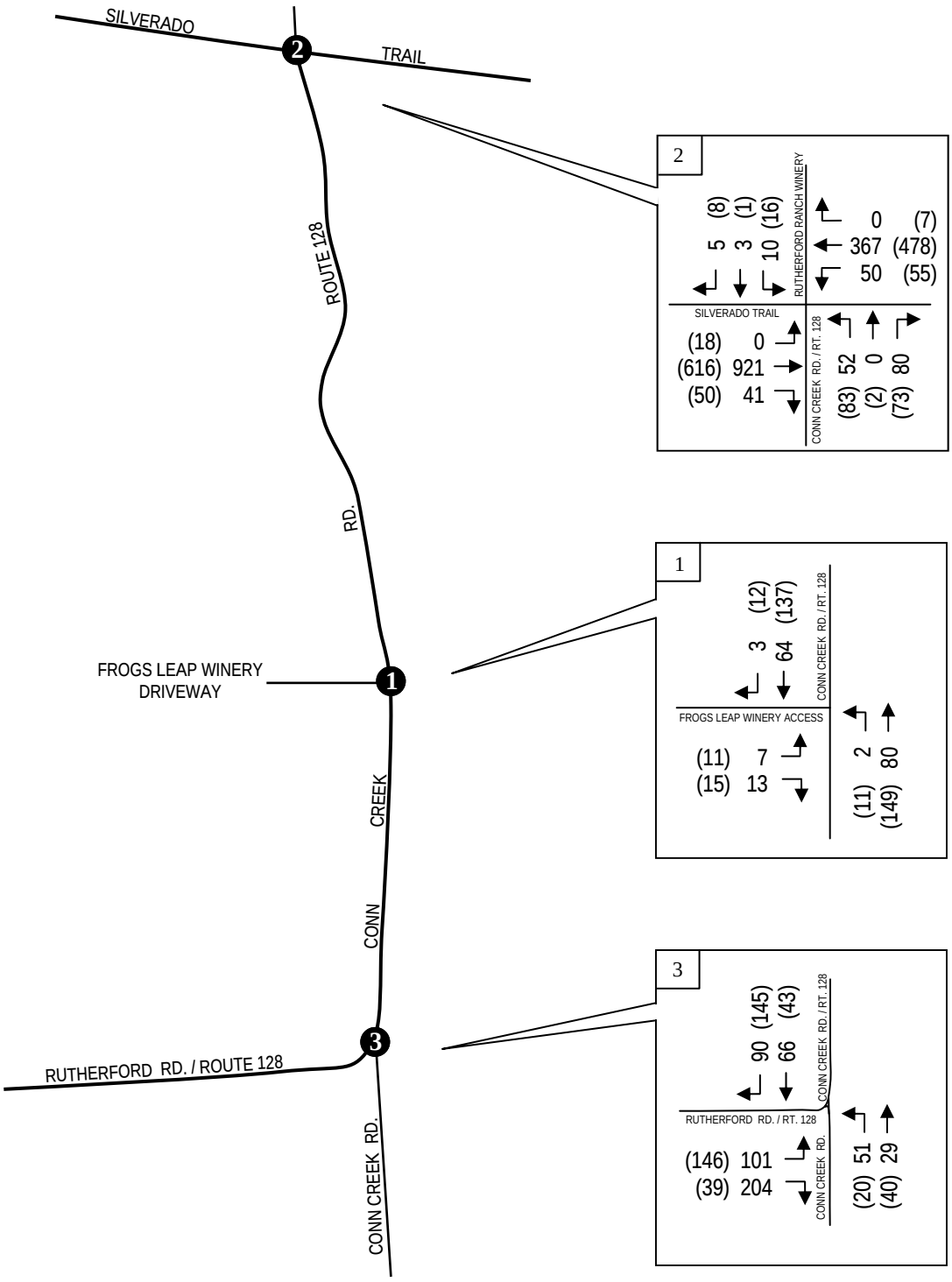
[8] *Dowling Associates, Napa County General Plan Update, Technical Memorandum for Traffic and Circulation Supporting the Findings and Recommendations, February 9, 2007.*
[9] *Ms. Shaveta Sharma, Planner III, Napa County Planning, Building, and Environmental Services, Frog's Leap Winery Use Modification Application P14-00054 Letter of Completion (and personal communication), September 11, 2014.*
[10] *W-Trans, Traffic Impact Study for Caymus Winery, Prepared for the County of Napa, October 3, 2104.*



NOT TO SCALE

Near Term Without Project
Weekday PM and (Weekend) Peak Hour Volumes

North

omni-means

figure 3

Near-Term (No Project) Intersection/Roadway Operation

With near-term (no project) volumes, study intersection LOS has been calculated and are shown in Table 1. The Frog's Leap Driveway/Conn Creek Road intersection would experience very slight increases in vehicle delays during the weekday PM peak hour and/or weekend mid-day peak hour. For the minor street (driveway) outbound turning movements, LOS would continue to operate at LOS A (8.9 secs.) During the Saturday mid-day peak, intersection LOS would remain at A (9.8 secs.). The Silverado Trail/Conn Creek Road intersection would operate at LOS F (85.8 seconds) during the weekday PM peak hour and LOS F (110.2 seconds) during the weekend mid-day peak hour. This LOS applies to the stop-sign controlled movements from Conn Creek Road and Rutherford Ranch Winery driveway onto Silverado Trail. The Rutherford Road/Conn Creek Road intersection would operate at LOS B (12.0 seconds) during the weekday PM peak hour and LOS B (10.4 seconds) during the weekend mid-day peak hour.

Based on CAMUTCD peak hour signal warrant criteria (Warrant #3), the Frog's Leap Driveway/Conn Creek Road and Rutherford Road/Conn Creek Road intersections would not qualify for signalization with near-term (no project) volumes. The Silverado Trail/Conn Creek Road intersection would continue to satisfy the peak hour signal warrant during both the weekday PM peak and weekend mid-day peak hour. ADT on Conn Creek Road would increase to 2,182 (LOS A). ADT on Silverado Trail would increase to 11,014 (LOS D).

3. Napa County Significance Criteria

The County of Napa's significance criteria has been based on a review of the Napa County Transportation and Planning Agency and Napa County General Plan documentation on roadway and intersection operations. Specifically, the Circulation Element of the County's General Plan outlines the following significance criteria specific to intersection operation:

Intersections

- The County shall seek to maintain a Level of Service D or better at all intersections, except where the level of service already exceeds this standard (i.e. Level of Service E or F) and where increased intersection capacity is not feasible without substantial additional right-of-way.
- No single level of service standard is appropriate for un-signalized intersections, which shall be evaluated on a case-by-case basis to determine if signal warrants are met.

Further significance criteria are based on County and CEQA guidelines and apply mainly to intersection operation and access. A significant impact occurs if project traffic would result in the following:

- Cause an increase in traffic which is substantial in relation to existing traffic load and capacity of the street system (i.e. result in a substantial increase in either the number of vehicle trips, the volume capacity ratio on roads, or congestion at intersections);
- Exceed either individually or cumulatively, an LOS standard established by the county congestion management agency for designated roads or highways;
- Result in a change of traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks;

- Substantially increase hazards due to a design feature (e.g. sharp curves or dangerous intersections) or incompatible uses (e.g. farm equipment);
- Result in inadequate emergency vehicle access;
- Project site or internal circulation on the site is not adequate to accommodate pedestrians and bicycles;

4. Proposed Project Impacts

Project Description

Proposed winery related operations would include completion of the Farm Management Center (FMC) and Agricultural Processing Center buildings as part of the overall Use Permit modification application. Based on discussions with the project applicant, current activities at the winery related to employee staffing and visitors would not increase beyond what is currently occurring as a result of these new uses.[11] In addition, there would be no increases in winery production. The proposed FMC building would not contribute to increases in staff, visitor/guests, or additional activities at the winery. It would allow the transferring of some staff members and storage from existing (over-crowded) buildings to new office space. The APC building would allow the winery to serve its visitors and guests more efficiently. The proposed use permit modification would merely bring the winery into compliance with existing activities currently occurring on-site.

Proposed project components can be described as follows:

•	Production	Gallons:	240,000 (annually)
•	Employees:	Weekday:	30 full-time, 5 part-time
		Weekend:	10 full-time, 5 part-time
•	Visitors:	Weekday:	125 visitors
		Weekend:	300 visitors
•	Trucks:	Weekday:	2 trucks per day
		Weekend:	2 trucks per day

Daily operations for the proposed Frog's Leap Winery project would involve an all on-site winery operation with a maximum annual production of 240,000 gallons. All fruit would be processed on-site during the year with the majority occurring during the harvest/crush season. 125 weekday visitors are expected with a maximum of 300 daily visitors on a Saturday/Sunday. Visitor hours would be limited between 10:00 a.m. – 6:00 p.m. and would be by appointment only. Employment is expected to be a maximum (on-site) of 30 full-time employees and 5 part-time employees during the weekdays and 10 full-time and 5 part-time during weekend periods. The proposed project's marketing plan can be described as follows:[12]

Winery Marketing Plan

- One (1) event per week: maximum of 20 guests with food prepared on-site;
- One (1) event per month: maximum of 150 guests (catered);
- Four (4) events per year: maximum of 500 guests (catered).

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[11] *Mr. Jonah Beer, Vice President/General Manager, Frog's Leap Winery, Personal communication on December 6, 2013.*
[12] *Mr. Jonah Beer, Vice President/General Manager, Frog's Leap Winery, Employee and guest data, October 28, 2013.*

Project Trip Generation/Distribution

The proposed project's weekday and weekend peak hour and daily traffic volumes have been calculated and are shown in Table 2. Peak hour project trip generation has been based on rates developed from actual counts performed at the winery. Based on employee attendance data supplied by the project applicant, all weekday (35) and weekend (15) employees were present during the peak hour vehicle counts. During the weekday peak hour of traffic flow (4:00-5:00 p.m.), the winery is closed to visitation. The recorded driveway trips represented two visitor/guest trips with the remaining trips attributed to employees. During the weekend mid-day peak hour (1:15-2:15 p.m.), all recorded driveway trips represented visitor/guest trips. Daily trip generation has been based on employee peaking factors and auto occupancy rates for visitors using recent winery research conducted by the Napa County Conservation, Development, and Planning Department.[13] Based on ultimate employee and visitor/guest data with FMC and APC buildings in use, the proposed project would be expected to generate 202 weekday daily trips with 30 PM peak hour trips (6 in, 24 out). During a typical weekend (Saturday), the project would be expected to generate 255 daily trips with 86 mid-day (afternoon) peak hour trips (40 in, 46 out).

During the six-week harvest crush season, the proposed project is expected to generate an average of 287 Saturday daily trips. Based on the largest marketing event attendance of 500 persons (four times per year), there would total generation of 403 event trips.

To determine traffic conditions with the proposed project, the calculated project trips were added to existing volumes. Based on observed turning percentages at the Frog's Leap driveway, the weekday PM peak hour project trips were distributed 37% to/from the north and 63% to/from the south on Conn Creek Road. Saturday mid-day peak hour project trip distribution was evenly distributed with 47% to/from the north and 53% to/from the south on Conn Creek Road

Daily, weekday PM peak hour, and weekend mid-day peak hour project trips (only) have been shown in Figure 4. Existing plus project and near-term plus project volumes have been shown in Figure 5 and 6.

Project Effects on Roadway/Intersection Operation

A. Existing Plus Project Conditions

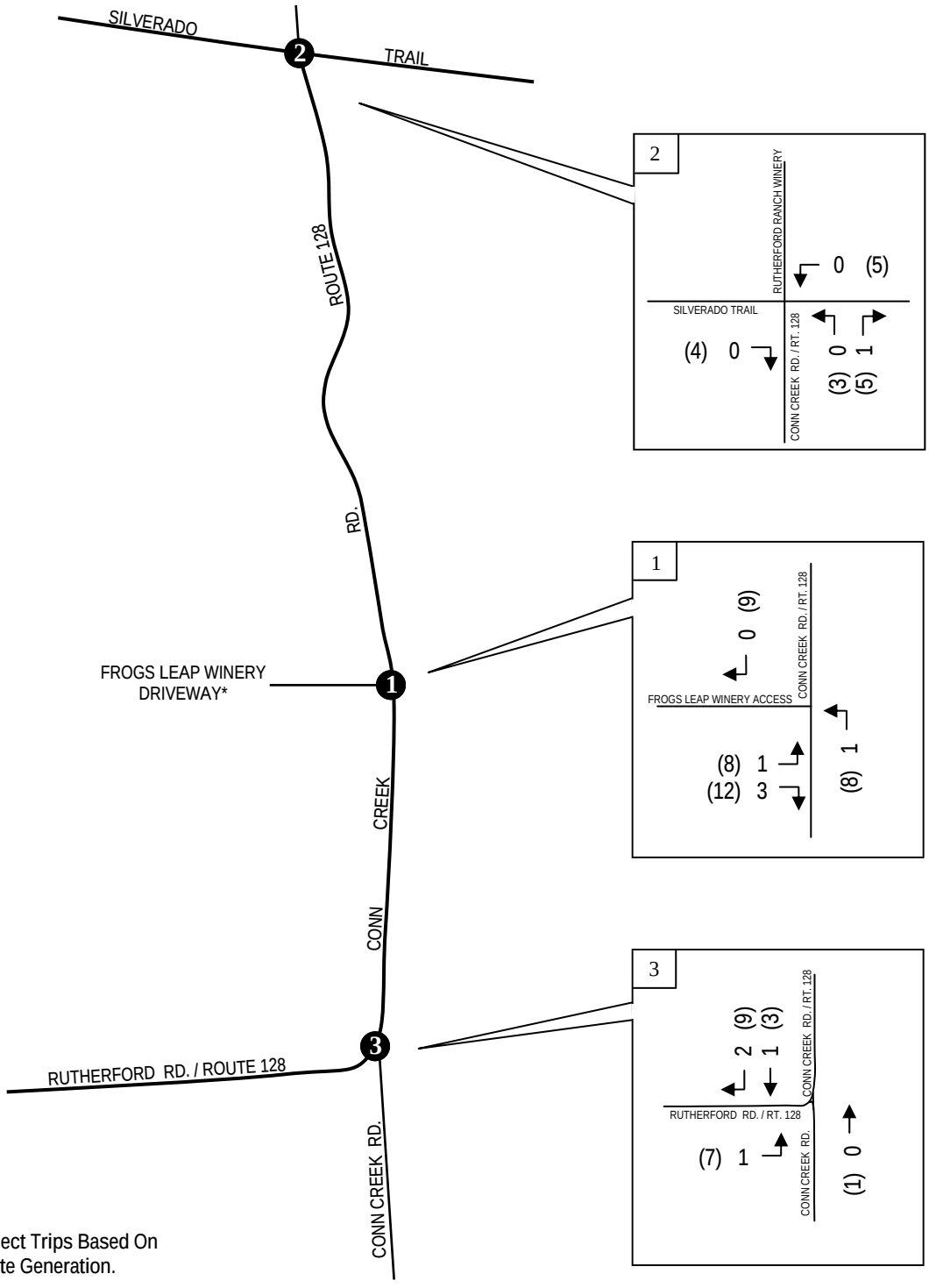
The fully operational winery would be expected to generate approximately 136 daily trips south of the site and 120 daily trips north of the site on Conn Creek Road. This would represent an increase of 16 percent to the daily volumes on Conn Creek Road. The combined existing plus project volume of 1,856 daily trips would remain well within the carrying capacity of a two-lane, rural arterial roadway with conditions equivalent to LOS 'A'. It is noted that these project volumes refer to the winery's total contribution to traffic on Conn Creek Road. A portion of these trips are already on the street network and are included in our peak hour count volumes. Silverado Trail would continue to operate at LOS D with a daily volume of 10,668 vehicles with proposed project traffic.

[13] *County of Napa, Conservation, Development, and Planning Department, "Use Permit Application Package," Napa County Winery Traffic Generation Characteristics, 2012.*

TABLE 2
PEAK HOUR AND DAILY TRIP GENERATION:
PROPOSED FROG'S LEAP WINERY PROJECT

Weekday Daily Traffic:		
125 visitors/2.6 persons per vehicle x 2 one-way trips	=	96 daily trips
30 full-time employees x 3.05 one-way trips	=	92 daily trips
5 part-time employees x 1.90 one-way trips	=	10 daily trips
240,000 gallons/1,000 x .009 daily trucks x 2 o-w trips	=	4 daily trips
Total Weekday Daily Trips	**=**	**202 daily trips**
Weekday PM Peak Hour Traffic:		
125 visitors x 0.056 trips/visitor	=	7 peak hour trips
35 full-time/part-time employees x 0.657 trips/emp.	=	23 peak hour trips
Total Weekday PM Peak Hour Trips	**=**	**30 trips (6 in, 24 out)**
Weekend (Saturday) Daily Traffic:		
300 visitors/2.8 persons per vehicle x 2 one-way trips	=	214 daily trips
10 full-time employees x 3.05 one-way trips	=	31 daily trips
5 part-time employees x 1.90 one-way trips	=	10 daily trips
Total Weekend (Saturday) Daily Trips	**=**	**255 daily trips**
Weekend (Saturday) Peak Hour Traffic:		
300 visitors x 0.286 trips/visitor	=	86 peak hour trips
15 full-time/part-time employees x 0 trips/emp.	=	0 peak hour trips
Total Weekend (Saturday) Peak Hour Trips	**=**	**86 trips (40 in, 46 out)**
Weekend (Saturday) Daily Harvest/Crush Traffic:		
300 visitors/2.8 persons per vehicle x 2 one-way trips	=	214 daily trips
15 full time employees x 3.05 one-way trips	=	46 daily trips
5 part-time employees x 1.90 one-way trips	=	10 daily trips
240,000 gallons/1,000 x .009 daily trucks x 2 o-w trips	=	4 daily trips
900 annual ton grapes (o-h)/144 daily trucks x 2 o-w trips	=	13 daily trips
Total Weekend (Saturday) Daily Harvest/Crush Trips	**=**	**287 daily trips**
Largest Marketing Event – Additional Traffic		
20 event staff x 2 one-way trips per person	=	40 event trips
500 visitors / 2.8 visitors per vehicle x 2 o-w trips	=	357 event trips
3 trucks x 2 one-way trips	=	6 event trips
Total Largest Event Marketing Trips:	**=**	**403 event trips**

Source: Production, employee, and visitor data provided by Mr. Jonah Beer (project applicant), October, November, December, 2013. Daily calculations based on County of Napa, Conservation, Development, and Planning Department, "Use Permit Application Package," Napa County Winery Traffic Generation Characteristics, 2012. Peak hour calculations based on rates developed from weekday peak hour and Saturday mid-day peak hour driveway counts at Frog's Leap Winery combined with visitor and employee data for specific count days.



*Net New Project Trips Based On Existing Site Generation.

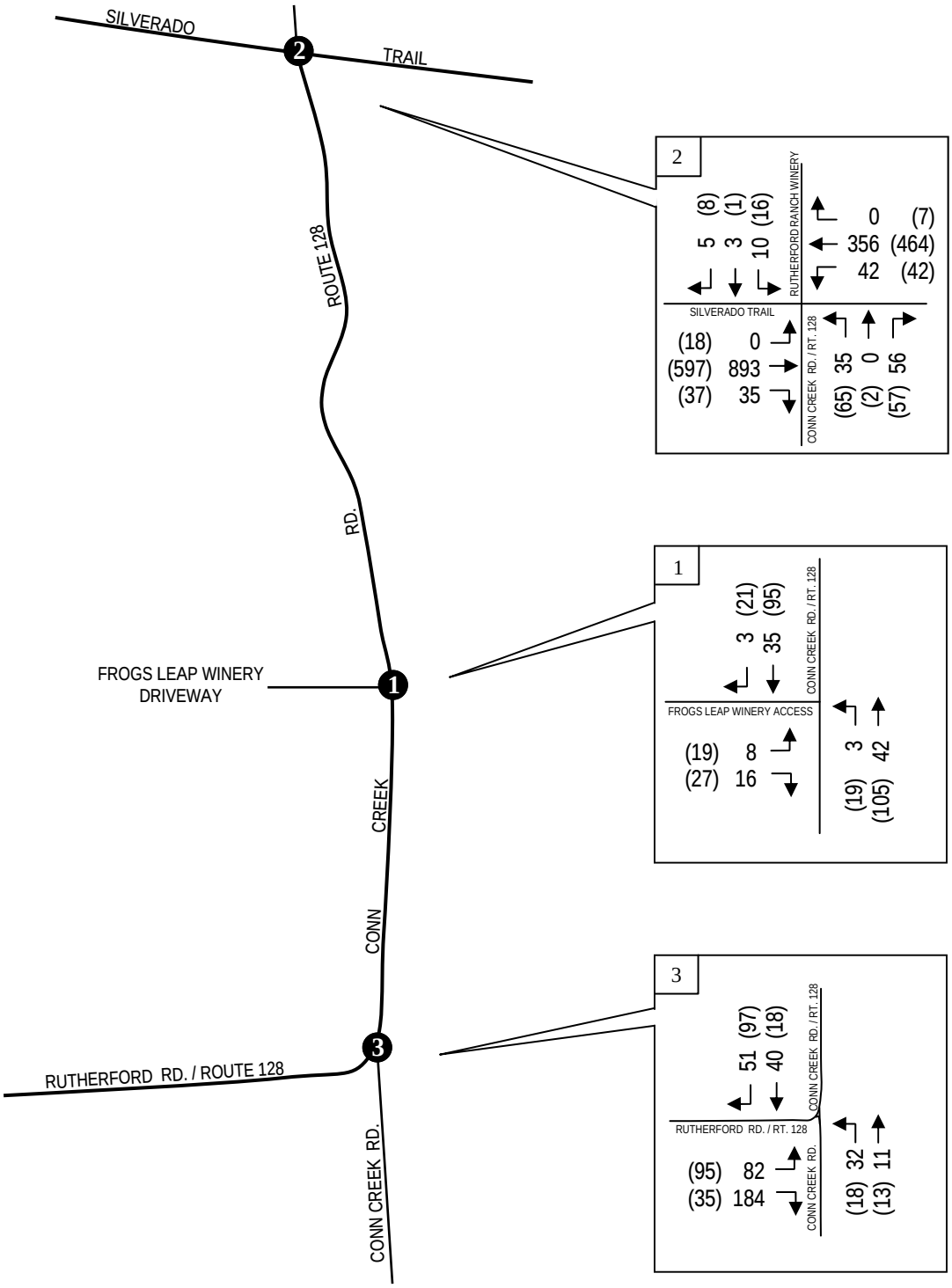
NOT TO SCALE

Weekday PM and (Weekend) Peak Hour Project Trips

North

omni-means

figure 4



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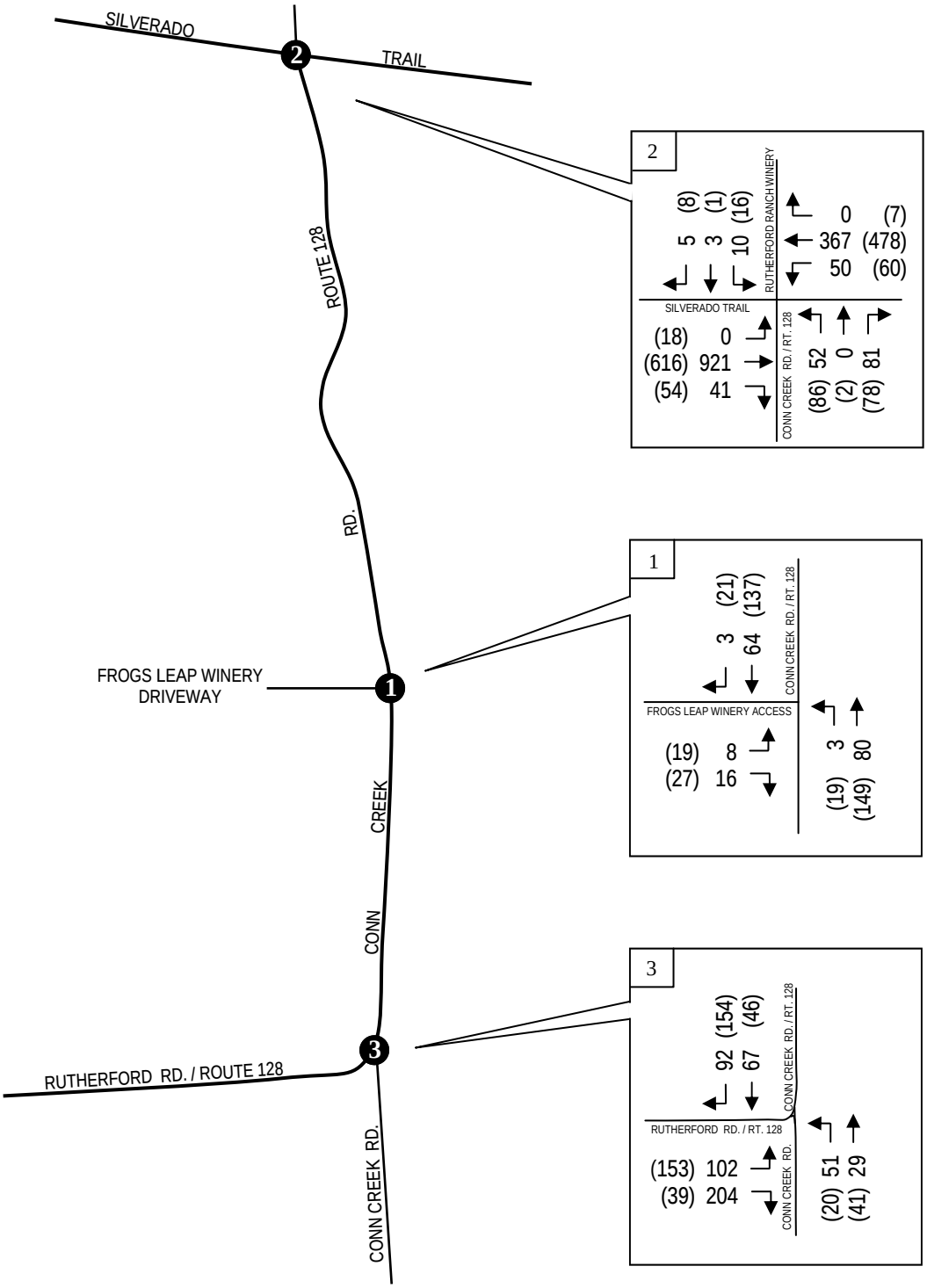
Existing + Project Weekday PM and (Weekend) Peak Hour Volumes

North

omni-means

figure 5



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Near Term + Project Weekday PM and (Weekend) Peak Hour Volumes

North

omni-means

figure 6

During the peak winery activity periods, the winery would generate 30 weekday PM peak hour and 86 Saturday mid-day peak hour trips. Weekday PM peak hour and weekend mid-day peak hour intersection levels of service were evaluated with proposed project traffic and are shown in Table 3.

With existing (counted) plus fully operational winery traffic volumes, all three project study intersections would continue to operate at the same LOS as under existing (no project) conditions. During the weekday PM peak hour, both the Frog's Leap Driveway/Conn Creek Road and Rutherford Road/Conn Creek Road intersections would operate at LOS A and B, respectively. The Silverado Trail/Conn Creek Road intersection would operate at LOS E. During the weekend mid-day peak hour, the Frog's Leap Driveway/Conn Creek Road and Rutherford Road/Conn Creek Road intersections would continue to operate at LOS A with the Silverado Trail/Conn Creek Road intersection operating at LOS E. Overall vehicle delay (in seconds) would increase slightly as a result of proposed project traffic.

The intersection of Frog's Leap Driveway/Conn Creek Road and Rutherford Road/Conn Creek Road would not meet the minimum volume required for signalization under CAMUTCD peak hour warrant criteria. The Silverado Trail/Conn Creek Road intersection would continue to meet the peak hour signal warrant with proposed project traffic.

TABLE 3
EXISTING PLUS PROJECT AND NEAR-TERM PLUS PROJECT CONDITIONS:
INTERSECTION LEVELS-OF-SERVICE
WEEKDAY PM PEAK AND WEEKEND MID-DAY PEAK HOUR

			Wkdy. PM LOS/Delay		Wknd. Mid-Day LOS/Delay	
#	Intersection	Control Type	Existing + Project	Near-Term + Project	Existing + Project	Near-Term + Project
1	Frog's Leap Driveway/Conn Creek Rd.	Stop	A 8.7	A 8.9	A 9.5	A 9.9
2	Silverado Trail/Conn Creek Rd.	Stop	E 44.1	F 85.8	E 47.9	F 127.6
3	Rutherford Rd./Conn Creek Rd.	Stop	B 10.6	B 12.0	A 9.8	B 10.5

Based on Highway Capacity Manual (HCM) 2000, Operations methodology for stop-sign controlled (unsignalized) intersections using Synchro-Simtraffic software. Intersection calculation yields an LOS and vehicle delay in seconds. Stated LOS refers to the minor street (stop-sign) controlled movement.

B. Near-Term Plus Project Conditions

With near-term plus project conditions, daily traffic volumes on Conn Creek Road would increase to 2,438 ADT. Again, this would be well within the carrying capacity of a two-lane, rural arterial roadway and reflect LOS A conditions. Silverado Trail would increase to 11,134 ADT with proposed project traffic and continue to operate at LOS D.

With near-term plus project traffic volumes, the two intersections of Frog's Leap Driveway/Conn Creek Road and Rutherford Road/Conn Creek Road would continue to operate at acceptable levels (LOS A or B) during both the weekday PM peak hour and weekend mid-day peak hour periods. The Silverado Trail/Conn Creek Road intersection would continue to operate at LOS F during both the weekday PM peak hour and during the weekend mid-day peak hour with proposed project traffic (minor street approaches).

The intersections of Frog's Leap Driveway/Conn Creek Road and Rutherford Road/Conn Creek Road intersections would not meet the minimum volume required for signalization under CAMUTCD peak hour warrant criteria. The Silverado Trail/Conn Creek Road intersection would continue to meet the peak hour signal warrant with proposed project traffic. Overall proposed

project trips would constitute 0.007% of the weekday PM peak hour vehicle trips at this intersection should the County and/or Caltrans require future signalization at this location.

5. Site Access/Design Parameters

Sight Distance

Vehicle sight distance at the existing Frog's Leap Driveway/Conn Creek Road intersection was evaluated. The required vehicle visibility or "corner sight distance" is a function of travel speeds Conn Creek Road. Caltrans design standards indicate that for appropriate corner sight distance, "a substantially clear line of sight should be maintained between the driver of a vehicle waiting at the cross road and the driver of an approaching vehicle in the right lane of the main highway". Caltrans design guidelines also indicate that the minimum corner sight distance "shall be equal to the stopping sight distance".

New radar speed surveys of Conn Creek Road were conducted for the roadway in the project area.[14] The "critical" vehicle speed (the speed at which 85% of all surveyed vehicles travel at or below) along Conn Creek Road was measured at 48 mph. Caltrans' design standards indicate that these vehicle speeds require a stopping sight distance of 415-430 feet, measured along the travel lanes on Conn Creek Road.[15] Based on field measurements, sight distance from the current Frog's Leap Winery driveway to the north on Conn Creek Road is approximately 460 feet. Sight distance from the existing driveway to the south is at least 1,600 feet. Therefore, the sight distance recommendations would be met for the speed limit and measured vehicle speeds. It is noted that sight distance to the north is predicated on keeping the shoulder free of vegetation/plantings adjacent to existing vineyards.

Left-Turn Lane/Right-Turn Lane Warrants

The existing plus project and near-term plus project volumes were compared with the Napa County guidelines for installing a northbound left-turn lane on Conn Creek Road at the Frog's Leap Winery driveway.[16] (The warrant graphs for weekday and Saturday conditions are provided in the Appendix). Napa County left-turn lane warrants are based on the combination of total proposed project daily trips at the driveway and overall ADT on Conn Creek Road. With 201-255 daily weekday/weekend trips at the proposed project driveway and 2,438 daily trips on Conn Creek Road, a northbound left-turn lane ***would be warranted*** on Conn Creek Road.

Existing plus project and near-term plus project volumes were also compared with Caltrans guidelines for installing a left-turn lane on Conn Creek Road at the project driveway. Compared to Napa County standards, Caltrans guidelines for installation of a left-turn lane are based on peak hour volumes and include actual left-turn volumes. As identified under near-term plus project conditions (worst case), the winery would generate 30 peak hour trips on a typical Friday and 86 peak hour trips on a Saturday, while the peak hour volumes on Conn Creek Road are projected to be 144 vehicles on Friday and 286 vehicles on Saturday.

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[14] *Omni Means Engineers & Planners, Radar vehicle speed surveys, Conn Creek Road, November 16, 2013.*
[15] *Caltrans, Highway Design Manual, Table 405.1A, Corner (Stopping) Sight Distance, 6th Edition, 2009.*
[16] *Napa County, Adopted Road and Street Standards, revised November 21, 2006.*

The peak hour traffic volumes at the winery access have been compared with left turn lane warrants outlined in a Caltrans intersection design guide.[17] By comparing the advancing and opposing S.R. 128 volumes with the percentage of left turning vehicles into the access road, the volumes are **well below** the Caltrans minimum threshold at which a left turn lane would be warranted.

The projected right turn volumes at the site driveway are well below minimum thresholds at which right turn lane would be required (right turn lane warrant graphs are included in the Appendix).[18]

The project applicant has requested an "exception to standards" related to the Napa County warrant being satisfied for the installation of a northbound left-turn lane at the project driveway on Conn Creek Road with proposed project traffic. [19] Consistent with the Napa County Adopted Road and Street Standards (Item #3—Exception To Standards), the request provided all supporting materials, details of the exceptions and mitigating factor, and map with the proposed location and sighting of the exception.[20] As stated in the exceptions section, "Standards that effect native trees or other geological features are prime examples of those circumstances where exceptions may be reviewed." Large native oak tree(s) are located off Conn Creek Road immediately adjacent to the proposed project driveway that would encroach on necessary ROW for installation of a left-turn lane. Subsequently, County Engineering staff has indicated that they will defer to Caltrans for any work conducted in their ROW should an encroachment permit be sought (see Appendices---Napa County Memorandum).[21]

Project Access and Circulation

Proposed project driveway access to/from Conn Creek Road would remain unchanged from existing conditions. As shown in Figure 7 (Project Site Plan), the Frog's Leap driveway extends west from Conn Creek Road to existing winery and administrative buildings. Approximately 460 feet west of Conn Creek Road the driveway splits; a northern driveway provides access to administrative buildings and parking areas whereas the remaining driveway continues west providing access to winery buildings and additional parking areas. The proposed Farm Management Building would be located on the west side of the facility (as would the proposed Agricultural Processing Center building) and would be most easily accessed for this western driveway. The internal driveway widths serving both winery and administrative uses meet the County's minimum requirement of an 18-foot travel width. The vehicle circulation area in front of the main buildings would allow access for emergency vehicles (fire trucks) and parking.

The Napa County Transportation & Planning Agency (NCTPA) in cooperation with Napa County and local City agencies is developing bicycle routes as outlined in the Napa Countywide Bicycle

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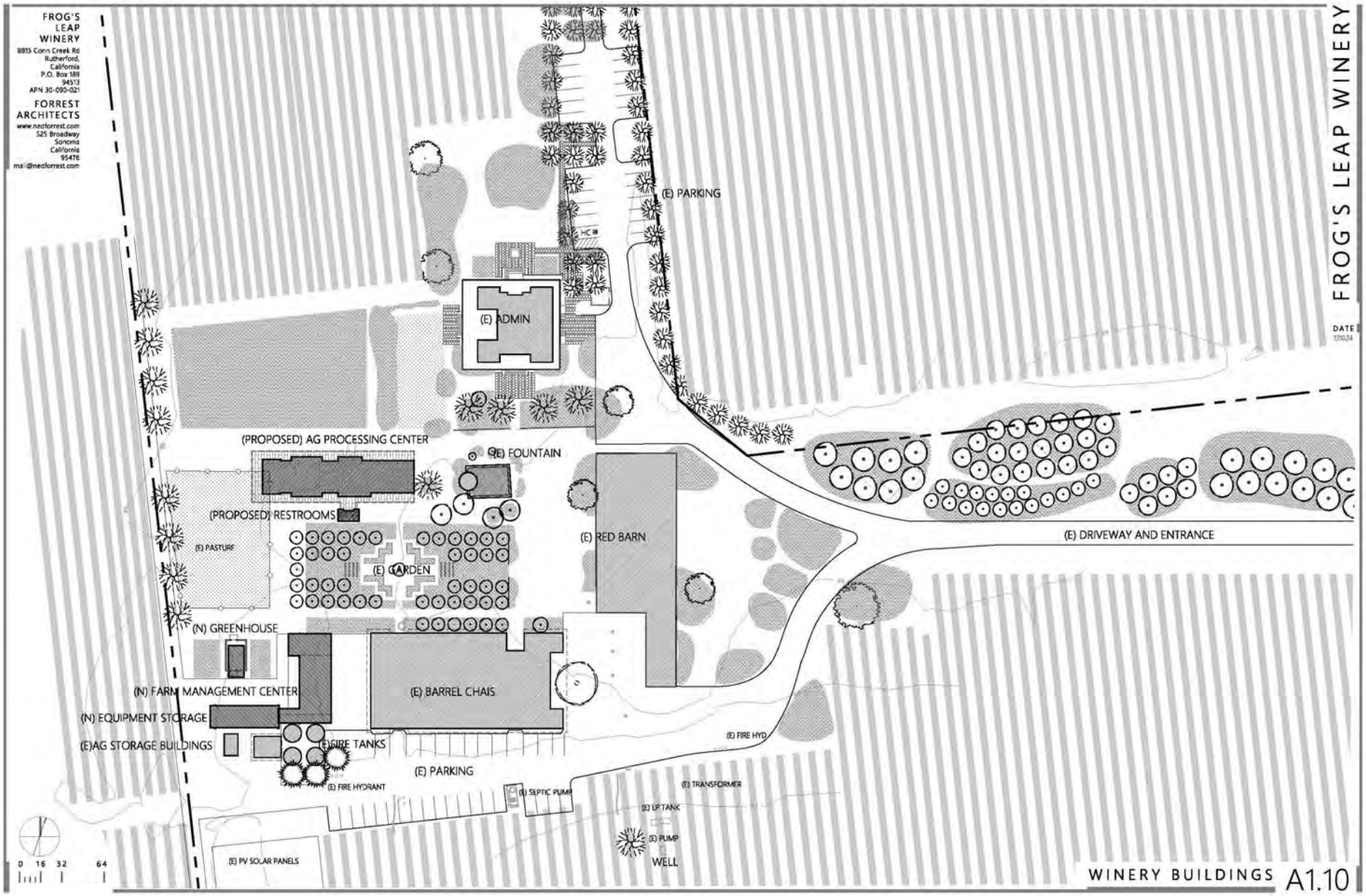
[17] Caltrans, Highway Design Manual, 6th Edition, 2009.
[18] Transportation Research Board, National Cooperative Highway Research Program Report 279, "Intersection Channelization Design Guide," November, 1985.
[19] Mr. Jonah Beer, General Manager, Frog's Leap Winery, Exception Request Letter to Mr. Nate Galambos, Engineering Services, Napa County, Frog's Leap Winery Use Permit Modification #P14-00054, 8815 Conn Creek Road, Rutherford, August 13, 2014.
[20] Napa County California, Adopted Road and Street Standards Napa County, Item #3—Exceptions To Standards, Revised August 31, 2004.
[21] Mr. Peter Corelis, Engineering and Conservation Division, Napa County, Memorandum to Ms. Shaveta Sharma, Planning Division, Napa County, Frog's Leap Ag. Processing Facility Use Permit Modification #P14-00054, 8815 Conn Creek Road, Rutherford, October 23, 2014.



Project Site Plan

North

Plan.[22] The plan encourages new developments to incorporate bicycle friendly design. Conn Creek Road has minimal striped shoulder areas (less than two feet--both directions). However, some visitors may utilize bicycles to access the proposed project. The project would provide bicycle racks for visitors to the proposed winery.

Marketing Events

The winery proposes to host the following marketing large events: four annual events with 500 guests (each). Based on standard auto occupancy rates, these annual 500-person events would be expected to generate approximately 403 trips (202 in, 201 out) including visitors and staff. These events are typically of sufficient duration in length that the inbound and outbound trips occur in separate hours, thus the number of trips on the street network at one time are half of the total volume. These events are usually held outside of typical peak traffic periods (during the middle of the day or later than 6:00 p.m.) and therefore generally do not impact peak hour operations and no other visitation or events would occur during the annual events.

6. Cumulative Conditions

Cumulative Year 2030 Projections

Model Forecast

As outlined in near-term (no project) conditions, cumulative (Year 2030) volume projections on Conn Creek Road-Rutherford Road (SR-128) and Silverado Trail were derived from the Napa County Transportation & Planning Agency's traffic volume forecasts in the Napa County General Plan Update EIR and approved/pending winery development on Conn Creek Road identified by the County (Caymus Vineyards & Frank Family Vineyards). The forecast increase in volume-to-capacity (v/c) ratio from Year 2003 to Year 2030 on Conn Creek Road-Rutherford Road between SR-29 and the Napa River was applied to the Year 2003 peak hour two-way volumes (313 vehicles). This yielded a future volume of 867 weekday PM peak hour trips on Conn Creek Road in the Year 2030. This would equate to an increase in traffic volumes of 3.9% per year to the Year 2030. Similarly, the increase in v/c ratio from Year 2003 to Year 2030 on Silverado Trail between Sage Creek Road and Yountville Cross Road was applied to the Year 2003 peak hour two-way volumes (1,352 vehicles). This yielded a future volume of 2,052 weekday PM peak hour vehicles on Silverado Trail at Sage Creek Road (adjacent to Conn Creek Road). This would equate to an increase in traffic volumes of 1.56% per year to the Year 2030 on the roadway.

Since future volume traffic forecasts are only available for the weekday PM peak hour and not for a Saturday mid-day peak hour, northbound and southbound volumes on Conn Creek Road were uniformly increased by the same percentage as listed above.

Cumulative Operating Conditions

Although cumulative volumes are conservative, the forecast volumes would yield acceptable LOS 'A-B' conditions (2,600-5,300 ADT) on Conn Creek Road-Rutherford Road. Applying the same weekday PM peak hour increase to daily traffic volumes (as a conservative measure), existing ADT on Conn Creek Road-Rutherford Road would increase from 1,600 trips to 2,656

[22] *Napa County, Countywide Bicycle Plan (2012), Planning Area-North Valley, May 2012.*

daily trips (LOS B). Existing ADT on Silverado Trail would increase from 10,548 trips to 13,345 daily trips (LOS D).

With regard to weekday PM peak hour and weekend mid-day peak hour intersection operation under cumulative year 2030 (no project) conditions, the existing Frog's Leap Winery/Conn Creek Road intersection would operate at acceptable conditions (LOS B or better) using County volume projections. With proposed project traffic, driveway intersection operation would operate at LOS A during the weekday PM peak hour and LOS B during the weekend mid-day peak hour.

The Rutherford Road/Conn Creek Road intersection would be operating at LOS D during the weekday PM and LOS C during weekend mid-day peak hour under cumulative year 2030 (no project) conditions. These operations would remain unchanged with proposed project traffic. The Silverado Trail/Conn Creek Road intersection would be operating at LOS F during both the weekday PM and weekend mid-day peak hours under cumulative year 2030 (no project) conditions. Again, these operations would remain unchanged with proposed project traffic.

The Frog's Leap Winery Driveway/Conn Creek Road and Rutherford Road/Conn Creek Road intersections would not qualify for signalization under cumulative year 2030 conditions. The Silverado Trail/Conn Creek Road intersection would continue to qualify for signalization under these same conditions. Total proposed project contribution to the intersection during the weekday PM peak hour would be 11 vehicle trips or 0.0049% of total cumulative year 2030 volumes at this location.

Additional improvements to the street network are anticipated and have been included in the General Plan's Improved 2030 Network model. As noted, the County has also adopted several measures identified in the General Plan to reduce vehicle trips through public transit and Transportation Demand Management (TDM) strategies: "The project should support programs to reduce single occupant vehicle use and encourage alternative travel modes."

- In keeping with the policy, the winery project provides bicycle racks for visitors who may arrive by bike. The project should also promote the use of public transportation and carpooling of employees (by adjusting work schedules, etc.) to facilitate the use of other transportation modes.

7. Summary and Conclusions

Daily and Peak Hour Operations

The proposed Frog's Leap fully operational winery project would generate 202-255 daily trips during the weekday and weekend periods (respectively). Proposed project traffic would represent an increase of 16 percent over the existing Conn Creek Road-Rutherford Road volume of 1,600 daily trips and would continue to operate at very acceptable levels (1,855 ADT = LOS A). Silverado Trail would continue to operate at LOS D with a daily volume of 10,668 vehicles with proposed traffic. With near-term (approved/pending) development traffic volumes, the near- term and near-term plus project conditions would continue to operate acceptably. Near-term daily volumes on Conn Creek Road-Rutherford Road are expected to be approximately 2,182 ADT without the project and 2,438 with the project trips, representative of LOS A conditions. Silverado Trial is expected to have 11,014 ADT without the project and 11,134 ADT with the proposed project indicative of LOS D operations.

The Frog's Leap Winery Driveway/Conn Creek Road and Rutherford Road/Conn Creek Road intersections would be operating at acceptable conditions (LOS A-B) under both existing plus project and near-term plus project conditions for both weekday PM and weekend mid-day peak hour conditions. The Silverado Trail/Conn Creek Road intersection would continue to operate at LOS E under existing plus project conditions for both the weekday and weekend peak hours. With near-term plus project conditions, the Silverado Trail/Conn Creek Road intersection would continue to operate at LOS F during the weekday PM and weekend mid-day peak hours, respectively.

Based on the CAMUTCD peak hour signal warrant criteria (peak hour #3), the Leap Winery Driveway/Conn Creek Road and Rutherford Road/Conn Creek Road intersections would not qualify for signalization under existing plus project or near-term plus project conditions. The Silverado Trail/Conn Creek Road intersection would continue to qualify for signalization under both scenarios. Overall project trips would constitute 0.007% of the weekday PM peak hour vehicle trips at this intersection should the County and/or Caltrans require future signalization at this location under near-term plus project conditions.

Warrant and Vehicle Sight Distance

The existing plus project and near-term plus project volumes were compared with the Napa County guidelines for installing a northbound left-turn lane on Conn Creek Road at the Frog's Leap Winery driveway.[23] (The warrant graphs for weekday and Saturday conditions are provided in the Appendix). Napa County left-turn lane warrants are based on the combination of total proposed project daily trips at the driveway and overall ADT on Conn Creek Road. With 202-255 daily weekday/weekend trips at the proposed project driveway and 2,438 daily trips on Conn Creek Road, a northbound left-turn lane ***would be warranted*** on Conn Creek Road.

Existing plus project and near-term plus project volumes were also compared with Caltrans guidelines for installing a left-turn lane on Conn Creek Road at the project driveway. Compared to Napa County standards, Caltrans guidelines for installation of a left-turn lane are based on peak hour volumes and include actual left-turn volumes. As identified under near-term plus project conditions (worst case), the winery would generate 30 peak hour trips on a typical Friday and 86 peak hour trips on a Saturday, while the peak hour volumes on Conn Creek Road are projected to be 144 vehicles on Friday and 286 vehicles on Saturday.

The peak hour traffic volumes at the winery access have been compared with left turn lane warrants outlined in a Caltrans intersection design guide.[24] By comparing the advancing and opposing S.R. 128 (Conn Creek Road) volumes with the percentage of left turning vehicles into the access road, the volumes are **well below** the Caltrans minimum threshold at which a left turn lane would be warranted. In addition, vehicle queuing analysis conducted for the intersection indicates the northbound left-turn movement from Conn Creek Road into the Frog's Leap driveway would require approximately one vehicle length (95% queue @ 30 feet) during normal weekday PM peak hour or Saturday mid-day peak hour conditions (see vehicle queuing report sheet in the Appendix).[25]

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[23] *Napa County, Adopted Road and Street Standards, revised November 21, 2006.*
[24] *Caltrans, Highway Design Manual, 6th Edition, 2009.*
[25] *Vehicle queuing analysis, Frog's Leap Driveway/Conn Creek Road, Saturday mid-day peak hour, Near-term plus project conditions (worst case), Synchro-Simtraffic software (version 6.0).*

The projected right turn volumes at the site driveway are well below minimum thresholds at which right turn lane would be required (right turn lane warrant graphs are included in the Appendix).[26]

The project applicant has requested an "exception to standards" related to the Napa County warrant being satisfied for the installation of a northbound left-turn lane at the project driveway on Conn Creek Road with proposed project traffic. [27] Consistent with the Napa County Adopted Road and Street Standards (Item #3—Exception To Standards), the request provided all supporting materials, details of the exceptions and mitigating factor, and map with the proposed location and sighting of the exception.[28] As stated in the exceptions section, "Standards that effect native trees or other geological features are prime examples of those circumstances where exceptions may be reviewed." Large native oak tree(s) are located off Conn Creek Road immediately adjacent to the proposed project driveway that would encroach on necessary ROW for installation of a left-turn lane. Subsequently, County Engineering staff has indicated that they will defer to Caltrans for any work conducted in their ROW should an encroachment permit be sought (see Appendices---Napa County Memorandum).[29]

New radar speed surveys of Conn Creek Road were conducted for the roadway in the project area. [30] The "critical" vehicle speed (the speed at which 85% of all surveyed vehicles travel at or below) along Conn Creek Road was measured at 48 mph. Caltrans' design standards indicate that these vehicle speeds require a stopping sight distance of 415-430 feet, measured along the travel lanes on Conn Creek Road.[31] Based on field measurements, sight distance from the current Frog's Leap Winery driveway to the north on Conn Creek Road is approximately 460 feet. Sight distance from the existing driveway to the south is at least 1,600 feet. Therefore, the sight distance recommendations would be met for the speed limit and measured vehicle speeds. It is noted that sight distance to the north is predicated on keeping the shoulder free of vegetation/plantings adjacent to existing vineyards.

Vehicle Circulation/Access

Proposed project driveway access to/from Conn Creek Road would remain unchanged from existing conditions. As shown in Figure 7 (Project Site Plan), the Frog's Leap driveway extends west from Conn Creek Road to existing winery and administrative buildings. Approximately 460 feet west of Conn Creek Road the driveway splits; a northern driveway provides access to administrative buildings and parking areas whereas the remaining driveway continues west providing access to winery buildings and additional parking areas. The proposed Farm Management Building would be located on the west side of the facility (as would the proposed Agricultural Processing Center building) and would be most easily accessed for this western driveway. The internal driveway widths serving both winery and administrative uses meet the

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[26] Transportation Research Board, National Cooperative Highway Research Program Report 279, "Intersection Channelization Design Guide," November, 1985.
[27] Mr. Jonah Beer, General Manager, Frog's Leap Winery, Exception Request Letter to Mr. Nate Galambos, Engineering Services, Napa County, Frog's Leap Winery Use Permit Modification #P14-00054, 8815 Conn Creek Road, Rutherford, August 13, 2014.
[28] Napa County California, Adopted Road and Street Standards Napa County, Item #3—Exceptions To Standards, Revised August 31, 2004.
[29] Mr. Peter Corelis, Engineering and Conservation Division, Napa County, Memorandum to Ms. Shaveta Sharma, Planning Division, Napa County, Frog's Leap Ag. Processing Facility Use Permit Modification #P14-00054, 8815 Conn Creek Road, Rutherford, October 23, 2014.
[30] Omni Means Engineers & Planners, Radar vehicle speed surveys, Conn Creek Road, November 16, 2013.
[31] Caltrans, Highway Design Manual, Table 405.1A, Corner (Stopping) Sight Distance, 6th Edition, 2009.

County's minimum requirement of an 18-foot travel width. The vehicle circulation area in front of the main buildings would allow access for emergency vehicles (fire trucks) and parking.

Cumulative Year 2030 Conditions

Cumulative (Year 2030) volume projections on Conn Creek Road were derived from the Napa County Transportation & Planning Agency's traffic volume forecasts in the Napa County General Plan Update EIR and adjacent approved/pending winery development identified by the County. The Frog's Leap Driveway/Conn Creek Road and Rutherford Road/Conn Creek Road intersections would operate at acceptable levels (LOS D or better) with or without proposed project traffic during the weekday PM and weekend mid-day peak hours. The Silverado Trail/Conn Creek Road intersection would be operating at LOS F with or without proposed project traffic during the same weekday and weekend peak hours. The intersection currently meets the peak hour signal warrant with existing (no project) volumes.
Overall project trips would constitute 0.0049% of the weekday PM peak hour vehicle trips at this intersection should the County and/or Caltrans require future signalization at this location.

ADT volumes on Conn Creek Road would be in the LOS A-B range at 2,656 vehicles with proposed project traffic. ADT volumes on Silverado Trail would be in the LOS D range at 13,345 vehicles with proposed project traffic.

APPENDIX

Level of Service Definitions

Level of Service Calculations

Signal Warrant Sheet

Radar Speed Surveys (Conn Creek Rd. @ Frog's Leap Winery Driveway)

Right-Turn Lane Warrant Sheet

Napa County Left-Turn Lane Warrant Graph

Caltran's Left-Turn Lane Warrant Graph

Napa County Memorandum—October 23, 2104

Synchro-Simtraffic Vehicle Queuing Report Sheet

LEVEL-OF-SERVICE CRITERIA FOR INTERSECTIONS

Level of Service	Type of Flow	Delay	Maneuverability	Control Delay (seconds/vehicle)		
				Signalized	Unsignalized	All-Way Stop
A	Stable Flow	Very slight delay. Progression is very favorable, with most vehicles arriving during the green phase not stopping at all.	Turning movements are easily made, and nearly all drivers find freedom of operation.	≤ 10.0 secs.	≤ 10.0	≤ 10.0
B	Stable Flow	Good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.	Vehicle platoons are formed. Many drivers begin to feel somewhat restricted within groups of vehicles.	>10 and ≤ 20.0 secs.	>10 and ≤ 15.0	>10 and ≤ 15.0
C	Stable Flow	Higher delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant, although many still pass through the intersection without stopping.	Back-ups may develop behind turning vehicles. Most drivers feel somewhat restricted	>20 and ≤ 35.0 secs.	>15 and ≤ 25.0	>15 and ≤ 25.0
D	Approaching Unstable Flow	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volume-to-capacity ratios. Many vehicles stop, and the proportion of vehicles of stopping declines. Individual cycle failures are noticeable.	Maneuverability is severely limited during short periods due to temporary back-ups.	>35 and ≤ 55.0 secs.	>25 and ≤ 35.0	>25 and ≤ 35.0
E	Unstable Flow	Generally considered to be the limit of acceptable delay. Indicative of poor progression, long cycle lengths, and high volume-to-capacity ratios. Individual cycle failures are frequent occurrences.	There are typically long queues of vehicles waiting upstream of the intersection.	>55 and ≤ 80.0 secs.	>35 and ≤ 50.0	>35 and ≤ 50.0
F	Forced Flow	Generally considered to be unacceptable to most drivers. Often occurs with over saturation. May also occur at high volume-to-capacity ratios. There are many individual cycle failures. Poor progression and long cycle lengths may also be major contributing factors.	Jammed conditions. Back-ups from other locations restrict or prevent movement. Volumes may vary widely, depending principally on the downstream back-up conditions.	> 80.0 secs.	> 50.0	> 50.0

References: 1. Highway Capacity Manual, Fourth Edition, Transportation Research Board, 2000,

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	7	13	2	42	35	3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	14	2	46	38	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	90	40	41			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	90	40	41			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	99	100			
cM capacity (veh/h)	910	1032	1568			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	22	48	41
Volume Left	8	2	0
Volume Right	14	0	3
cSH	1587	1568	1700
Volume to Capacity	0.01	0.00	0.02
Queue Length 95th (ft)	1	0	0
Control Delay (s)	8.7	0.3	0.0
Lane LOS	A	A	
Approach Delay (s)	8.7	0.3	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	13.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	11	15	11	105	95	12
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	12	16	12	114	103	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	248	110	116			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	248	110	116			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	98	99			
cM capacity (veh/h)	735	944	1472			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	28	126	116
Volume Left	12	12	0
Volume Right	16	0	13
cSH	1636	1472	1700
Volume to Capacity	0.02	0.01	0.07
Queue Length 95th (ft)	1	1	0
Control Delay (s)	9.3	0.8	0.0
Lane LOS	A	A	
Approach Delay (s)	9.3	0.8	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	22.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	35	0	55	10	3	5	42	356	0	1	893	35
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	0	60	11	3	5	46	387	0	1	971	38
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			1									
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1477	1470	990	1481	1489	387	1009			387		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1477	1470	990	1481	1489	387	1009			387		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	60	100	80	86	97	99	93			100		
cM capacity (veh/h)	96	119	299	79	116	661	687			1172		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	98	20	46	387	1	1009
Volume Left	38	11	46	0	1	0
Volume Right	60	5	0	0	0	38
cSH	205	112	687	1700	1172	1700
Volume to Capacity	0.48	0.17	0.07	0.23	0.00	0.59
Queue Length 95th (ft)	58	15	5	0	0	0
Control Delay (s)	37.6	43.9	10.6	0.0	8.1	0.0
Lane LOS	E	E	B		A	
Approach Delay (s)	37.6	43.9	1.1		0.0	
Approach LOS	E	E				

Intersection Summary				
Average Delay	3.2			
Intersection Capacity Utilization	65.9%	ICU Level of Service	C	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	62	2	52	16	1	8	37	464	7	18	597	33
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	67	2	57	17	1	9	40	504	8	20	649	36
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			1									
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1300	1298	667	1306	1312	508	685			512		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1300	1298	667	1306	1312	508	685			512		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	48	99	88	85	99	98	96			98		
cM capacity (veh/h)	129	152	459	113	149	565	909			1053		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	126	27	40	512	20	685
Volume Left	67	17	40	0	20	0
Volume Right	57	9	0	8	0	36
cSH	213	154	909	1700	1053	1700
Volume to Capacity	0.59	0.18	0.04	0.30	0.02	0.40
Queue Length 95th (ft)	83	15	3	0	1	0
Control Delay (s)	43.8	33.3	9.1	0.0	8.5	0.0
Lane LOS	E	D	A		A	
Approach Delay (s)	43.8	33.3	0.7		0.2	
Approach LOS	E	D				

Intersection Summary				
Average Delay	4.9			
Intersection Capacity Utilization	50.1%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	81	184	39	49	32	11
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	88	200	42	53	35	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			288		326	188
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			288		326	188
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		95	99
cM capacity (veh/h)			1274		646	854

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	288	90	47
Volume Left	0	42	35
Volume Right	200	0	12
cSH	1700	1274	689
Volume to Capacity	0.17	0.03	0.07
Queue Length 95th (ft)	0	3	5
Control Delay (s)	0.0	3.7	10.6
Lane LOS		A	B
Approach Delay (s)	0.0	3.7	10.6
Approach LOS			B

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	33.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	88	35	15	88	18	12
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	96	38	16	96	20	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			134		243	115
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			134		243	115
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		97	99
cM capacity (veh/h)			1451		737	938

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	134	112	33
Volume Left	0	16	20
Volume Right	38	0	13
cSH	1700	1451	806
Volume to Capacity	0.08	0.01	0.04
Queue Length 95th (ft)	0	1	3
Control Delay (s)	0.0	1.2	9.7
Lane LOS		A	A
Approach Delay (s)	0.0	1.2	9.7
Approach LOS			A

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	25.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	7	13	2	80	64	3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	14	2	87	70	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	162	71	73			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	162	71	73			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	99	100			
cM capacity (veh/h)	827	991	1527			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	22	89	73
Volume Left	8	2	0
Volume Right	14	0	3
cSH	1525	1527	1700
Volume to Capacity	0.01	0.00	0.04
Queue Length 95th (ft)	1	0	0
Control Delay (s)	8.9	0.2	0.0
Lane LOS	A	A	
Approach Delay (s)	8.9	0.2	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	15.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	11	15	11	149	137	12
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	12	16	12	162	149	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	341	155	162			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	341	155	162			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	98	99			
cM capacity (veh/h)	649	890	1417			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	28	174	162
Volume Left	12	12	0
Volume Right	16	0	13
cSH	1535	1417	1700
Volume to Capacity	0.02	0.01	0.10
Queue Length 95th (ft)	1	1	0
Control Delay (s)	9.8	0.6	0.0
Lane LOS	A	A	
Approach Delay (s)	9.8	0.6	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	26.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	52	0	80	10	3	5	50	367	0	1	921	41
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	57	0	87	11	3	5	54	399	0	1	1001	45
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			1									
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1540	1533	1023	1554	1555	399	1046			399		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1540	1533	1023	1554	1555	399	1046			399		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	34	100	70	82	97	99	92			100		
cM capacity (veh/h)	85	107	286	60	104	651	665			1160		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	143	20	54	399	1	1046
Volume Left	57	11	54	0	1	0
Volume Right	87	5	0	0	0	45
cSH	171	89	665	1700	1160	1700
Volume to Capacity	0.84	0.22	0.08	0.23	0.00	0.62
Queue Length 95th (ft)	145	20	7	0	0	0
Control Delay (s)	85.8	56.9	10.9	0.0	8.1	0.0
Lane LOS	F	F	B		A	
Approach Delay (s)	85.8	56.9	1.3		0.0	
Approach LOS	F	F				

Intersection Summary				
Average Delay	8.4			
Intersection Capacity Utilization	69.2%	ICU Level of Service	C	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	83	2	73	16	1	8	55	478	7	18	616	50
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	90	2	79	17	1	9	60	520	8	20	670	54
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			1									
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1384	1383	697	1392	1406	523	724			527		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1384	1383	697	1392	1406	523	724			527		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	18	98	82	81	99	98	93			98		
cM capacity (veh/h)	110	131	441	90	127	554	879			1040		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	172	27	60	527	20	724
Volume Left	90	17	60	0	20	0
Volume Right	79	9	0	8	0	54
cSH	179	125	879	1700	1040	1700
Volume to Capacity	0.96	0.22	0.07	0.31	0.02	0.43
Queue Length 95th (ft)	190	20	5	0	1	0
Control Delay (s)	110.2	41.5	9.4	0.0	8.5	0.0
Lane LOS	F	E	A		A	
Approach Delay (s)	110.2	41.5	1.0		0.2	
Approach LOS	F	E				

Intersection Summary				
Average Delay	13.6			
Intersection Capacity Utilization	56.9%	ICU Level of Service	B	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	101	204	66	90	51	29
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	110	222	72	98	55	32
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			332		462	221
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			332		462	221
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			94		89	96
cM capacity (veh/h)			1228		525	819

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	332	170	87
Volume Left	0	72	55
Volume Right	222	0	32
cSH	1700	1228	604
Volume to Capacity	0.20	0.06	0.14
Queue Length 95th (ft)	0	5	13
Control Delay (s)	0.0	3.7	12.0
Lane LOS		A	B
Approach Delay (s)	0.0	3.7	12.0
Approach LOS			B

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	40.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	146	39	43	145	20	40
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	159	42	47	158	22	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			201		431	180
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			201		431	180
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		96	95
cM capacity (veh/h)			1371		562	863

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	201	204	65
Volume Left	0	47	22
Volume Right	42	0	43
cSH	1700	1371	732
Volume to Capacity	0.12	0.03	0.09
Queue Length 95th (ft)	0	3	7
Control Delay (s)	0.0	2.0	10.4
Lane LOS		A	B
Approach Delay (s)	0.0	2.0	10.4
Approach LOS			B

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	33.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	8	16	3	42	35	3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	17	3	46	38	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	92	40	41			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	92	40	41			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	98	100			
cM capacity (veh/h)	906	1032	1568			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	26	49	41
Volume Left	9	3	0
Volume Right	17	0	3
cSH	1548	1568	1700
Volume to Capacity	0.02	0.00	0.02
Queue Length 95th (ft)	1	0	0
Control Delay (s)	8.7	0.5	0.0
Lane LOS	A	A	
Approach Delay (s)	8.7	0.5	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	14.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	19	27	19	105	95	21
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	21	29	21	114	103	23
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	270	115	126			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	270	115	126			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	97	99			
cM capacity (veh/h)	709	938	1460			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	50	135	126
Volume Left	21	21	0
Volume Right	29	0	23
cSH	1598	1460	1700
Volume to Capacity	0.03	0.01	0.07
Queue Length 95th (ft)	2	1	0
Control Delay (s)	9.5	1.2	0.0
Lane LOS	A	A	
Approach Delay (s)	9.5	1.2	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	23.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	35	0	56	10	3	5	42	356	0	1	893	35
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	0	61	11	3	5	46	387	0	1	971	38
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			1									
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1477	1470	990	1482	1489	387	1009			387		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1477	1470	990	1482	1489	387	1009			387		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	60	100	80	86	97	99	93			100		
cM capacity (veh/h)	96	119	299	78	116	661	687			1172		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	99	20	46	387	1	1009
Volume Left	38	11	46	0	1	0
Volume Right	61	5	0	0	0	38
cSH	207	111	687	1700	1172	1700
Volume to Capacity	0.48	0.18	0.07	0.23	0.00	0.59
Queue Length 95th (ft)	58	15	5	0	0	0
Control Delay (s)	37.3	44.1	10.6	0.0	8.1	0.0
Lane LOS	E	E	B		A	
Approach Delay (s)	37.3	44.1	1.1		0.0	
Approach LOS	E	E				

Intersection Summary				
Average Delay	3.2			
Intersection Capacity Utilization	65.9%	ICU Level of Service	C	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	65	2	57	16	1	8	42	464	7	18	597	37
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	71	2	62	17	1	9	46	504	8	20	649	40
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			1									
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1313	1311	669	1320	1328	508	689			512		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1313	1311	669	1320	1328	508	689			512		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	44	99	86	84	99	98	95			98		
cM capacity (veh/h)	126	148	458	109	145	565	905			1053		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	135	27	46	512	20	689
Volume Left	71	17	46	0	20	0
Volume Right	62	9	0	8	0	40
cSH	211	148	905	1700	1053	1700
Volume to Capacity	0.64	0.18	0.05	0.30	0.02	0.41
Queue Length 95th (ft)	95	16	4	0	1	0
Control Delay (s)	47.9	34.6	9.2	0.0	8.5	0.0
Lane LOS	E	D	A		A	
Approach Delay (s)	47.9	34.6	0.8		0.2	
Approach LOS	E	D				

Intersection Summary				
Average Delay	5.6			
Intersection Capacity Utilization	50.5%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	82	184	40	51	32	11
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	89	200	43	55	35	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			289		332	189
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			289		332	189
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		95	99
cM capacity (veh/h)			1273		641	853

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	289	99	47
Volume Left	0	43	35
Volume Right	200	0	12
cSH	1700	1273	684
Volume to Capacity	0.17	0.03	0.07
Queue Length 95th (ft)	0	3	5
Control Delay (s)	0.0	3.6	10.6
Lane LOS		A	B
Approach Delay (s)	0.0	3.6	10.6
Approach LOS			B

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	33.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	95	35	18	97	18	13
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	103	38	20	105	20	14
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			141		267	122
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			141		267	122
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		97	98
cM capacity (veh/h)			1442		713	929

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	141	125	34
Volume Left	0	20	20
Volume Right	38	0	14
cSH	1700	1442	790
Volume to Capacity	0.08	0.01	0.04
Queue Length 95th (ft)	0	1	3
Control Delay (s)	0.0	1.3	9.8
Lane LOS		A	A
Approach Delay (s)	0.0	1.3	9.8
Approach LOS			A

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	26.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	8	16	3	80	64	3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	17	3	87	70	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	165	71	73			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	165	71	73			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	98	100			
cM capacity (veh/h)	824	991	1527			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	26	90	73
Volume Left	9	3	0
Volume Right	17	0	3
cSH	1487	1527	1700
Volume to Capacity	0.02	0.00	0.04
Queue Length 95th (ft)	1	0	0
Control Delay (s)	8.9	0.3	0.0
Lane LOS	A	A	
Approach Delay (s)	8.9	0.3	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	16.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	19	27	19	149	137	21
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	21	29	21	162	149	23
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	364	160	172			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	364	160	172			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	97	99			
cM capacity (veh/h)	626	885	1405			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	50	183	172
Volume Left	21	21	0
Volume Right	29	0	23
cSH	1507	1405	1700
Volume to Capacity	0.03	0.01	0.10
Queue Length 95th (ft)	3	1	0
Control Delay (s)	9.9	1.0	0.0
Lane LOS	A	A	
Approach Delay (s)	9.9	1.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	30.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	52	0	81	10	3	5	50	367	0	1	921	41
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	57	0	88	11	3	5	54	399	0	1	1001	45
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			1									
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1540	1533	1023	1555	1555	399	1046			399		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1540	1533	1023	1555	1555	399	1046			399		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	34	100	69	82	97	99	92			100		
cM capacity (veh/h)	85	107	286	60	104	651	665			1160		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	145	20	54	399	1	1046
Volume Left	57	11	54	0	1	0
Volume Right	88	5	0	0	0	45
cSH	172	88	665	1700	1160	1700
Volume to Capacity	0.84	0.22	0.08	0.23	0.00	0.62
Queue Length 95th (ft)	146	20	7	0	0	0
Control Delay (s)	85.8	57.2	10.9	0.0	8.1	0.0
Lane LOS	F	F	B		A	
Approach Delay (s)	85.8	57.2	1.3		0.0	
Approach LOS	F	F				

Intersection Summary				
Average Delay	8.5			
Intersection Capacity Utilization	69.3%	ICU Level of Service	C	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	86	2	78	16	1	8	60	478	7	18	616	54
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	93	2	85	17	1	9	65	520	8	20	670	59
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			1									
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1397	1396	699	1406	1421	523	728			527		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1397	1396	699	1406	1421	523	728			527		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	13	98	81	80	99	98	93			98		
cM capacity (veh/h)	108	128	440	86	124	554	875			1040		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	180	27	65	527	20	728
Volume Left	93	17	65	0	20	0
Volume Right	85	9	0	8	0	59
cSH	176	120	875	1700	1040	1700
Volume to Capacity	1.02	0.23	0.07	0.31	0.02	0.43
Queue Length 95th (ft)	212	20	6	0	1	0
Control Delay (s)	127.6	43.4	9.4	0.0	8.5	0.0
Lane LOS	F	E	A		A	
Approach Delay (s)	127.6	43.4	1.0		0.2	
Approach LOS	F	E				

Intersection Summary				
Average Delay	16.1			
Intersection Capacity Utilization	57.1%	ICU Level of Service		B
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	102	204	67	92	51	29
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	111	222	73	100	55	32
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			333		467	222
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			333		467	222
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			94		89	96
cM capacity (veh/h)			1227		521	818

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	333	173	87
Volume Left	0	73	55
Volume Right	222	0	32
cSH	1700	1227	600
Volume to Capacity	0.20	0.06	0.14
Queue Length 95th (ft)	0	5	13
Control Delay (s)	0.0	3.7	12.0
Lane LOS		A	B
Approach Delay (s)	0.0	3.7	12.0
Approach LOS			B

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	41.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	153	39	46	154	20	41
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	166	42	50	167	22	45
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			209		455	188
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			209		455	188
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		96	95
cM capacity (veh/h)			1362		543	855

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	209	217	66
Volume Left	0	50	22
Volume Right	42	0	45
cSH	1700	1362	719
Volume to Capacity	0.12	0.04	0.09
Queue Length 95th (ft)	0	3	8
Control Delay (s)	0.0	2.0	10.5
Lane LOS		A	B
Approach Delay (s)	0.0	2.0	10.5
Approach LOS			B

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	34.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	8	16	3	105	84	3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	17	3	114	91	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	214	93	95			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	214	93	95			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	98	100			
cM capacity (veh/h)	773	964	1499			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	26	117	95
Volume Left	9	3	0
Volume Right	17	0	3
cSH	1446	1499	1700
Volume to Capacity	0.02	0.00	0.06
Queue Length 95th (ft)	1	0	0
Control Delay (s)	9.1	0.2	0.0
Lane LOS	A	A	
Approach Delay (s)	9.1	0.2	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	17.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	19	27	19	210	130	21
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	21	29	21	228	141	23
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		1				
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	422	153	164			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	422	153	164			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	97	99			
cM capacity (veh/h)	580	893	1414			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	50	249	164
Volume Left	21	21	0
Volume Right	29	0	23
cSH	1403	1414	1700
Volume to Capacity	0.04	0.01	0.10
Queue Length 95th (ft)	3	1	0
Control Delay (s)	10.1	0.7	0.0
Lane LOS	B	A	
Approach Delay (s)	10.1	0.7	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	33.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	49	0	76	10	3	5	49	585	0	1	1467	40
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	53	0	83	11	3	5	53	636	0	1	1595	43
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			1									
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2368	2361	1616	2380	2383	636	1638			636		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2368	2361	1616	2380	2383	636	1638			636		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	35	0	89	99	87			100		
cM capacity (veh/h)	20	31	128	8	30	478	395			948		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	136	20	53	636	1	1638
Volume Left	53	11	53	0	1	0
Volume Right	83	5	0	0	0	43
cSH	41	13	395	1700	948	1700
Volume to Capacity	3.30	1.56	0.13	0.37	0.00	0.96
Queue Length 95th (ft)	Err	80	12	0	0	0
Control Delay (s)	Err	885.9	15.5	0.0	8.8	0.0
Lane LOS	F	F	C		A	
Approach Delay (s)	Err	885.9	1.2		0.0	
Approach LOS	F	F				

Intersection Summary			
Average Delay	554.3		
Intersection Capacity Utilization	97.7%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	78	2	69	16	1	8	54	763	7	18	981	49
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	85	2	75	17	1	9	59	829	8	20	1066	53
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			1									
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	2088	2086	1093	2095	2109	833	1120			837		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	2088	2086	1093	2095	2109	833	1120			837		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	95	71	27	98	98	91			98		
cM capacity (veh/h)	34	47	261	24	45	368	624			797		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	162	27	59	837	20	1120
Volume Left	85	17	59	0	20	0
Volume Right	75	9	0	8	0	53
cSH	57	35	624	1700	797	1700
Volume to Capacity	2.84	0.77	0.09	0.49	0.02	0.66
Queue Length 95th (ft)	418	68	8	0	2	0
Control Delay (s)	981.8	252.9	11.4	0.0	9.6	0.0
Lane LOS	F	F	B		A	
Approach Delay (s)	981.8	252.9	0.7		0.2	
Approach LOS	F	F				

Intersection Summary				
Average Delay	75.0			
Intersection Capacity Utilization	72.2%	ICU Level of Service	C	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	554	190	63	364	49	28
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	602	207	68	396	53	30
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			809		1238	705
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			809		1238	705
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			92		70	93
cM capacity (veh/h)			817		178	436

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	809	464	84
Volume Left	0	68	53
Volume Right	207	0	30
cSH	1700	817	227
Volume to Capacity	0.48	0.08	0.37
Queue Length 95th (ft)	0	7	40
Control Delay (s)	0.0	2.4	29.9
Lane LOS		A	D
Approach Delay (s)	0.0	2.4	29.9
Approach LOS			D

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		

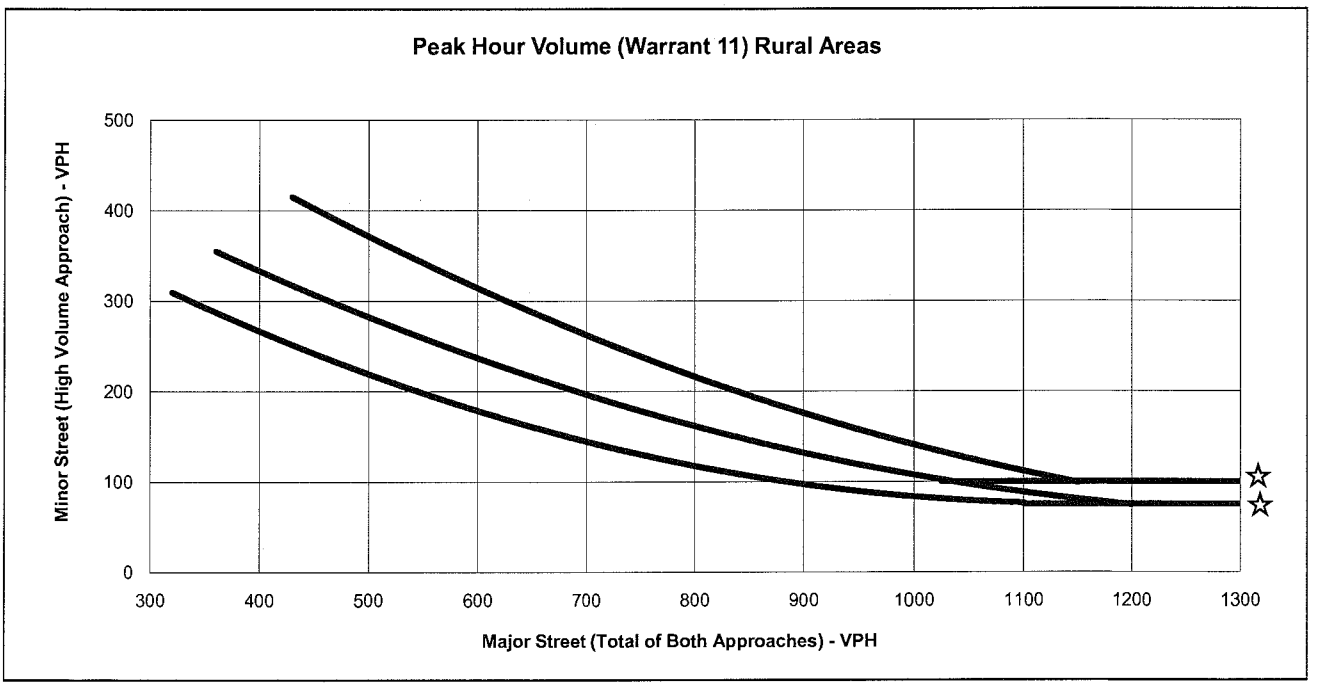
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	484	36	42	484	19	39
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	526	39	46	526	21	42
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			565		1163	546
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			565		1163	546
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			95		90	92
cM capacity (veh/h)			1007		205	538

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	565	572	63
Volume Left	0	46	21
Volume Right	39	0	42
cSH	1700	1007	352
Volume to Capacity	0.33	0.05	0.18
Queue Length 95th (ft)	0	4	16
Control Delay (s)	0.0	1.2	17.5
Lane LOS		A	C
Approach Delay (s)	0.0	1.2	17.5
Approach LOS			C

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	68.9%	ICU Level of Service	C
Analysis Period (min)	15		

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
370	280				
400	270	460	297	430	410
500	215	500	290	500	380
600	185	600	230	600	310
700	140	700	198	700	265
800	115	800	170	800	210
900	99	900	125	900	180
1000	85	1000	105	1000	140
1100	75	1100	90	1100	110
1200	75	1200	75	1150	100
1300	75	1300	75	1300	100

** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation*

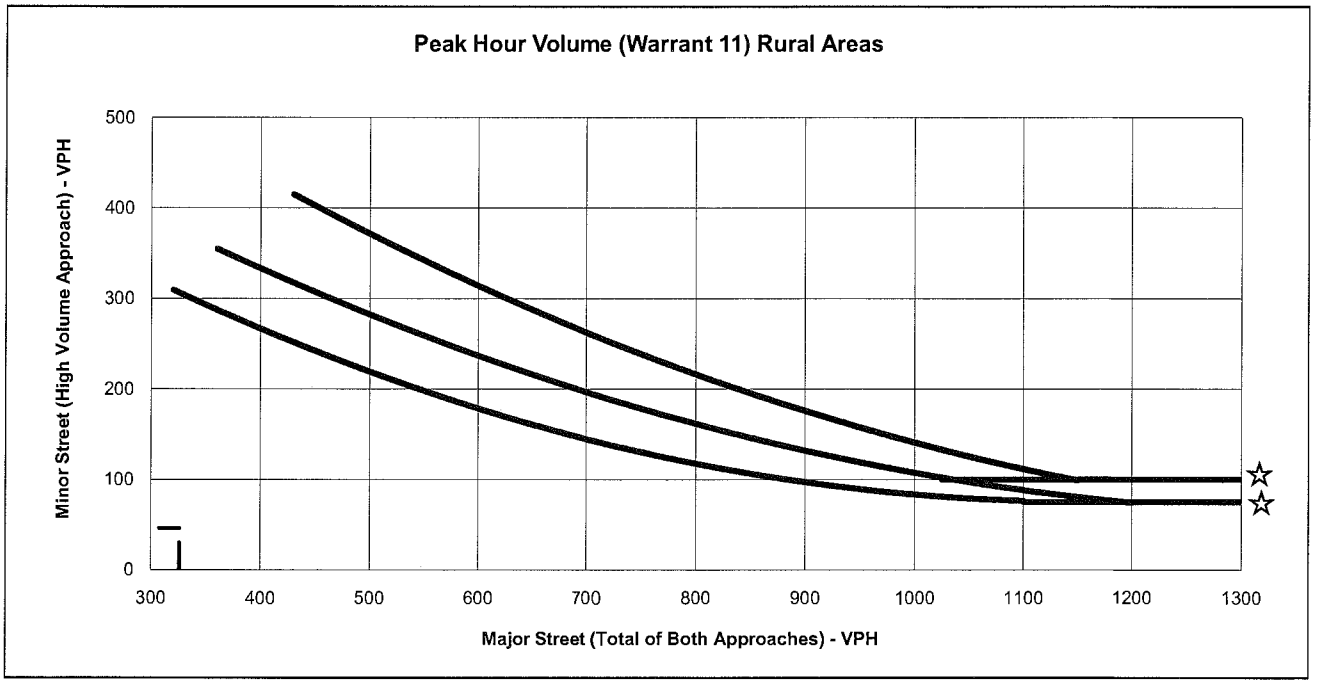


☆ NOTE:
100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Intersection:	Frog's Leap Driveway / Conn Creek Road (S.R. 128)
Scenario:	Weekday PM Peak Hour----Near-Term plus Project Conditions (worst case)
Minor St. Volume:	24
Major St. Volume:	150
Warrant Met?:	**NO**

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
370	280				
400	270	460	297	430	410
500	215	500	290	500	380
600	185	600	230	600	310
700	140	700	198	700	265
800	115	800	170	800	210
900	99	900	125	900	180
1000	85	1000	105	1000	140
1100	75	1100	90	1100	110
1200	75	1200	75	1150	100
1300	75	1300	75	1300	100

** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation*

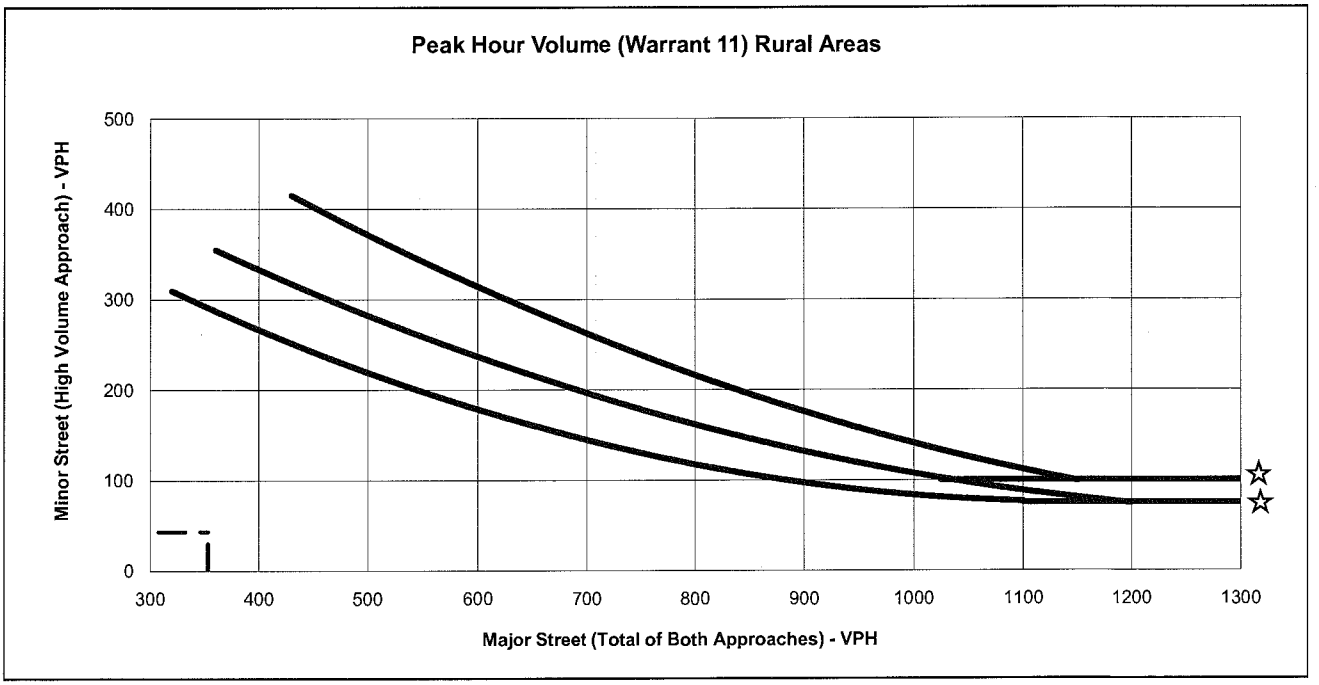


☆ NOTE:
100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Intersection:	Frog's Leap Driveway / Conn Creek Road (S.R. 128)
Scenario:	Saturday mid-day peak hour -- Near-Term plus Project Conditions (worst case)
Minor St. Volume:	46
Major St. Volume:	326
Warrant Met?:	**NO**

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
370	280				
400	270	460	297	430	410
500	215	500	290	500	380
600	185	600	230	600	310
700	140	700	198	700	265
800	115	800	170	800	210
900	99	900	125	900	180
1000	85	1000	105	1000	140
1100	75	1100	90	1100	110
1200	75	1200	75	1150	100
1300	75	1300	75	1300	100

** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation*



☆ NOTE:
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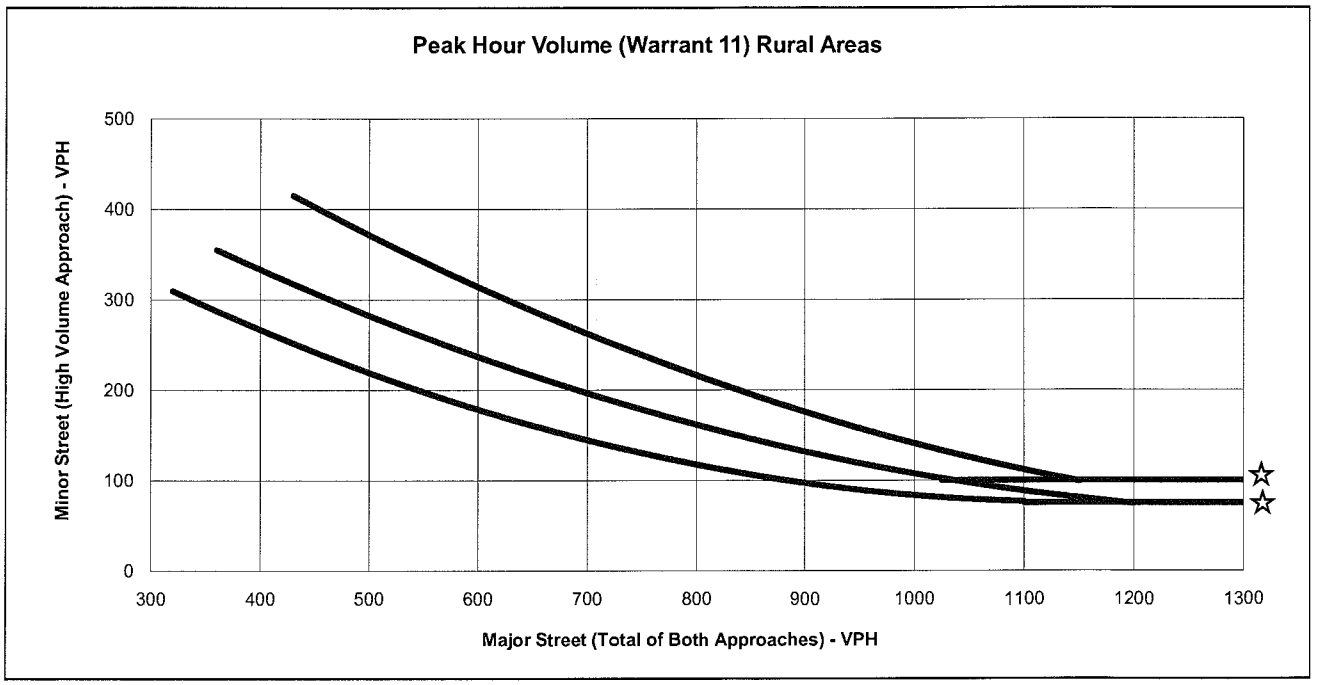
Intersection:	Rutherford Road / Conn Creek Road (S.R. 128)
Scenario:	Weekday PM Peak Hour --- Existing Conditions
Minor St. Volume:	43
Major St. Volume:	353
Warrant Met?:	**NO**

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
370	280				
400	270	460	297	430	410
500	215	500	290	500	380
600	185	600	230	600	310
700	140	700	198	700	265
800	115	800	170	800	210
900	99	900	125	900	180
1000	85	1000	105	1000	140
1100	75	1100	90	1100	110
1200	75	1200	75	1150	100
1300	75	1300	75	1300	100

** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation*



☆ NOTE:
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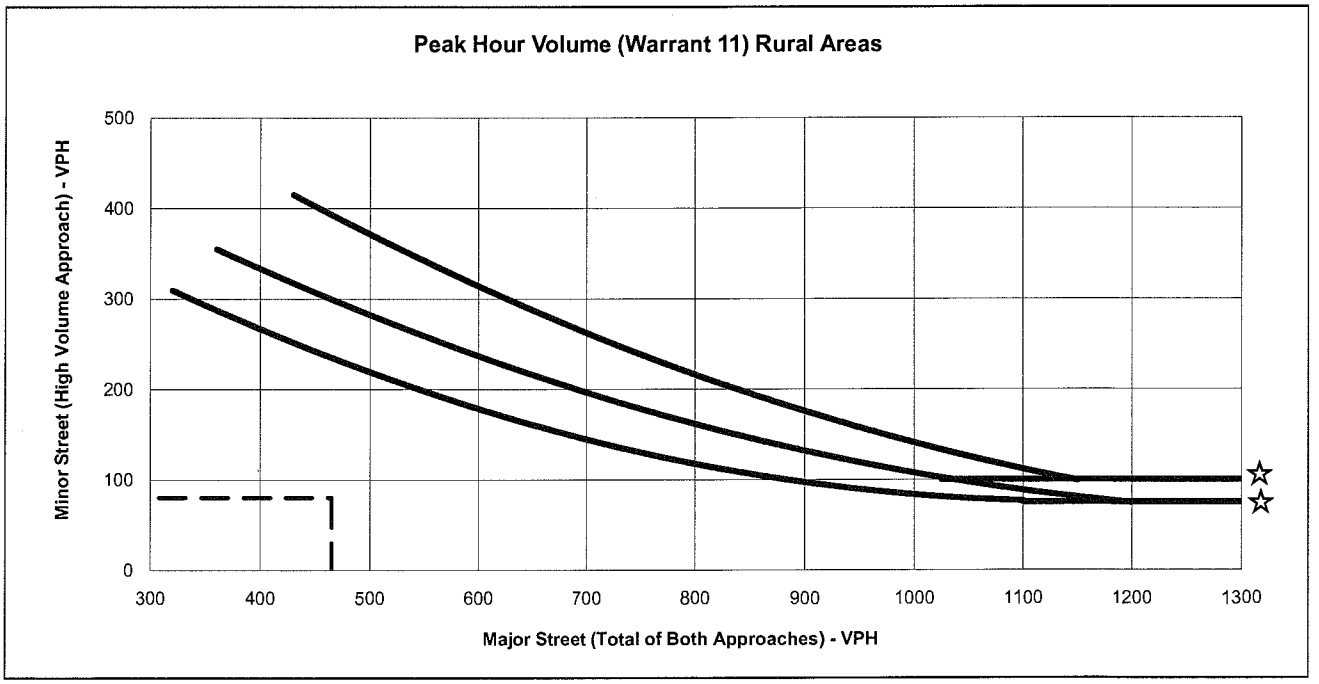
Intersection: Rutherford Road / Conn Creek Road (S.R. 128)
Scenario: Saturday mid-day peak hour -- Existing Conditions
Minor St. Volume: 30
Major St. Volume: 226
Warrant Met?: **NO**

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
370	280				
400	270	460	297	430	410
500	215	500	290	500	380
600	185	600	230	600	310
700	140	700	198	700	265
800	115	800	170	800	210
900	99	900	125	900	180
1000	85	1000	105	1000	140
1100	75	1100	90	1100	110
1200	75	1200	75	1150	100
1300	75	1300	75	1300	100

** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation*

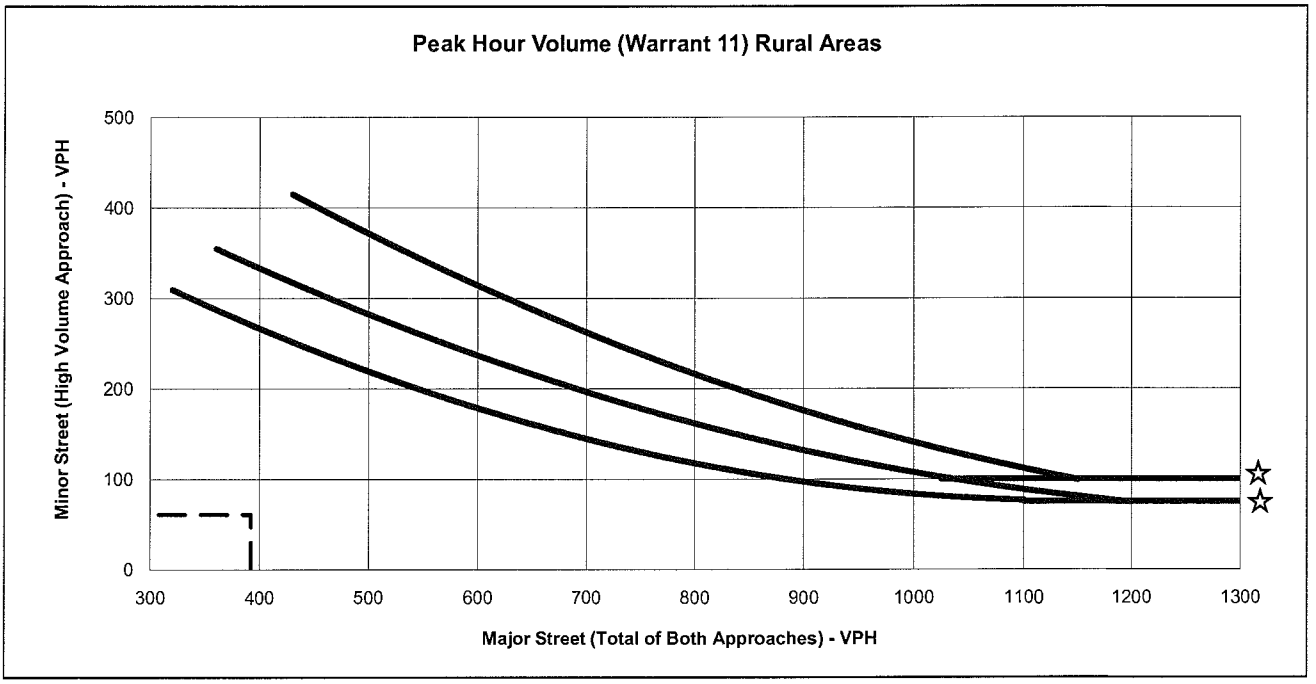


☆ NOTE:
100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Intersection:	Rutherford Road / Conn Creek Road (S.R. 128)
Scenario:	Weekday PM Peak Hour --- Near-Term plus Project Conditions (Worst Case)
Minor St. Volume:	80
Major St. Volume:	465
Warrant Met?:	**NO**

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
370	280				
400	270	460	297	430	410
500	215	500	290	500	380
600	185	600	230	600	310
700	140	700	198	700	265
800	115	800	170	800	210
900	99	900	125	900	180
1000	85	1000	105	1000	140
1100	75	1100	90	1100	110
1200	75	1200	75	1150	100
1300	75	1300	75	1300	100

** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation*



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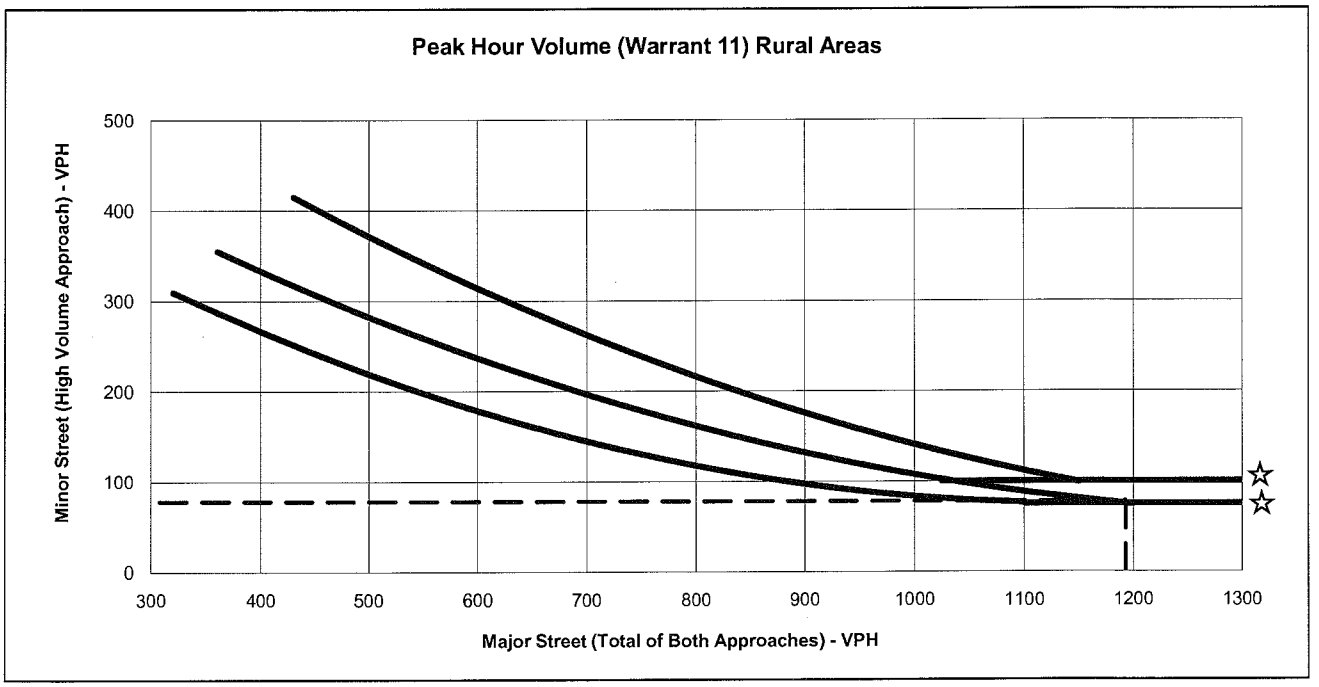
Intersection:	Rutherford Road / Conn Creek Road (S.R. 128)
Scenario:	Saturday mid-day peak hour -- Near-Term plus Project Conditions (Worst Case)
Minor St. Volume:	61
Major St. Volume:	392
Warrant Met?:	**NO**

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
370	280				
400	270	460	297	430	410
500	215	500	290	500	380
600	185	600	230	600	310
700	140	700	198	700	265
800	115	800	170	800	210
900	99	900	125	900	180
1000	85	1000	105	1000	140
1100	75	1100	90	1100	110
1200	75	1200	75	1150	100
1300	75	1300	75	1300	100

** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation*

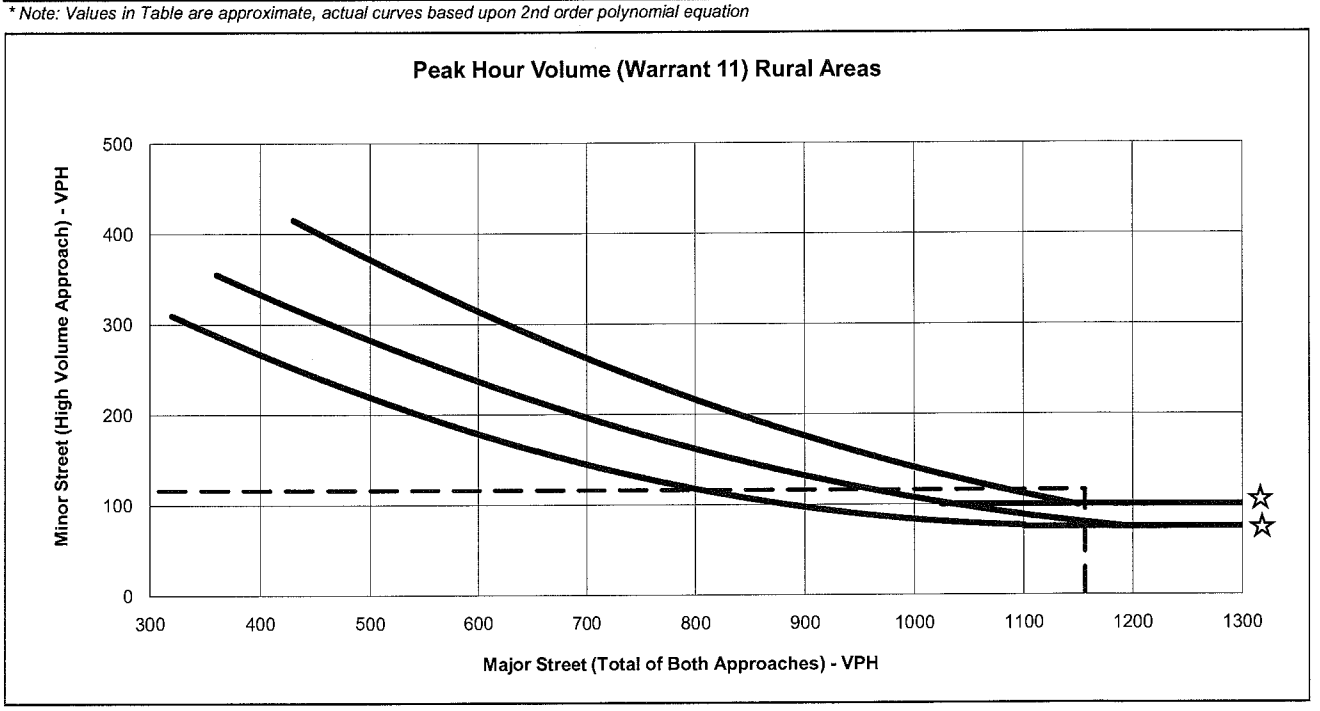


☆ NOTE:
100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Intersection:	Silverado Trail / Conn Creek Road (S.R. 128)
Scenario:	Weekday PM Peak Hour --- Existing Conditions
Minor St. Volume:	78
Major St. Volume:	1193
Warrant Met?:	**YES**

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
370	280				
400	270	460	297	430	410
500	215	500	290	500	380
600	185	600	230	600	310
700	140	700	198	700	265
800	115	800	170	800	210
900	99	900	125	900	180
1000	85	1000	105	1000	140
1100	75	1100	90	1100	110
1200	75	1200	75	1150	100
1300	75	1300	75	1300	100

** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation*

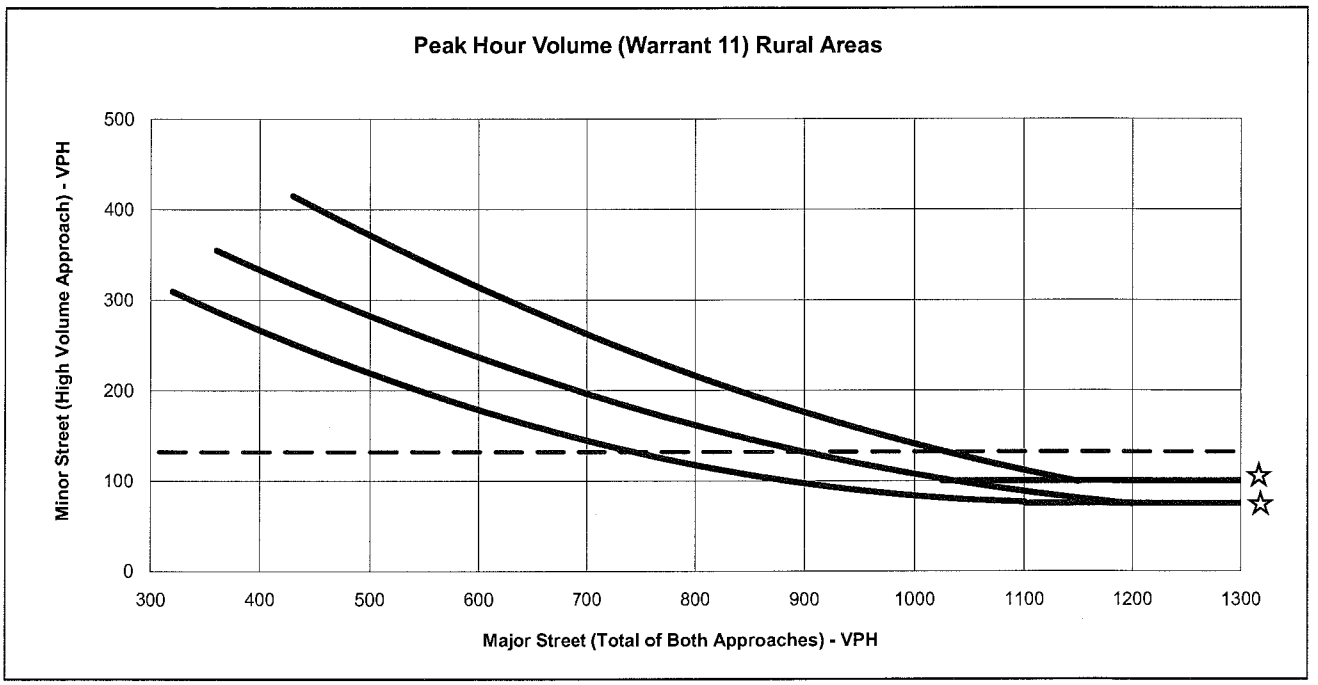


☆ NOTE:
100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Intersection: Silverado Trail / Conn Creek Road (S.R. 128)
Scenario: Weekdend Mid-Day PM Peak Hour --- Existing Conditions
Minor St. Volume: 116
Major St. Volume: 1156
Warrant Met?: **YES**

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
370	280				
400	270	460	297	430	410
500	215	500	290	500	380
600	185	600	230	600	310
700	140	700	198	700	265
800	115	800	170	800	210
900	99	900	125	900	180
1000	85	1000	105	1000	140
1100	75	1100	90	1100	110
1200	75	1200	75	1150	100
1300	75	1300	75	1300	100

** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation*

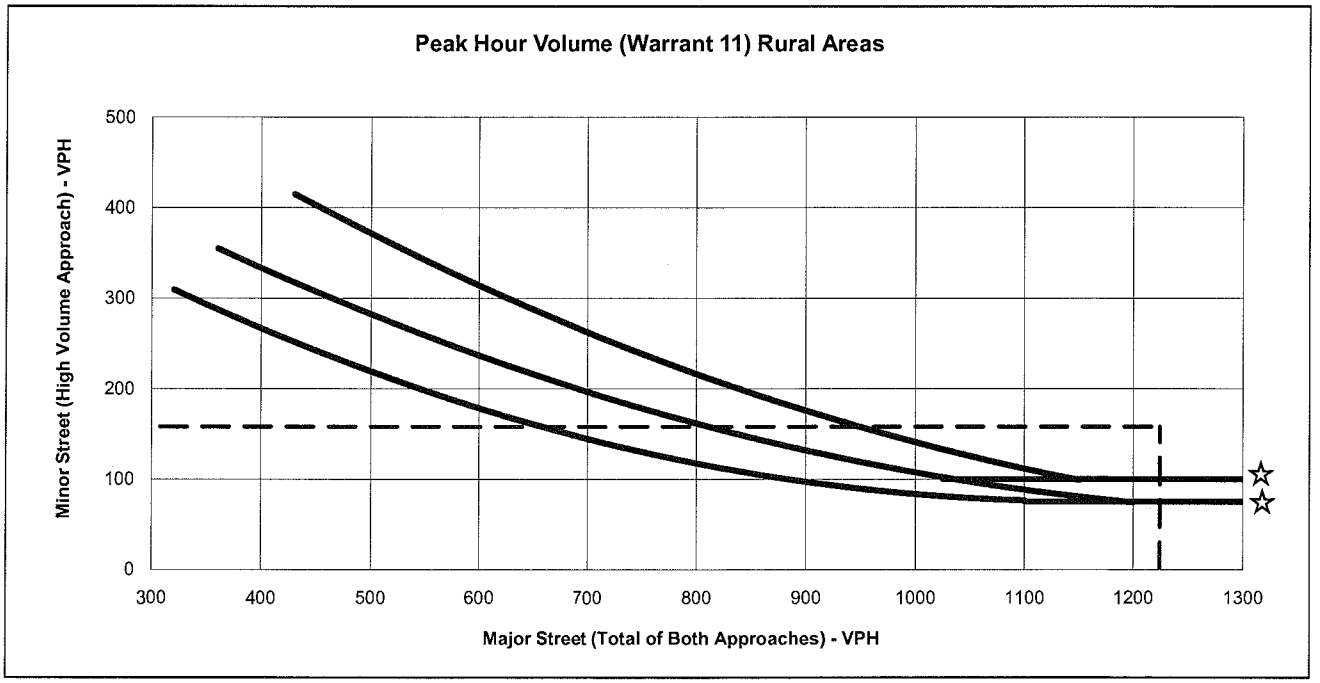


☆ NOTE:
100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Intersection: Silverado Trail / Conn Creek Road (S.R. 128)
Scenario: Weekday PM Peak Hour --- Near-Term plus Project Conditions
Minor St. Volume: 132
Major St. Volume: 1379
Warrant Met?: **YES**

Both 1 Lane Approaches		2 or more Lane and One Lane Approaches		Both 2 or more Lane Approaches	
Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach	Major Street Total of Both Approaches	Minor Street High Volume Approach
370	280				
400	270	460	297	430	410
500	215	500	290	500	380
600	185	600	230	600	310
700	140	700	198	700	265
800	115	800	170	800	210
900	99	900	125	900	180
1000	85	1000	105	1000	140
1100	75	1100	90	1100	110
1200	75	1200	75	1150	100
1300	75	1300	75	1300	100

** Note: Values in Table are approximate, actual curves based upon 2nd order polynomial equation*



☆ NOTE:
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Intersection:	Silverado Trail / Conn Creek Road (S.R. 128)
Scenario:	Weekdend Mid-Day PM Peak Hour --- Near-Term plus Project Conditions
Minor St. Volume:	158
Major St. Volume:	1224
Warrant Met?:	**YES**

RADAR SPEED SURVEY

OMNI-MEANS LTD.

Conn Creek Rd. approaching Frogs Leap Winery Access

DATE: 11/16/13 TIME START: 1:30pm TIME END: 3:00pm WEATHER: Clear ROAD TYPE: 2 lanes; Rural

DIRECTION: Both SPEED LIMIT: Not Posted OBSERVER: o-m CALIBRATION TEST: Yes

SPEED	FREQUENCY	ACUM %	PERCENTAGE BREAKDOWN
33	2	2.0	!**
34	1	3.0	!***
35	3	6.0	!****5*
36	5	11.0	!****5****1*
37	6	17.0	!****5****1****5**
38	6	23.0	!****5****1****5****2***
39	3	26.0	!****5****1****5****2****5*
40	3	29.0	!****5****1****5****2****5****
41	4	33.0	!****5****1****5****2****5****3***
42	5	38.0	!****5****1****5****2****5****3****5***
43	8	46.0	!****5****1****5****2****5****3****5****4****5*
44	5	51.0	!****5****1****5****2****5****3****5****4****5****5*
45	10	61.0	!****5****1****5****2****5****3****5****4****5****5****5****6*
46	8	69.0	!****5****1****5****2****5****3****5****4****5****5****5****6****5****
47	10	79.0	!****5****1****5****2****5****3****5****4****5****5****5****6****5****7****5****
48	6	85.0	!****5****1****5****2****5****3****5****4****5****5****5****6****5****7****5****8****5
49	2	87.0	!****5****1****5****2****5****3****5****4****5****5****5****6****5****7****5****8****5**
50	2	89.0	!****5****1****5****2****5****3****5****4****5****5****5****6****5****7****5****8****5****
51	3	92.0	!****5****1****5****2****5****3****5****4****5****5****5****6****5****7****5****8****5****9**
52	6	98.0	!****5****1****5****2****5****3****5****4****5****5****5****6****5****7****5****8****5****9****5***
53	1	99.0	!****5****1****5****2****5****3****5****4****5****5****5****6****5****7****5****8****5****9****5****
54	1	100.0	!****5****1****5****2****5****3****5****4****5****5****5****6****5****7****5****8****5****9****5****0

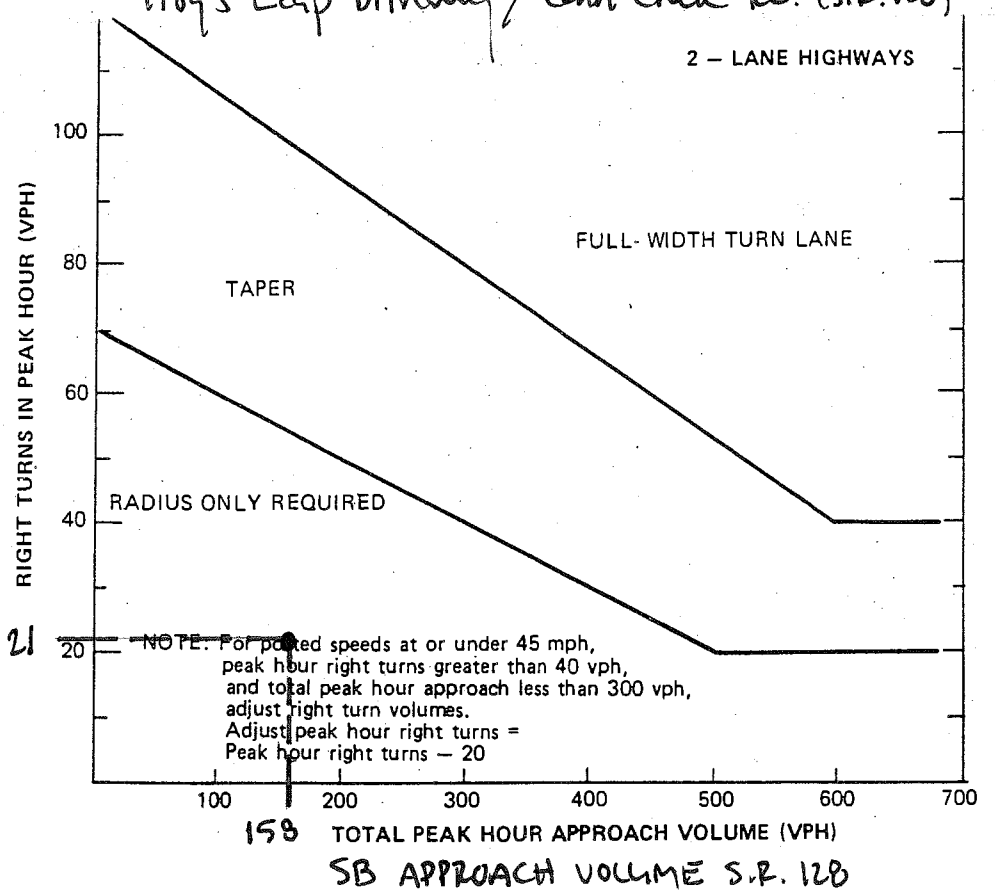
100

AVERAGE SPEED = 43.5
50th PERCENTILE = 43.8
85th PERCENTILE = 48
90th PERCENTILE = 50.3
95th PERCENTILE = 51.5

PACE = 38 - 47
% IN PACE = 62
VEHICLES IN PACE = 62

SAMPLE VARIANCE = 26.71354
STANDARD DEVIATION = 5.168515
RANGE 1*S = 62
RANGE 2*S = 97
RANGE 3*S = 100

Frog's Leap Driveway / Conn Creek Rd. (S.R. 128)



SB RIGHT-TURNS S.R. 128

21

158

SB APPROACH VOLUME S.R. 128

N-D WKND. 2-T + Project (worst case)

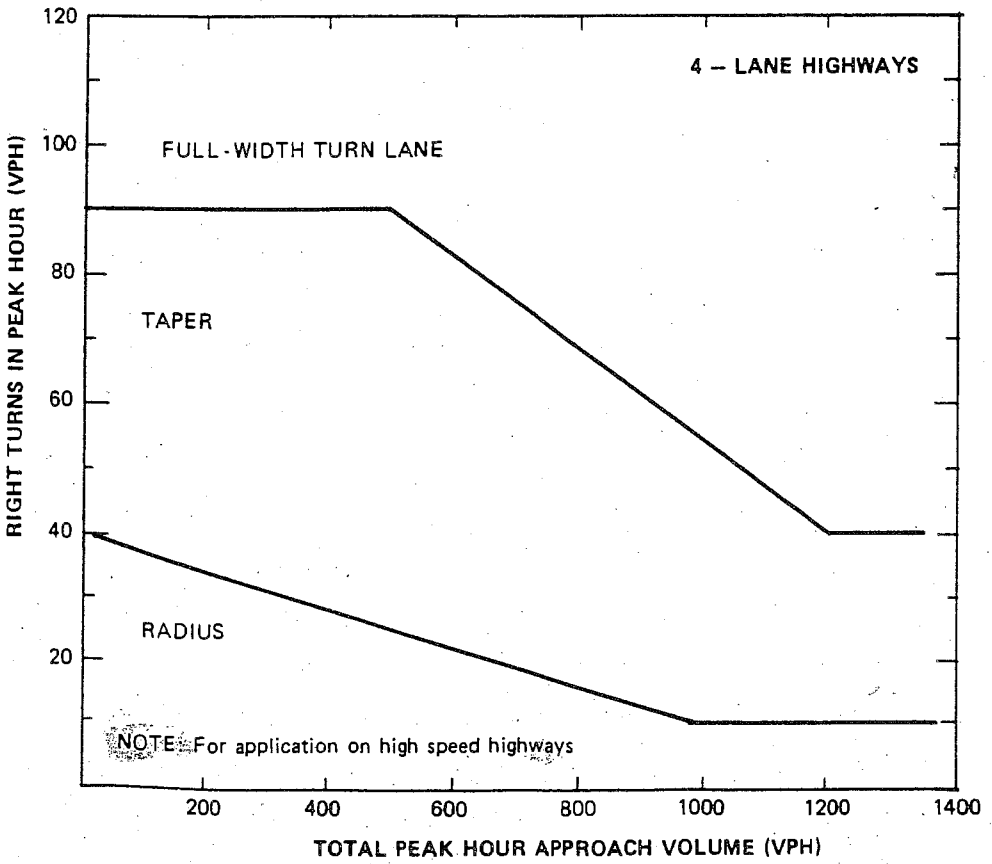
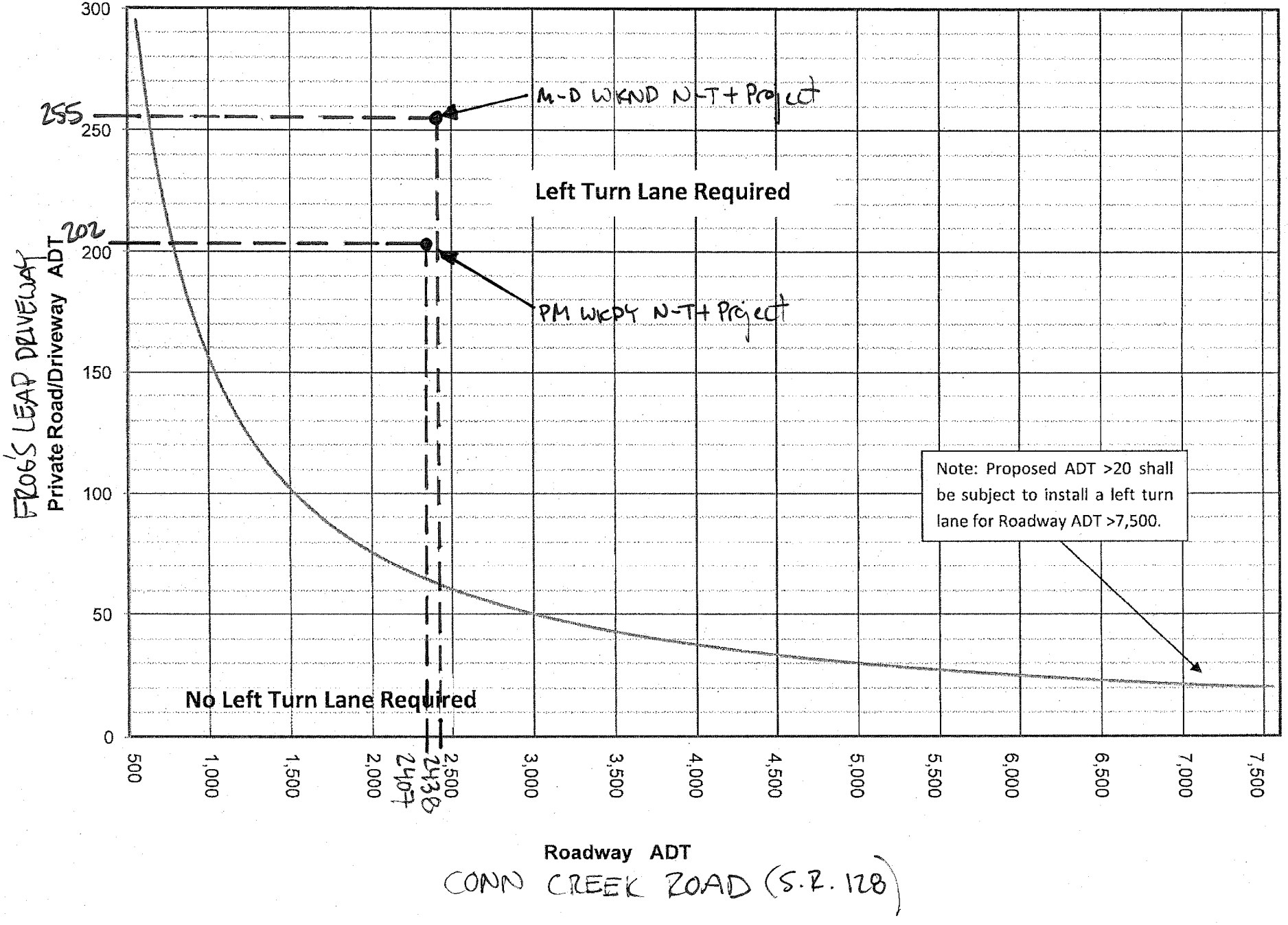


Figure 4-23. Traffic volume guidelines for design of right-turn lanes. (Source: Ref. *4-11*)

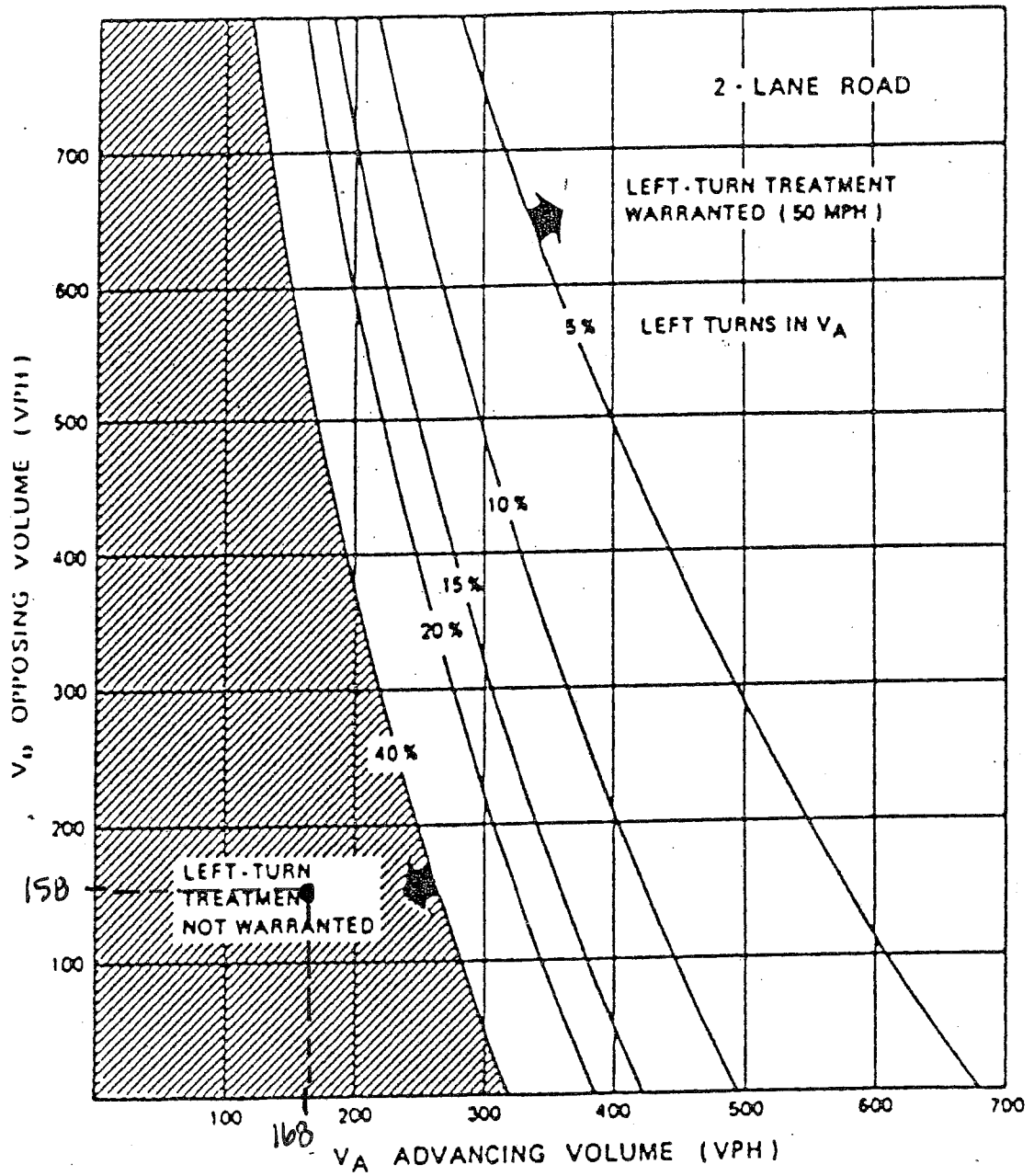
FROG'S LEAP DRIVEWAY / CONN CREEK ROAD

LEFT TURN LANE WARRANT GRAPH



CALTRAN'S LEFT-TURN WARRANT

FROG'S LEAP DRIVEWAY / CONN CREEK Rd. (5.2.128)



CONN CREEK RD. SB 137 through 21 right-turns

CONN CREEK RD. NB 149 through 15 left-turns

Planning, Building & Environmental Services

1195 Third Street, Suite 210
Napa, CA 94559
www.countyofnapa.org

Pete Parkinson
Interim Director

A Tradition of Stewardship
A Commitment to Service

MEMORANDUM

To:	Shaveta Sharma, Planning Division	From:	Peter Corelis, Engineering and Conservation Division P.S.C.
Date:	October 23rd, 2014	Re:	Frog's Leap Ag. Processing Facility Use Permit: P14-00054 APN: 030-090-033

The Engineering Division received a submittal of a proposal for a major modification to a use permit generally requesting the following:

To approve the use of a new 2,902 square foot combined agricultural processing facility (APC) and tasting room with an attached restroom and porch. The facility will be used to process fruit not associated with wine production and serve an expanded marketing and visitation plan and an increase in employees. The proposed project is located at 8815 Conn Creek Road in the County of Napa.

The Engineering Division reviewed the submitted August 13th, 2014 submission of the left turn lane exhibits and request for an exception to the Napa County Road and Street Standards (NCRSS). The submitted information has shown that a left turn lane mitigation is required by County development standards due to the increase in average daily trips (ADT) to and from the facility. The exception request concerns roadway improvements on land owned and operated by the State of California under the authority of Caltrans. Site constraints and findings interfering with design standards for a left turn lane configuration must be addressed through the permittee of the left turn lane improvements. Please direct design exception requests to Caltrans for an equivalent mitigation.

Should you have any questions of me, please feel free to contact me at (707) 259-8757 or peter.corelis@countyofnapa.org

Intersection: 1: Frog's Leap & Conn Creek Rd.

Movement	EB	EB	NB
Directions Served	L	R	LT
Maximum Queue (ft)	55	55	53
Average Queue (ft)	17	27	6
95th Queue (ft)	49	58	30
Link Distance (ft)	4660		3454
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		25	
Storage Blk Time (%)	2	3	
Queuing Penalty (veh)	0	1	

Nework Summary

Network wide Queuing Penalty: 1

Intersection: 1: Frog's Leap & Conn Creek Rd.

Movement	EB	EB	NB
Directions Served	L	R	LT
Maximum Queue (ft)	69	52	39
Average Queue (ft)	18	25	3
95th Queue (ft)	53	57	20
Link Distance (ft)	4660		3454
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		25	
Storage Blk Time (%)	2	2	
Queuing Penalty (veh)	0	0	

Nework Summary

Network wide Queuing Penalty: 1