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Traffic Study and Left Turn Lane Exception Request

Chanticleer Winery P14-00304-UP and P14-00305-VAR
Planning Commission Hearing September 7, 2016

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Napa County Planning, Building
& Environmental Services

Chanticleer Winery
4 Vineyard View Avenue
Yountville, California 94599

July 15, 2015

Steve Lederer,
Director of Public Works
County of Napa
1195 Third Street, Suite 210
Napa, California 94559

Re: Request for Road Exception Chanticleer Winery Use Permit #P14-00304 APN 034-150-026

Dear Mr. Lederer:

My client is currently a processing a use permit to develop a small winery of 10,000 gallons annual production with a very modest visitation program on a 40+ acre parcel located south of the Veterans Home in Yountville. In response to a request from Paul Wilkinson, county traffic engineer a traffic study was prepared in March 2015. The traffic study conducted by W-TRANS concluded that existing traffic volumes without the winery project being constructed met Napa County guidelines for installing a left turn lane as shown on the Left Turn Warrant Graph at page 21 of the Road and Street Standards as revised August 2011.[1] This letter is to request an exception to the requirement to construct a left turn lane on northbound Solano Avenue at the intersection of Vineyard View Avenue and Solano Avenue adjacent to the Town limits of Yountville.

W-TRANS Traffic Study Findings

An updated traffic study was submitted to the County of Napa in March 2015 and a copy is attached. The study concluded that although a left-turn lane is needed at Vineyard View Drive under the County of Napa's criteria, the need for a left-turn lane was also evaluated based on criteria contained in the *Intersection Channelization Design Guide*, National Cooperative Highway Research Program (NCHRP) Report No. 279, Transportation Research Board, 1985, as well as an update of the methodology developed by the Washington State Department of Transportation. This methodology is based on equations that can be applied to expected or actual traffic volumes in order to determine the need for a left-turn pocket based on safety issues. The more detailed analysis performed for this study indicates that there is no apparent need for a left-turn lane to address operational or safety issues with or without the proposed

[1] Napa County, Adopted Road and Street Standards, revised August 9, 2011

project.[2]

The W-TRANS study indicated that the project itself would generate only six (6) daily northbound trips and two (2) during peak hour periods.[3] Northbound and southbound conditions on Solano Avenue would remain at LOS B during future and future plus project conditions.[4] The post-project LOS exceeds the general plan standards for county roadways.[5]

Site distance at Solano Avenue/Vineyard View Drive was observed on the field. Based on a design speed of 55 mph, which is the sign posted speed limit of Solano Avenue at Vineyard View Drive, in the County of Napa, the minimum stopping sight distance needed is 500 feet per Caltrans Highway Design Manual Table 201.1 as attached. Site visit observations indicate that available sight distance is in excess of 500 feet. Therefore, the sight distance at Solano Avenue/Vineyard View Drive is adequate.[6]

Section 3 Findings, Napa County Road and Street Standards (RSS)

The Road and Street Standards allow the Planning Commission to grant exceptions to the left turn lane requirement as part of our pending use permit application if the request complies with Item 3, beginning with page 6 of the adopted RSS.[7]

Section 3D provides in part that "an exception may be allowed ... if one or more of the findings in that section can be made." In addition to the findings required in Section (D), the Planning Commission shall not grant an exception unless it finds that grant of the exception, as condition, provides the same overall practical effect as these Standards towards providing defensible space, and consideration towards life, safety and public welfare. In reviewing these findings, we believe site and neighborhood conditions support the issuance of an exception as detailed below.

Findings in Support of the Granting of an Exception

The March 2015 study prepared by W-TRANS provides an analysis of the environmental, jurisdiction and other conditions that support the granting of a road exception. W-TRANS concludes that because of the difference in findings between the two methodologies, consideration was given to the potential drawbacks of installing a left-turn lane. It was noted that such a project could have significant negative environmental impacts on the stream immediately north of Vineyard View Drive as a result of the additional paved surface of Solano Avenue and associated run-off.

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[2] Traffic Impact Study for the Chanticleer Winery, Whitlock & Weinberger Transportation, Inc., March 6, 2015 page 5
[3] Ibid., Table 2 page 3
[4] Ibid., Table 5 page 4
[5] Ibid., page 4
[6] Ibid., page 5
[7] Napa County Road and Street Standards August 2011, page 6-7

Roadway widening to accommodate the left-turn lane would need to begin within Yountville Town Limits, which presents a jurisdictional constraint as it would require approval from Town of Yountville staff.

The attached Exhibit shows Option A - Symmetrical Left Turn Lane (LTL) per Napa County Road and Street Standards Left-Turn Storage Lane Layout. This layout would require grading within the creek setback per Napa County Code (NCC) Section 18.108.025 and impact the jurisdictional stream (California Department of Fish and Wildlife and Napa County) including recent tree plantings carried out by Napa County Flood Control District.

The attached Exhibit also shows Option B - Asymmetrical LTL per Napa County Road and Street Standards Left-Turn Storage Lane Layout. For this option, all widening would occur on the south west side of Solano Avenue. This would require grading within and easements over adjoining parcels for a widening right-of-way.

Both Options A and B would require the culvert located immediately north of Vineyard View Drive to be widened, which could have impacts on the stream. This stream is considered to be a jurisdictional stream per NCC Section 18.108.030. Culvert and road widening would be required within the 35 feet setback per NCC Section 18.108.025.

Roadway widening would reduce the separation between Solano Avenue and the planned Napa Vine Trail, a Class I trail planned just east of Solano Avenue. Finally, there are no other left-turn lanes along this stretch of roadway, including at the intersections and driveways between Hoffman Lane and Oak Grove Avenue, so driver expectation is not violated by the lack of a turn lane at Vineyard View Drive.

The attached exhibit illustrates the relationship between the left turn lane, the existing Salvador Creek channel, the Yountville Town limits and the proposed Vine Trail bike path.

Finding 3E: Provides that the Planning Commission may grant an exception to the RSS only if the exception provides the same overall practical effect as these Standards towards providing defensible space, and consideration towards life, safety, and public welfare. The preferred outcome is the elimination of the left turn lane at the driveway entrance of Solano Avenue and Vineyard View Avenue. However, if the Commission believes that a left turn lane is necessary, W-TRANS has recommended that the county consider the alternative of a minor roadway widening along both sides of Solano Avenue to provide six feet outside the bike lane stripe along the project frontage on Solano Avenue.

Summary

In conclusion, we believe that findings required under Section 3D of the Road and Street Standards to grant an exception are met. Site and neighborhood conditions include the following:

- The proposed winery will generate only six (6) 6 daily trips over the eight (8) weekday hours that the winery will operate. Only two (2) additional trips during peak hour would be expected
- There have been no collisions at the subject intersection over the past 5 years;
- Sight distance at the subject intersection exceeds Caltrans standards based upon posted speeds on Solano Avenue. It should be noted that speed limits on Solano Avenue reduced to 35 mph in the vicinity of the driveway thus increasing the safety margins
- Despite the fact that the county has had the ability to require the installation of a left turn lane at the subject intersection since 2003, it has not done so.[8] The absence of a left turn lane has not resulted in traffic delays or decreased traffic safety at this intersection
- The costs and potential environmental impacts of constructing a left turn lane at this time to accommodate two (2) additional peak hour trips at an intersection with excellent sight distance and no history of collisions is not commensurate with the benefits to the public. Further, the analysis of the professional traffic engineer using accepted more detailed methodologies concluded that no left turn lane is warranted for the expected daily or peak hour trips.

We thank you for your consideration of our request for an exception. And we would very much appreciate your support of our request.

Please let me know if you have any questions.

Sincerely,

Jeff Redding

CC: Dalene Whitlock, W-TRANS
George Grodahl, Chanticleer Winery
Bruce Fenton, RSA+
Emily Hedge, Project Planner

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[8] See Keever Vineyard Use Permit #02587-UP

CHAPTER 200
GEOMETRIC DESIGN AND STRUCTURE STANDARDS

Topic 201 - Sight Distance

Index 201.1 - General

Sight distance is the continuous length of highway ahead, visible to the highway user. Four types of sight distance are considered herein: passing, stopping, decision, and corner. Passing sight distance is used where use of an opposing lane can provide passing opportunities (see Index 201.2). Stopping sight distance is the minimum sight distance for a given design speed to be provided on multilane highways and on 2-lane roads when passing sight distance is not economically obtainable. Stopping sight distance also is to be provided for all users, including motorists and bicyclists, at all elements of interchanges and intersections at grade, including private road connections (see Topic 504, Index 405.1, & Figure 405.7). Decision sight distance is used at major decision points (see Indexes 201.7 and 504.2). Corner sight distance is used at intersections (see Index 405.1, Figure 405.7, and Figure 504.3J).

Table 201.1 shows the minimum standards for stopping sight distance related to design speed for motorists. Stopping sight distances given in the table are suitable for Class II and Class III bikeways. The stopping sight distances are also applicable to roundabout design on the approach roadway, within the circulatory roadway, and on the exits prior to the pedestrian crossings. Also shown in Table 201.1 are the values for use in providing passing sight distance.

See Chapter 1000 for Class I bikeway sight distance guidance.

Chapter 3 of "A Policy on Geometric Design of Highways and Streets," AASHTO, contains a thorough discussion of the derivation of stopping sight distance.

201.2 Passing Sight Distance

Passing sight distance is the minimum sight distance required for the driver of one vehicle to pass another vehicle safely and comfortably. Passing must be accomplished assuming an oncoming vehicle comes into view and maintains the design speed, without reduction, after the overtaking maneuver is started.

Table 201.1
Sight Distance Standards

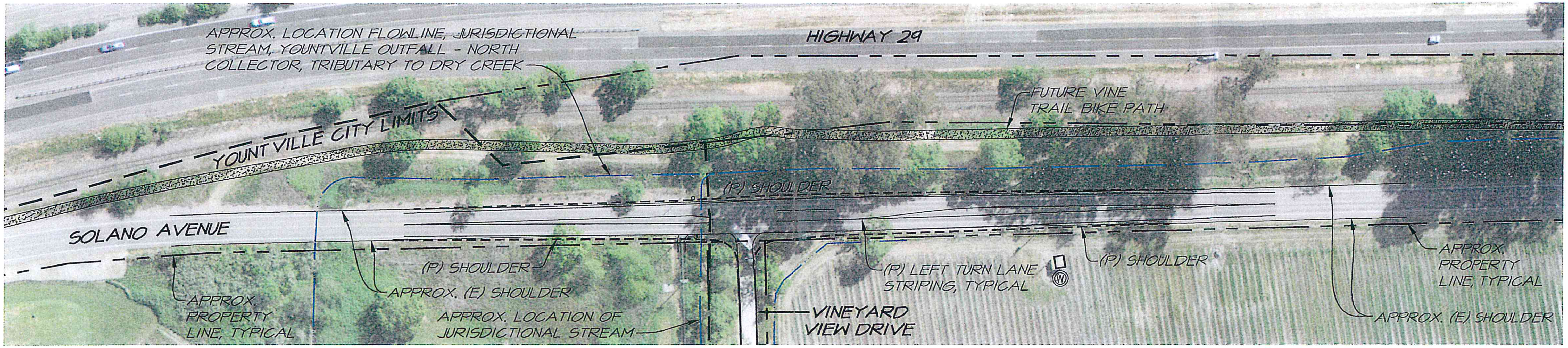
Design Speed(1) (mph)	Stopping(2) (ft)	Passing (ft)
10	50	--
15	100	--
20	125	800
25	150	950
30	200	1,100
35	250	1,300
40	300	1,500
45	360	1,650
50	430	1,800
55	500	1,950
60	580	2,100
65	660	2,300
70	750	2,500
75	840	2,600
80	930	2,700

(1) See Topic 101 for selection of design speed.
(2) For sustained downgrades, refer to advisory standard in Index 201.3

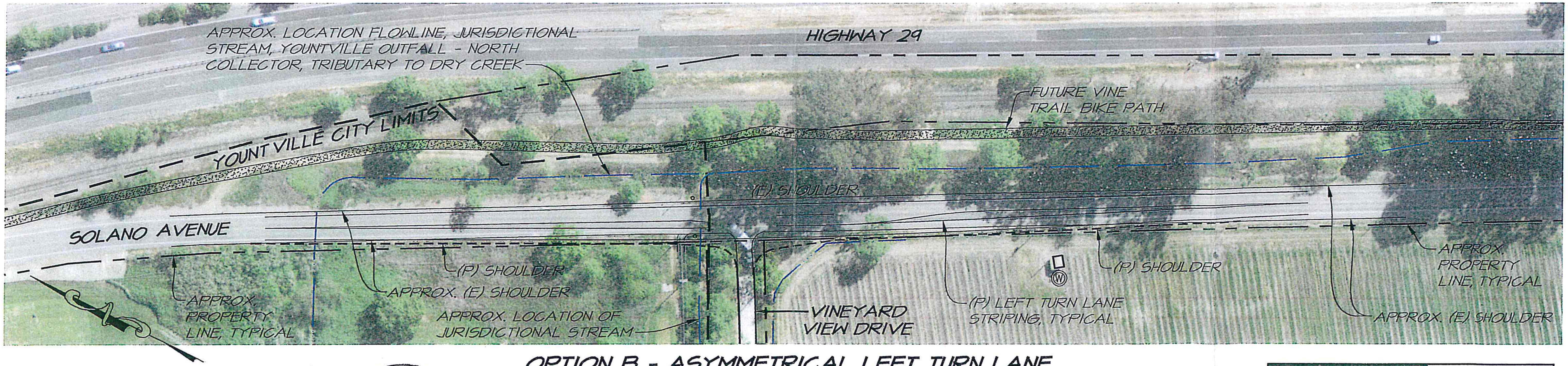
The sight distance available for passing at any place is the longest distance at which a driver whose eyes are 3 ½ feet above the pavement surface can see the top of an object 4 ¼ feet high on the road. See Table 201.1 for the calculated values that are associated with various design speeds.

In general, 2-lane highways should be designed to provide for passing where possible, especially those routes with high volumes of trucks or recreational vehicles. Passing should be done on tangent horizontal alignments with constant grades or a slight sag vertical curve. Not only are drivers reluctant to pass on a long crest vertical curve, but it is impracticable to design crest vertical curves to provide for passing sight distance because of high

CHANTILCEER WINERY
LEFT TURN LANE EXCEPTION EXHIBIT



OPTION A - SYMMETRICAL LEFT TURN LANE



OPTION B - ASYMMETRICAL LEFT TURN LANE

GRAPHIC SCALE

100 0 100 200

(IN FEET)
1 inch = 100 FT

REGISTERED PROFESSIONAL ENGINEER
BRUCE FENTON
1859
Exp. 06/30/17
CIVIL
STATE OF CALIFORNIA

NOTE: LEFT TURN LANE GEOMETRY FROM NAPA COUNTY ROAD & STREET STANDARDS DRAWING TITLED "LEFT-TURN STORAGE LANE" DATED SEPT 23, 2010

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MAR 17 2015
Napa County Planning, Building
& Environmental Services

March 16, 2015

Mr. George Grodahl
Chanticleer Winery
c/o Mr. Jeffrey Redding
4 Vineyard View Drive
Yountville, CA 94599

Traffic Impact Study for the Chanticleer Winery

Dear Mr. Grodahl;

Whitlock & Weinberger Transportation, Inc. (W-Trans) has completed this focused traffic analysis addressing potential traffic impacts and circulation needs for a proposed new winery to be located on Vineyard View Drive near Solano Avenue in the County of Napa. The scope of this traffic study was developed based on discussions with County staff on January 28, 2015.

Project Description

The project includes a proposed winery with a production capacity of up to 10,000 gallons of wine annually and operation of a tasting room with an average of eight visitors per weekday and 10 visitors per day on the weekends.

Study Area

The study area consists of the project site and the segment of Solano Avenue within one-half mile from Vineyard View Drive. The project site is located on the west side of Solano Avenue along Vineyard View Drive, approximately 150 feet south of the Yountville town limits. Current uses along Vineyard View Drive, which include nine single-family residences and the Keever Winery, would not change with the proposed project.

Solano Avenue is a two-lane undivided highway with existing four-foot wide bike lanes that runs north-south in the study area, with a posted speed limit of 35 miles per hour (mph) in the Town of Yountville that transitions to 55 mph south of the Town limits. Based on mechanical tube counts collected in January 2015, the average daily traffic (ADT) on Solano Avenue in the project's vicinity is approximately 1,650 vehicles per day on weekdays and 1,250 vehicles per day on weekend days, and the ADT on Vineyard View Drive is approximately 315 vehicles per day on weekdays and 195 vehicles per day on weekends.

<u>Future Conditions</u>

The Future traffic scenario represents General Plan buildout at an estimated time horizon of the year 2030. Future projected traffic volumes were obtained from the Solano Transportation Authority (STA) who maintains the joint Napa County/Solano County 2010-2030 Travel Demand Forecasting Model. This data was provided in the form of segment volumes. Because there is incomplete data for Solano Avenue, a projected growth rate of 1.6 was developed based on volumes during the p.m. peak hour on State Route 29 near the project site. This rate of approximately 2.4 percent per year was applied to represent the approximate level of growth on Solano Avenue. The model does not include forecasts for the weekend midday peak hour; therefore, the weekday p.m. peak hour growth rate was applied to the weekend midday peak to analyze future operations.

Collision History

The collision history for the study segment of Solano Avenue within one-half mile of Vineyard View Drive was reviewed to determine any trends or patterns that indicate a safety risk that may be exacerbated by the addition of project traffic. Average annual collision rates were calculated based on records for October 2008 through September 2013 obtained through the California Highway Patrol and published in their Statewide Integrated Traffic Records System (SWITRS) reports. A copy of the spreadsheet is enclosed for reference.

The statewide average collision rate for a rural two-lane road with a speed limit of 55 mph or less is 1.03 collisions/million vehicle miles (c/mvm). The one-mile segment of Solano Avenue within one-half mile of the project site had three reported collisions over the five-year study period for a calculated collision rate of 1.04 c/mvm, approximately equal to the average collision rate at similar facilities statewide. All three collisions were single-vehicle collisions that occurred away from the intersection of Solano Avenue/Vineyard View Drive. These types of single-vehicle collisions would not be expected to increase with the development of the proposed project as the road geometry would not be changed by the project.

Trip Generation

The anticipated trip generation for a proposed project is typically estimated using standard rates published by the Institute of Transportation Engineers (ITE) in *Trip Generation Manual*, 9th Edition, 2012. However, the publication contains no such information for a winery. Therefore, the County of Napa's Winery Traffic Information/Trip Generation Sheet was used to determine the anticipated traffic that would be generated by the proposed tasting room. A copy of this worksheet is enclosed for reference.

Since the County of Napa's Winery Traffic Information/Trip Generation Sheet does not include guidance on inbound versus outbound trips, it was assumed that all employees and two-thirds of tasting room visitors' trips at the winery would be outbound during the weekday p.m. peak hour since most of the trips would be associated with customers leaving at closure of the winery. For the weekend midday peak hour it was assumed that inbound and outbound trips would be evenly split. A summary of the project's trip generation potential is provided in Table 1.

Table 1
Trip Generation Summary

Trip Type	Daily	Weekday PM Peak			Weekend Midday Peak		
	Trips	Trips	In	Out	Trips	In	Out
Winery plus Tasting Room							
Tasting Room Visitors	6	1	0	1	4	2	2
Winery Employees	10	4	0	4	1	1	0
Total Trips	**16**	**5**	**0**	**5**	**5**	**3**	**2**

Note: Trip generation does not include traffic associated with special events

Trip Distribution

The pattern used to allocate new project trips to the street network was based our understanding of the regional network, and in particular the route that most employees and tasting room visitors would take given the proximity to the interchange at California Drive. The applied distribution assumptions and resulting trips are shown in Table 2.

Table 2
Trip Distribution Assumptions

Route	Percent	Daily Trips	Weekday PM Peak	Saturday Midday Peak
To/from north Solano Ave	60%	10	3	3
To/from south Solano Ave	40%	6	2	2
TOTAL	**100%**	**16**	**5**	**5**

Roadway segment volumes on Solano Avenue are summarized in Table 3, including the existing volumes counted, projected future volumes, and resulting volumes with project trips added.

Table 3
Traffic Volume Summary

Scenario	Weekday PM Peak	Saturday Midday Peak
Solano Ave		
Existing	187	146
Existing plus Project	192	151
Future	267	209
Future plus Project	272	214

Roadway Segment Operations

Level of Service analysis of Solano Avenue was conducted for the Future and Future plus Project scenarios using the Highway Capacity Manual (HCM) "Two-Lane Highway Methodology". The methodology considers traffic volumes, terrain, roadway cross-section, the proportion of heavy vehicles, and the amount of no passing zones. LOS is based on the average travel speed (ATS) estimate as produced by the methodology, the percent time spent following (PTSF) estimate produced by the methodology, as well as the classification of the roadway. Solano Avenue was defined as Class I roadways for the purposes of this analysis. A summary of the ATS and PTSF breakpoints is shown in Table 4.

Table 4
Two-Lane Highway Level of Service Criteria

LOS	ATS	PTSF
A	>55 mph	≤ 35%
B	>50-55 mph	>35%-50%
C	>45-50 mph	>50%-65%
D	>40-45 mph	>65%-80%
E	≤40 mph	>80%
F	Capacity exceeds 1,700 vphpl	

Notes: ATS = Average Travel Speed;
PTSF = Percent Time Spent Following;
VPHPL = Vehicles Per Hour Per Lane

The Napa County's Level of Service Standard for county roadways is LOS D, as noted in Napa County's General Plan. Under Future volumes, Solano is expected to operate acceptably at LOS B in both directions with or without the project. These results are summarized in Table 5.

Table 5
Future and Future plus Project Peak Hour Two-Lane Highway Levels of Service

Segment	Future Conditions				Future plus Project			
	Weekday PM Peak		Weekend Midday Peak		Weekday PM Peak		Weekend Midday Peak	
	ATS/PTSF	LOS	ATS/PTSF	LOS	ATS/PTSF	LOS	ATS/PTSF	LOS
Northbound Solano Ave (California Dr to Hoffman Ln)	53.3/ 20.6%	B	54.6/ 21.9%	B	53.3/ 20.7%	B	54.6/ 22.2%	B
Southbound Solano Ave (California Dr to Hoffman Ln)	53.7/ 26.1%	B	54.2/ 16.5%	B	53.7/ 26.3%	B	54.2/ 16.6%	B

Notes: ATS = Average Travel Speed (expressed in miles per hour); PTSF = Percent Time Spent Following; LOS = Level of Service

Site Access

Vehicular site access to the project would be via Vineyard View Drive, a gated private road that intersects Solano Avenue just south of the Yountville Town Limits.

Sight Distance

Sight distance along Solano Avenue at Vineyard View Drive was evaluated based on sight distance criteria contained in the *Highway Design Manual* published by Caltrans. The recommended sight distance for minor street approaches that are private roads are based on stopping sight distance, which use the approach travel speeds as the basis for determining the recommended sight distance. Additionally, the stopping sight distance needed for a following driver to stop if there is a vehicle waiting to turn into a side street or driveway is evaluated based on stopping sight distance criterion and the approach speed on the major street.

Sight distance at Solano Avenue/Vineyard View Drive was observed on the field. Although sight distance requirements are not technically applicable to urban driveways, the stopping sight distance criterion for private street intersections was applied for evaluation purposes. Based on a design speed of 55 mph, the minimum stopping sight distance needed is 500 feet. Site visit observations indicate that available sight distance is in excess of 500 feet. Therefore, the sight distance at Solano Avenue/Vineyard View Drive is adequate.

Left-Turn Lane Warrants

The need for a left-turn lane on northbound Solano Avenue at Vineyard View Drive was evaluated using Napa County's Left-Turn Lane Warrant, which is based on the ADT of the roadway and the projected ADT of the proposed use, as well as safety criteria. It is worth noting that a left-turn lane warrant analysis was completed in 2003 for the development of the nearby Keever Winery, and at that time Keever Winery was required to enter into a deferred agreement to install a left-turn lane when directed to do so by the Napa County Public Works Department.

Under Existing Conditions without project-related traffic, with approximately 1,650 vehicles per day on Solano Avenue and 315 vehicles per day on Vineyard View Drive, a northbound left-turn lane on Solano Avenue is warranted using the graph from Napa County's Left-Turn Lane Warrant.

Although a left-turn lane is needed at Vineyard View Drive under the County of Napa's criteria, the need for a left-turn lane was also evaluated based on criteria contained in the *Intersection Channelization Design Guide*, National Cooperative Highway Research Program (NCHRP) Report No. 279, Transportation Research Board, 1985, as well as an update of the methodology developed by the Washington State Department of Transportation. This methodology is based on equations that can be applied to expected or actual traffic volumes in order to determine the need for a left-turn pocket based on safety issues. The more detailed analysis performed for this study indicates that there is no apparent need for a left-turn lane to address operational or safety issues with or without the proposed project.

Because of the difference in findings between the two methodologies, consideration was given to the potential drawbacks of installing a left-turn lane. It was noted that such a project could have significant negative environmental impacts on the stream immediately north of Vineyard View Drive as a result of the additional paved surface and associated run-off; further the culvert located immediately north of Vineyard View Drive would need to be widened, which could have impacts on existing plant aquatic life in the area that would be paved over. Roadway widening to accommodate the left-turn lane would need to begin within Yountville Town Limits, which presents a jurisdictional constraint as it would require approval from Yountville's staff. Roadway widening would reduce the separation between Solano Avenue and the planned Napa Vine Trail, a Class I trail planned just east of Solano Avenue. Finally, there are no other left-turn lanes along this stretch of roadway, including at the intersections and driveways between Hoffman Lane and Oak Grove Avenue, so driver expectation is not violated by the lack of a turn lane at Vineyard View Drive.

Based on the analysis performed together with the character of the roadway, installation of a left-turn lane at Vineyard View Drive is not recommended. Instead, it is recommended that the applicant work with County staff to obtain a design exception for the required left-turn lane based on criteria listed in item 3.D in the *Napa County Road & Street Standards*, Napa County Department of Public Works, 2011.

Conclusions

- The proposed project would generate an average of 16 new weekday trips, including five weekday p.m. peak hour trips and five Saturday midday peak hour trips.
- Solano Avenue at the project site is expected to operate acceptably at LOS B under Future Conditions with or without the project.
- Applying County of Napa left-turn lane warrant criterion, a left-turn lane is warranted at Vineyard View Drive with or without the proposed project. However, when more detailed analysis techniques are applied, there does not appear to be a need for a left-turn lane at this driveway. Further, there may be negative environmental impacts associated with installing a left-turn lane; one is therefore not recommended.
- It is recommended that the applicant work with County Staff to obtain a design exception for the County-required left-turn lane.

Thank you for giving W-Trans the opportunity to provide these services. Please call if you have any questions.

Sincerely,

Sam Lam, PE
Associate Traffic Engineer

Dalene J. Whitlock, PE, PTOE
Principal

DJW/stl/NAX088.L1

Enclosures: Two-Lane Highway Level of Service Calculations
Collision Rate Spreadsheet
Winery Trip Generation Worksheet
Left-Turn Lane Warrants Calculations

SEGMENT COLLISION RATE CALCULATIONS

Chanticleer Winery Focused TIS

Location: Solano Avenue - near Vineyard View Drive

Date of Count: Friday, January 09, 2015
ADT: 1,700

Number of Collisions: 3
Number of Injuries: 0
Number of Fatalities: 0
Start Date: October 1, 2008
End Date: September 30, 2013
Number of Years: 5

Highway Type: Conventional 2 lanes or less
Area: Rural
Design Speed: ≤55
Terrain: Flat

Segment Length: 0.9 miles
Direction: North/South

$$\frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times 365 \text{ Days per Year} \times \text{Segment Length} \times \text{Number of Years}}$$

$$\frac{3 \times 1{,}000{,}000}{1{,}700 \times 365 \times 0.93 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Segment	**1.04 c/mvm**	**0.0%**	**0.0%**
Statewide Average*	**1.03 c/mvm**	**2.4%**	**40.1%**

ADT = average daily traffic volume
c/mvm = collisions per million vehicle miles
* 2010 Collision Data on California State Highways, Caltrans

Winery Traffic Information / Trip Generation Sheet

Project Name: Chanticleer Winery TIS Project Scenario: Proposed Project (New Winery)

Traffic during a Typical Weekday

Number of FT employees:	2	x 3.05 one-way trips per employee	=	6.10 daily trips.
Number of PT employees:	2	x 1.90 one-way trips per employee	=	3.80 daily trips.
Average number of weekday visitors:	8	/ 2.6 visitors per vehicle x 2 one-way trips	=	6.15 daily trips.
Gallons of production:	10000	/ 1,000 x .009 truck trips daily[3] x 2 one-way trips	=	0.18 daily trips.
		Total	=	16 **daily trips.**
(№ of FT employees) + (№ of PT employees/2) + (sum of visitor and truck trips x .38)			=	5 **PM peak trips.**

Traffic during a Typical Saturday

Number of FT employees (on Saturdays):	1	x 3.05 one-way trips per employee	=	3.05 daily trips.
Number of PT employees (on Saturdays):	0	x 1.90 one-way trips per employee	=	0.00 daily trips.
Average number of Saturday visitors:	10	/ 2. 8 visitors per vehicle x 2 one-way trips	=	7.14 daily trips.
		Total	=	10 **daily trips.**
(№ of FT employees) + (№ of PT employees/2) + (visitor trips x .57)			=	5 **PM peak trips.**

Traffic during a Crush Saturday

Number of FT employees (during crush):	1	x 3.05 one-way trips per employee	=	3.05 daily trips.
Number of PT employees (during crush):	2	x 1.90 one-way trips per employee	=	3.80 daily trips.
Average number of Saturday visitors:	10	/ 2. 8 visitors per vehicle x 2 one-way trips	=	7.14 daily trips.
Gallons of production:	10000	/ 1,000 x .009 truck trips daily x 2 one-way trips	=	0.18 daily trips.
Avg. annual tons of grape on-haul:	60	/ 144 truck trips daily[4] x 2 one-way trips	=	0.83 daily trips.
		Total	=	15 **daily trips.**

Largest Marketing Event- Additional Traffic

Number of event staff (largest event):	3	x 2 one-way trips per staff person	=	6 trips.
Number of visitors (largest event):	25	/ 2.8 visitors per vehicle x 2 one-way trips	=	18 trips.
Number of special event truck trips (largest event):	1	x 2 one-way trips	=	2 trips.

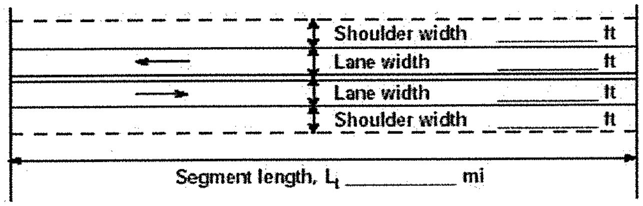
[3] Assumes 1.47 materials & supplies trips + 0.8 case goods trips per 1,000 gallons of production / 250 days per year (see *Traffic Information Sheet Addendum* for reference).
[4] Assumes 4 tons per trip / 36 crush days per year (see *Traffic Information Sheet Addendum* for reference).

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*SL*	Highway / Direction of Travel	*Solano Avenue NB*
Agency or Company	*W-Trans*	From/To	*Hoffman Ln to Vineyard View Dr*
Date Performed	*2/17/2015*	Jurisdiction	*County of Napa*
Analysis Time Period	*Future Wkdy PM No Project*	Analysis Year	*2030*

Project Description: *Chanticleer Winery Focused TIS*

Input Data



☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Analysis direction vol., V_d	*116*veh/h
Opposing direction vol., V_o	*151*veh/h
Shoulder width ft	*4.0*
Lane Width ft	*11.0*
Segment Length mi	*1.0*
Grade Length mi	Up/down
Peak-hour factor, PHF	*0.88*
No-passing zone	*0%*
% Trucks and Buses , P_T	*1 %*
% Recreational vehicles, P_R	*0%*
Access points *mi*	*5/mi*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.8*	*1.6*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.992*	*0.994*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF^* f_{g,ATS} * f_{HV,ATS})$	*133*	*173*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
		Base free-flow speed[4], BFFS	*60.0 mi/h*
		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.7 mi/h*
Mean speed of sample[3], S_{FM}		Adj. for access points[4], f_A (Exhibit 15-8)	*1.3 mi/h*
Total demand flow rate, both directions, *v*		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.0 mi/h*
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*53.3 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*1.4 mi/h*	Percent free flow speed, PFFS	*93.4 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.999*	*0.999*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF^* f_{HV,PTSF}^* f_{g,PTSF})$	*132*	*172*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*15.0*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*12.8*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*20.6*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*B*
Volume to capacity ratio, *v/c*	*0.08*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1690*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1698*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*93.4*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*131.8*
Effective width, Wv (Eq. 15-29) ft	*21.30*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*2.22*
Bicycle level of service (Exhibit 15-4)	*B*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If $v_i(v_d$ or $v_o)$ >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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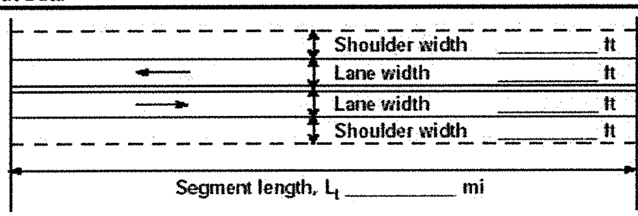
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*SL*	Highway / Direction of Travel	*Solano Avenue SB*
Agency or Company	*W-Trans*	From/To	*Vineyard View Dr to Hoffman Ln*
Date Performed	*2/17/2015*	Jurisdiction	*County of Napa*
Analysis Time Period	*Future Wkdy PM No Project*	Analysis Year	*2030*

Project Description: *Chanticleer Winery Focused TIS*

Input Data



☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Analysis direction vol., V_d	*151*veh/h
Opposing direction vol., V_o	*116*veh/h
Shoulder width ft	*4.0*
Lane Width ft	*11.0*
Segment Length mi	*1.0*
Grade Length mi	Up/down
Peak-hour factor, PHF	*0.88*
No-passing zone	*0%*
% Trucks and Buses , P_T	*1 %*
% Recreational vehicles, P_R	*0%*
Access points *mi*	*5*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.6*	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.994*	*0.992*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*173*	*133*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.7 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*1.3 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.9 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.0 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*53.7 mi/h*
		Percent free flow speed, PFFS	*94.2 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.999*	*0.999*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*172*	*132*
Base percent time-spent-following[4], $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*18.9*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*12.8*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*26.1*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*B*
Volume to capacity ratio, *v/c*	*0.10*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1686*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1698*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*94.2*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*171.6*
Effective width, Wv (Eq. 15-29) ft	*18.68*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*2.88*
Bicycle level of service (Exhibit 15-4)	*C*
Notes	
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain. 2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F. 3. For the analysis direction only and for v>200 veh/h. 4. For the analysis direction only 5. Exhibit 15-20 provides coefficients a and b for Equation 15-10. 6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.	

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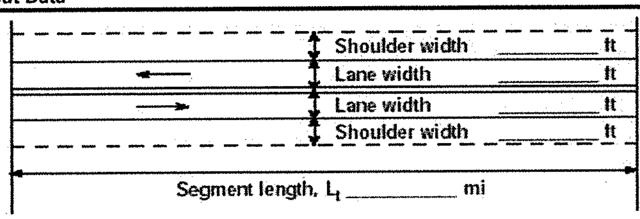
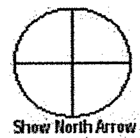
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*SL*	Highway / Direction of Travel	*Solano Avenue NB*
Agency or Company	*W-Trans*	From/To	*Hoffman Ln to Vineyard View Dr*
Date Performed	*2/17/2015*	Jurisdiction	*County of Napa*
Analysis Time Period	*Future Wkdy PM No Project*	Analysis Year	*2030*

Project Description: *Chanticleer Winery Focused TIS*

Input Data





☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Analysis direction vol., V_d	*120veh/h*
Opposing direction vol., V_o	*89veh/h*
Shoulder width ft	*4.0*
Lane Width ft	*11.0*
Segment Length mi	*1.0*
Grade Length mi	Up/down
Peak-hour factor, PHF	*0.88*
No-passing zone	*0%*
% Trucks and Buses, P_T	*1 %*
% Recreational vehicles, P_R	*0%*
Access points *mi*	*5/mi*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.8*	*1.9*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.992*	*0.991*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF^* f_{g,ATS} {}^* f_{HV,ATS})$	*137*	*102*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS} (Exhibit 15-7)	*1.7 mi/h*
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Adj. for access points[4], f_A (Exhibit 15-8)	*1.3 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.6 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.0 mi/h*
		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*54.6 mi/h*
		Percent free flow speed, PFFS	*95.7 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.999*	*0.999*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF^*f_{HV,PTSF}{}^* f_{g,PTSF})$	*136*	*101*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*15.4*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*11.3*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}{}^*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*21.9*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*B*
Volume to capacity ratio, *v/c*	*0.08*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1685*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1698*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*95.7*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*136.4*
Effective width, Wv (Eq. 15-29) ft	*21.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*2.29*
Bicycle level of service (Exhibit 15-4)	*B*
Notes	
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain. 2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F. 3. For the analysis direction only and for v>200 veh/h. 4. For the analysis direction only 5. Exhibit 15-20 provides coefficients a and b for Equation 15-10. 6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.	

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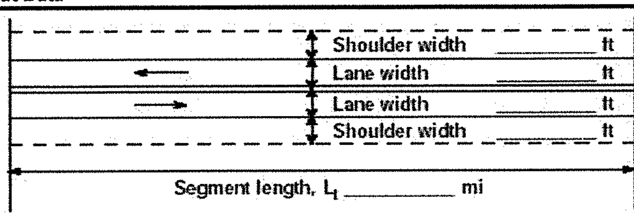
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		*Site Information*	
Analyst	*SL*	Highway / Direction of Travel	*Solano Avenue SB*
Agency or Company	*W-Trans*	From/To	*Vineyard View Dr to Hoffman Ln*
Date Performed	*2/17/2015*	Jurisdiction	*County of Napa*
Analysis Time Period	*Future Wknd Midday No Project*	Analysis Year	*2030*

Project Description: *Chanticleer Winery Focused TIS*

Input Data



☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi	Up/down
Peak-hour factor, PHF	*0.88*
No-passing zone	*0%*
% Trucks and Buses , P_T	*1 %*
% Recreational vehicles, P_R	*0%*
Access points *mi*	*5/mi*

Analysis direction vol., V_d	*89veh/h*
Opposing direction vol., V_o	*120veh/h*
Shoulder width ft	*4.0*
Lane Width ft	*11.0*
Segment Length mi	*1.0*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.9*	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T-1)+P_R (E_R -1))	*0.991*	*0.992*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*102*	*137*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
		Base free-flow speed[4], BFFS	*60.0 mi/h*
		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.7 mi/h*
Mean speed of sample[3], S_{FM}		Adj. for access points[4], f_A (Exhibit 15-8)	*1.3 mi/h*
Total demand flow rate, both directions, *v*			
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*1.0 mi/h*	Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*54.2 mi/h*
		Percent free flow speed, PFFS	*95.0 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.999*	*0.999*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*101*	*136*
Base percent time-spent-following[4], $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*11.7*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*11.3*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*16.5*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*B*
Volume to capacity ratio, *v/c*	*0.06*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1686*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1698*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*95.0*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*101.1*
Effective width, Wv (Eq. 15-29) ft	*23.33*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*1.63*
Bicycle level of service (Exhibit 15-4)	*B*
Notes	
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain. 2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F. 3. For the analysis direction only and for v>200 veh/h. 4. For the analysis direction only 5. Exhibit 15-20 provides coefficients a and b for Equation 15-10. 6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.	

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DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	SL	Highway / Direction of Travel	Solano Avenue NB
Agency or Company	W-Trans	From/To	Hoffman Ln to Vineyard View Dr
Date Performed	2/17/2015	Jurisdiction	County of Napa
Analysis Time Period	Future Wkdy PM + Project	Analysis Year	2030

Project Description: *Chanticleer Winery Focused TIS*

Input Data

Shoulder width ____ ft
Lane width ____ ft
Lane width ____ ft
Shoulder width ____ ft
Segment length, L_t ____ mi

Show North Arrow

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Analysis direction vol., V_d	117veh/h
Opposing direction vol., V_o	152veh/h
Shoulder width ft	4.0
Lane Width ft	11.0
Segment Length mi	1.0
Grade Length mi	Up/down
Peak-hour factor, PHF	0.88
No-passing zone	0%
% Trucks and Buses , P_T	1 %
% Recreational vehicles, P_R	0%
Access points *mi*	5/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	1.8	1.6
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	1.0	1.0
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.992	0.994
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	1.00	1.00
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF^* f_{g,ATS} * f_{HV,ATS})$	134	174

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	60.0 mi/h
Total demand flow rate, both directions, v		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	1.7 mi/h
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Adj. for access points[4], f_A (Exhibit 15-8)	1.3 mi/h
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	1.4 mi/h	Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	57.0 mi/h
		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	53.3 mi/h
		Percent free flow speed, PFFS	93.4 %

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	1.1	1.1
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	1.0	1.0
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	0.999	0.999
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	1.00	1.00
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF^*f_{HV,PTSF}^* f_{g,PTSF})$	133	173
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	15.1	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	12.9	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	20.7	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	B
Volume to capacity ratio, *v/c*	0.08

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1690*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1698*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*93.4*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*133.0*
Effective width, Wv (Eq. 15-29) ft	*21.23*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*2.24*
Bicycle level of service (Exhibit 15-4)	*B*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If $v_i(v_d$ or $v_o)$ >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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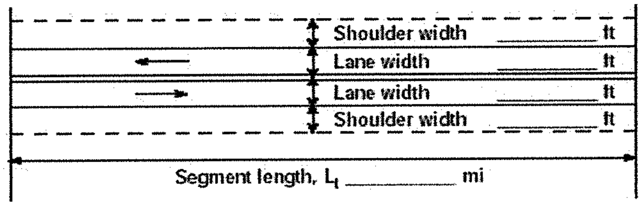
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*SL*	Highway / Direction of Travel	*Solano Avenue SB*
Agency or Company	*W-Trans*	From/To	*Vineyard View Dr to Hoffman Ln*
Date Performed	*2/17/2015*	Jurisdiction	*County of Napa*
Analysis Time Period	*Future Wkdy PM + Project*	Analysis Year	*2030*

Project Description: *Chanticleer Winery Focused TIS*

Input Data



☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Analysis direction vol., V_d	*152veh/h*
Opposing direction vol., V_o	*117veh/h*
Shoulder width ft	*4.0*
Lane Width ft	*11.0*
Segment Length mi	*1.0*
Grade Length mi	Up/down
Peak-hour factor, PHF	*0.88*
No-passing zone	*0%*
% Trucks and Buses , P_T	*1 %*
% Recreational vehicles, P_R	*0%*
Access points *mi*	*5/mi*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.6*	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.992*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i(pc/h) $v_i=V_i/(PHF^* f_{g,ATS} * f_{HV,ATS})$	*174*	*134*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
		Base free-flow speed[4], BFFS	*60.0 mi/h*
		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.7 mi/h*
Mean speed of sample[3], S_{FM}		Adj. for access points[4], f_A (Exhibit 15-8)	*1.3 mi/h*
Total demand flow rate, both directions, *v*		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.0 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(v/ $f_{HV,ATS}$)		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*53.7 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.9 mi/h*	Percent free flow speed, PFFS	*94.1 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.999*	*0.999*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF^*f_{HV,PTSF}{}^* f_{g,PTSF})$	*173*	*133*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*19.0*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*12.9*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*26.3*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*B*
Volume to capacity ratio, *v/c*	*0.10*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1686*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1698*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*94.1*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*172.7*
Effective width, Wv (Eq. 15-29) ft	*18.60*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*2.89*
Bicycle level of service (Exhibit 15-4)	C
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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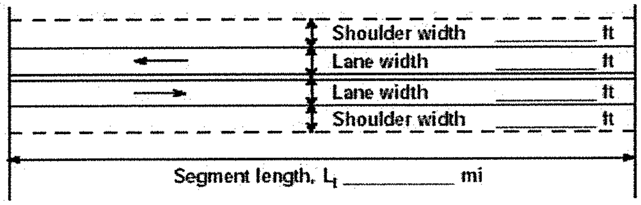
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*SL*	Highway / Direction of Travel	*Solano Avenue NB*
Agency or Company	*W-Trans*	From/To	*Hoffman Ln to Vineyard View Dr*
Date Performed	*2/17/2015*	Jurisdiction	*County of Napa*
Analysis Time Period	*Future Wkdy PM + Project*	Analysis Year	*2030*

Project Description: *Chanticleer Winery Focused TIS*

Input Data



☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi	Up/down
Peak-hour factor, PHF	*0.88*
No-passing zone	*0%*
% Trucks and Buses , P_T	*1 %*
% Recreational vehicles, P_R	*0%*
Access points *mi*	5/mi

Analysis direction vol., V_d	*121*veh/h
Opposing direction vol., V_o	*90*veh/h
Shoulder width ft	*4.0*
Lane Width ft	*11.0*
Segment Length mi	*1.0*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.7*	*1.9*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/\ (1+ P_T(E_T-1)+P_R(E_R-1))$	*0.993*	*0.991*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i\ /\ (PHF* f_{g,ATS} * f_{HV,ATS})$	*138*	*103*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.7 mi/h*
Free-flow speed, $FFS=S_{FM}+0.00776(v/\ f_{HV,ATS})$		Adj. for access points[4], f_A (Exhibit 15-8)	*1.3 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*0.6 mi/h*	Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*57.0 mi/h*
		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS} + v_{o,ATS}) - f_{np,ATS}$	*54.6 mi/h*
		Percent free flow speed, PFFS	*95.6 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/\ (1+ P_T(E_T-1)+P_R(E_R-1))$	*0.999*	*0.999*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}* f_{g,PTSF})$	*138*	*102*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*15.6*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*11.4*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF} *(v_{d,PTSF}\ /\ v_{d,PTSF} + v_{o,PTSF})$	*22.2*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*B*
Volume to capacity ratio, *v/c*	*0.08*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1685*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1698*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*95.6*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*137.5*
Effective width, Wv (Eq. 15-29) ft	*20.93*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*2.32*
Bicycle level of service (Exhibit 15-4)	*B*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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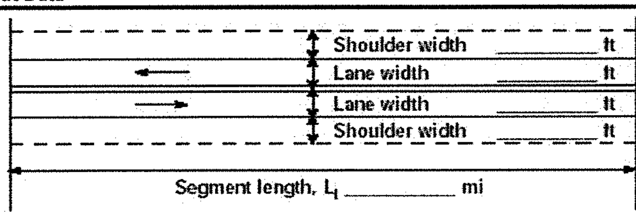
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		*Site Information*	
Analyst	*SL*	Highway / Direction of Travel	*Solano Avenue SB*
Agency or Company	*W-Trans*	From/To	*Vineyard View Dr to Hoffman Ln*
Date Performed	*2/17/2015*	Jurisdiction	*County of Napa*
Analysis Time Period	*Future Wknd Midday + Project*	Analysis Year	*2030*

Project Description: *Chanticleer Winery Focused TIS*

Input Data



Analysis direction vol., V_d	*90*veh/h
Opposing direction vol., V_o	*121*veh/h
Shoulder width ft	*4.0*
Lane Width ft	*11.0*
Segment Length mi	*1.0*

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi	Up/down
Peak-hour factor, PHF	*0.88*
No-passing zone	*0%*
% Trucks and Buses , P_T	*1 %*
% Recreational vehicles, P_R	*0%*
Access points *mi*	*5*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.9*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}$=1/ (1+ P_T (E_T -1)+P_R (E_R -1))	*0.991*	*0.993*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) v_i=V_i / (PHF* $f_{g,ATS}$ * $f_{HV,ATS}$)	*103*	*138*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
		Base free-flow speed[4], BFFS	*60.0 mi/h*
		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.7 mi/h*
Mean speed of sample[3], S_{FM}		Adj. for access points[4], f_A (Exhibit 15-8)	*1.3 mi/h*
Total demand flow rate, both directions, *v*		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.0 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*54.2 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*1.0 mi/h*	Percent free flow speed, PFFS	*95.0 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))	*0.999*	*0.999*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) v_i=V_i/(PHF*$f_{HV,PTSF}$* $f_{g,PTSF}$)	*102*	*138*
Base percent time-spent-following[4], $BPTSF_d$(%)=100(1-$e^{av_d^b}$)	*11.8*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*11.4*	
Percent time-spent-following, $PTSF_d$(%)=$BPTSF_d$+$f_{np,PTSF}$ *($v_{d,PTSF}$ / $v_{d,PTSF}$ + $v_{o,PTSF}$)	*16.6*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*B*
Volume to capacity ratio, *v/c*	*0.06*

Capacity, $C_{d,ATS}$ (Equation 15-12) veh/h	*1688*
Capacity, $C_{d,PTSF}$ (Equation 15-13) veh/h	*1698*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*95.0*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*102.3*
Effective width, Wv (Eq. 15-29) ft	*23.25*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*1.65*
Bicycle level of service (Exhibit 15-4)	*B*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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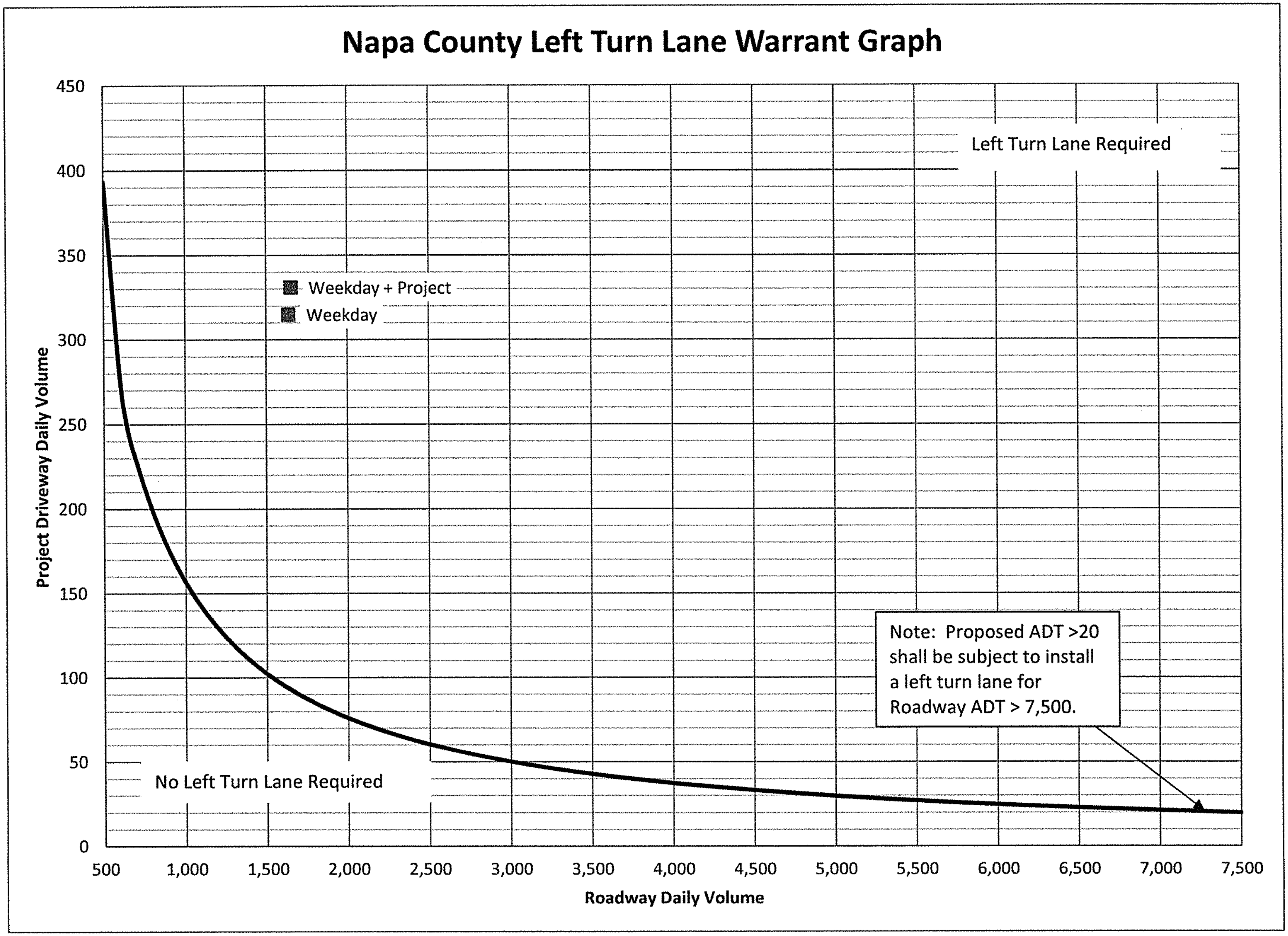

Napa County Left Turn Lane Warrant Graph
Left Turn Lane Required
Weekday + Project
Weekday
Note: Proposed ADT >20 shall be subject to install a left turn lane for Roadway ADT > 7,500.
No Left Turn Lane Required
Project Driveway Daily Volume
0
50
100
150
200
250
300
350
400
450
Roadway Daily Volume
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
6,500
7,000
7,500

Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: Solano Avenue at Vineyard View Drive
Study Scenario: Existing Weekday PM Peak

Direction of Analysis Street: North/South

Cross Street Intersects: From the West

Solano Avenue
Southbound Volumes (veh/hr)
Through Volume = 106
Right Turn Volume = 14

Solano Avenue
Northbound Volumes (veh/hr)
81 = Through Volume
11 = Left Turn Volume

Vineyard View Drive

Southbound Speed Limit: 50 mph
Southbound Configuration: 2 Lanes - Undivided

Northbound Speed Limit: 50 mph
Northbound Configuration: 2 Lanes - Undivided

Southbound Right Turn Lane Warrants

1. Check for right turn volume criteria

NOT WARRANTED Less than 40 vehicles

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold	AV =	-
Advancing Volume	Va =	120
If AV<Va then warrant is met		-

Right Turn Lane Warranted: NO

Southbound Right Turn Taper Warrants
(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

2. Check advance volume threshold criteria for taper

Advancing Volume Threshold	AV =	-
Advancing Volume	Va =	120
If AV<Va then warrant is met		-

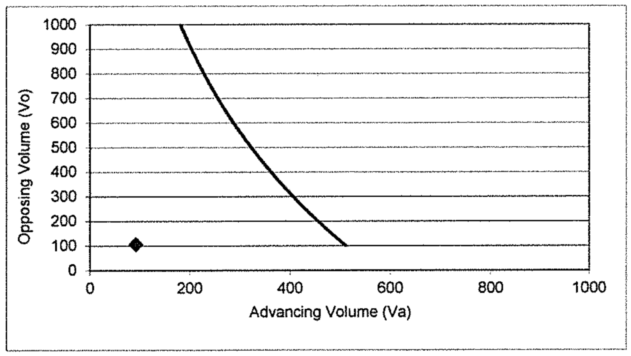
Right Turn Taper Warranted: NO

Northbound Left Turn Lane Warrants

Percentage Left Turns %lt 12.0 %

Advancing Volume Threshold AV 508 veh/hr

If AV<Va then warrant is met



◆ Study Intersection

——— Two lane roadway warrant threshold for: 50 mph

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

Left Turn Lane Warranted: NO

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

Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: Solano Avenue at Vineyard View Drive
Study Scenario: Existing Weekday PM Peak + Project

Direction of Analysis Street: North/South

Cross Street Intersects: From the West

Solano Avenue			Solano Avenue	
Southbound Volumes (veh/hr)			Northbound Volumes (veh/hr)	
Through Volume =	106		81	= Through Volume
Right Turn Volume =	15		11	= Left Turn Volume
Southbound Speed Limit:	50 mph		Northbound Speed Limit:	50 mph
Southbound Configuration:	2 Lanes - Undivided	**Vineyard View Drive**	Northbound Configuration:	2 Lanes - Undivided

Southbound Right Turn Lane Warrants

1. Check for right turn volume criteria

NOT WARRANTED Less than 40 vehicles

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold	AV =	-
Advancing Volume	Va =	121
If AV<Va then warrant is met		-

Right Turn Lane Warranted: NO

Southbound Right Turn Taper Warrants
(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

2. Check advance volume threshold criteria for taper

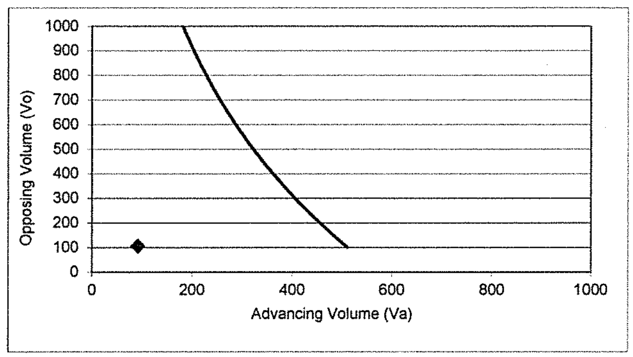
Advancing Volume Threshold	AV =	-
Advancing Volume	Va =	121
If AV<Va then warrant is met		-

Right Turn Taper Warranted: NO

Northbound Left Turn Lane Warrants

Percentage Left Turns %lt	12.0 %
Advancing Volume Threshold AV	508 veh/hr

If AV<Va then warrant is met



◆ Study Intersection
——— Two lane roadway warrant threshold for: 50 mph
Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: NO

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