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Traffic Study

TRAFFIC IMPACT REPORT

KITOKO VINEYARDS WINERY

February 20, 2018

Prepared for: KITOKO VINEYARDS WINERY

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I. INTRODUCTION

This traffic report has been prepared at the request of the Napa County Public Works Department as authorized by the Kitoko Vineyards Winery applicant. It has determined if traffic from the proposed Kitoko Vineyards Winery will result in any significant impacts to the local circulation system and the need for any mitigation measures. **Figure 1** shows the winery location along Atlas Peak Road in the hills near Napa Valley.

II. SCOPE OF SERVICES

The scope of service for this traffic study was developed to respond to work tasks typically requested by the Napa County Public Works Department. Evaluation was conducted for harvest Friday and Saturday PM peak traffic conditions. Existing (2017), year 2020 and year 2030 (Cumulative – General Plan Buildout) horizons were evaluated both with and without project traffic for harvest conditions. Operating conditions along Atlas Peak Road at the project entrance as well as at the Atlas Peak Road/Monticello Road (SR 121) and Silverado Trail/Hardman Avenue intersections were evaluated for all analysis scenarios based upon the County’s significance criteria. In addition, the project driveway intersection with Atlas Peak Road was evaluated for sight line adequacy as well as the need for a left turn lane based upon County warrant criteria. Significant impacts, if any, were identified and measures listed, if needed, to mitigate all impacts to a less than significant level.

III. SUMMARY OF FINDINGS

A. “WITHOUT PROJECT” OPERATING CONDITIONS

1. EXISTING VOLUMES – HARVEST 2017

Analysis peak traffic hours were based upon the highest volumes surveyed along Silverado Trail at the Hardman Avenue, as volumes at this location were significantly higher than those at the Atlas Peak Road/Monticello Road intersection. Along Silverado Trail, projected two-way volumes north of Hardman Avenue during harvest would be expected to be higher during the Friday PM peak hour compared to the Saturday PM peak hour (about 1,715 Friday PM peak hour two-way vehicles versus about 1,510 Saturday PM peak hour vehicles). Volumes along Monticello Road just west of Atlas Peak Road would also be expected to be higher during the Friday PM peak hour compared to the Saturday PM peak hour (about 1,230 vehicles during the Friday PM peak hour versus about 800 vehicles during the Saturday PM peak hour). Atlas Peak Road at the project site would also be expected to have higher Friday than Saturday PM peak volumes (19 vehicles during the Friday PM peak hour and 5 vehicles during the Saturday PM peak hour). The driveway serving the Kitoko Vineyards site had 1 vehicle during the Friday PM peak hour and 0 vehicles during the Saturday PM peak hour.

2. YEAR 2017 HARVEST – CIRCULATION SYSTEM UNACCEPTABLE OPERATION

INTERSECTION LEVEL OF SERVICE

- **Atlas Peak Road/Monticello Road (signal)**
 - Acceptable Friday & Saturday PM peak hour operation
- **Silverado Trail/Hardman Avenue (unsignalized)**
 - Unacceptable Friday & Saturday PM peak hour operation

INTERSECTION SIGNAL WARRANT

- **Silverado Trail/Hardman Avenue**
 - Volumes would exceed both rural and urban peak hour signal Warrant #3 volume criteria during both the Friday and Saturday PM peak hours.

3. YEAR 2020 HARVEST – CIRCULATION SYSTEM UNACCEPTABLE OPERATION

INTERSECTION LEVEL OF SERVICE

- **Atlas Peak Road/Monticello Road (signal)**
 - Acceptable Friday & Saturday PM peak hour operation
- **Silverado Trail/Hardman Avenue (unsignalized)**
 - Unacceptable Friday & Saturday PM peak hour operation

INTERSECTION SIGNAL WARRANT

- **Silverado Trail/Hardman Avenue**
 - Volumes would exceed both rural and urban peak hour signal Warrant #3 volume criteria during both the Friday and Saturday PM peak hours.

4. YEAR 2030 HARVEST – CIRCULATION SYSTEM UNACCEPTABLE OPERATION

INTERSECTION LEVEL OF SERVICE

- **Atlas Peak Road/Monticello Road (signal)**
 - Acceptable Friday & Saturday PM peak hour operation
- **Silverado Trail/Hardman Avenue (unsignalized)**
 - Unacceptable Friday & Saturday PM peak hour operation

INTERSECTION SIGNAL WARRANT

- **Silverado Trail/Hardman Avenue**
 - Volumes would exceed both rural and urban peak hour signal Warrant #3 volume criteria during both the Friday and Saturday PM peak hours.

B. PROJECT IMPACTS

1. Project Trip Generation

The proposed project will result in the following trip generation during harvest Friday and Saturday PM peak traffic hours.

PROJECT TRIP GENERATION

HARVEST

FRIDAY PM PEAK HOUR* (4:15-5:15)		SATURDAY PM PEAK HOUR* (4:30-5:30)	
INBOUND TRIPS	OUTBOUND TRIPS	INBOUND TRIPS	OUTBOUND TRIPS
0	3	0	3

* Peak traffic hour along Silverado Trail.

Trips during the Friday and Saturday PM peak hours will be a combination of the last visitors of the day leaving and the tour/tasting employee going home.

2. Year 2017 Harvest + Project Off-Site Circulation Impacts

The project would not result in any significant level of service or signal warrant impacts to the unsignalized Silverado Trail/Hardman Avenue intersection. Although the stop sign controlled Hardman Avenue intersection approach to Silverado Trail would be operating at an unacceptable level of service with or without the project, the increase in traffic on the Hardman Avenue approach due to the project would be less than 10 percent. Also the project would not result in any significant level of service impact at the signalized Atlas Peak Road/Monticello Road intersection and would not degrade operation from acceptable to unacceptable. *Less than significant.*

3. Year 2020 Harvest + Project Off-Site Circulation Impacts

The project would not result in any significant level of service or signal warrant impacts to the unsignalized Silverado Trail/Hardman Avenue intersection. Although the stop sign controlled Hardman Avenue intersection approach to Silverado Trail would be operating at an unacceptable level of service with or without the project, the increase in traffic on the Hardman Avenue approach due to the project would be less than 10 percent. Also the project would not result in any significant level of service impact at the signalized Atlas Peak Road/Monticello Road intersection and would not degrade operation from acceptable to unacceptable. *Less than significant.*

4. Year 2030 (Cumulative) Harvest + Project Off-Site Circulation Impacts

The project would result in a significant level of service impact to the Silverado Trail/Hardman Avenue intersection during both the Friday and Saturday PM peak hours. The growth in traffic from existing to cumulative conditions on the stop sign controlled Hardman Avenue approach to Silverado Trail would be increased by more than 5 percent

due to the addition of project traffic during both peak hours. However, there would be no level of service impacts to the signalized Atlas Peak Road/Monticello Road intersection and the project would not degrade operation from acceptable to unacceptable. ***Potentially significant Impact.***

5. Need for Left Turn Lane on Atlas Peak Road at Project Entrance

Volumes with the project would not meet County warrant criteria for provision of a left turn lane on the Atlas Peak Road uphill approach to the project driveway. ***Less than significant.***

6. Sight Lines at Project Driveway

Sight lines are currently acceptable in both directions at the project's driveway connection to Atlas Peak Road, but brush will need to be trimmed on a regular basis in order to maintain the acceptable sight lines. ***Potentially significant.***

7. Marketing Events

The proposed marketing events each year may would be scheduled to eliminate any guest traffic on the local circulation system between 3:00 and 5:30 PM on any day of the week. In addition, no events will be held during the evening. ***Less than significant.***

8. Mitigations

- Remove brush on a regular basis along the project's Atlas Peak Road frontage to the north and south of the project driveway in order to maintain acceptable sight lines to accommodate 30 mile per hour traffic speeds on Atlas Peak Road.
- Provide a sign along the project driveway for exiting traffic directing drivers desiring to travel up the Napa Valley to make a right turn at the signalized Atlas Peak road/Monticello (SR 121) intersection to access either Silverado Trail or SR 29.

All potentially significant impacts reduced to a less than significant level.

C. CONCLUSIONS & RECOMMENDATIONS

- The project will result in no significant off-site circulation system operational impacts at the signalized Atlas Peak Road/Monticello Road intersection, but will result in a significant cumulative impact at the unsignalized Silverado Trail/Hardman Avenue intersection.
- Marketing events will be scheduled to preclude any new traffic on the valley roadway network between 3:00 and 5:30 PM.
- Sight lines at the project driveway connection to Atlas Peak Road are currently acceptable in both directions based upon prevailing vehicle speeds, but will require

regular brush removal or trimming along the project frontage in order to maintain acceptable sight lines for exiting drivers.

- Provide a sign along the project driveway for exiting traffic directing drivers desiring to travel up the Napa Valley to make a right turn at the signalized Atlas Peak road/Monticello (SR 121) intersection to access either Silverado Trail or SR 29.

IV. PROJECT LOCATION & DESCRIPTION

The Kitoko Vineyards Winery will be located on the west side of Atlas Peak Road by an existing driveway about 5.75 miles north of the Atlas Peak Road/Monticello Road intersection (see **Figure 1**). The current driveway connection provides access to a single family residence and vineyard and will be maintained. No left turn lane will be provided on the northbound Atlas Peak Road approach to the winery entrance. **Figure 2** presents existing intersection geometrics and approach lanes at analysis intersections.

The proposed Kitoko Vineyards Winery employment, visitation and marketing events are as follows.

- 40,000 gallons per year production.
- 5 full-time and 1 part-time employees during a crush weekday; 3 full-time employees during a crush Saturday.
- All bottling on-site; 8 days per year.
- 17% of grapes will be grown on site. New grapes will be transported to the site in about 20 trucks spread over about 10 days.
- 9 grape outhaul truck trips/year will be eliminated.
- Tours and tasting by appointment only – 7 days per week from 10:00 AM to 5:00 PM, 20 visitors/day maximum (8 vehicles) on weekdays and weekend days.
- Marketing events
 - 10/year, 30 visitors per event (between 10:00 AM and 6:00 PM)
 - 1/year, 100 visitors on Saturday or Sunday (between 10:00 AM and 6:00 PM)
 - No marketing event guest traffic will be on the local circulation system between 3:00 and 5:30 PM.

V. EXISTING CIRCULATION SYSTEM EVALUATION PROCEDURES

A. ANALYSIS LOCATIONS

The following locations have been evaluated.

1. **Atlas Peak Road/Monticello Road (SR 121) (signal)**
2. **Silverado Trail/Hardman Avenue intersection (the Hardman Avenue westbound approach is stop sign controlled)**
3. **Atlas Peak Road/Project Driveway intersection**

B. ROADWAY DESCRIPTION

Atlas Peak Road is primarily a two-lane rural road extending in a general northeasterly direction from Monticello Road and the Silverado Country Club up the mountains lining the east side of the Napa Valley. It has numerous horizontal curves, minimal to no shoulders and a general south-to-north uphill grade. Near Monticello Road it has four travel lanes and a 40 mph speed limit. The road narrows to two lanes near the entrance to the Golf Club and has a 55 mph speed limit north of this point until the road begins its uphill alignment. There is a 25 mph speed advisory sign at the beginning of the uphill grade. Pavement condition ranges from good to adequate.

Silverado Trail provides subregional access to the project vicinity. It is a two-lane highway with a 55 mile per hour posted speed limit near the project site. It extends northerly from the City of Napa through the Napa Valley to its terminus at State Route 29 in the City of Calistoga. Silverado Trail has two well-paved travel lanes and wide paved shoulders that are signed and striped as Class II bicycle lanes in the project study area.

Monticello Road (State Route 121 [SR 121]) is a two-lane highway extending in a general north-east direction from the City of Napa towards Lake Berryessa and roadway connections to Fairfield and the Central Valley. At its signalized intersection with Atlas Peak Road it has a 40 mile per hour (mph) speed limit, an exclusive left turn lane on the eastbound approach and an exclusive right turn lane on the westbound intersection approach.

C. VOLUMES

1. ANALYSIS SEASONS AND DAYS OF THE WEEK

At County request project traffic impacts have been evaluated during harvest conditions. Based upon year 2015 and 2016 Friday and Saturday PM peak period counts from Caltrans PeMS (Performance Measurement System) count surveys along SR 29 in the Napa Valley, September has the highest weekday and weekend volumes of the year (during harvest).

In regards to the peak traffic days of the week, the Napa County Travel Behavioral Study¹ shows that the highest weekday volumes in Napa Valley occur on a Friday, with the highest weekend volumes occurring on a Saturday. In addition, historical count data from the City of Napa show that Friday has the highest volumes of any weekday, while Caltrans historical counts for SR 29 between St. Helena and Napa also show that weekday AM and PM peak hour volumes are higher on a Friday than on either a Wednesday or Thursday. Therefore, Friday and Saturday peak traffic conditions were evaluated at all analysis locations in this study.

2. COUNT RESULTS

Friday 2:30 to 6:00 PM and Saturday noon to 6:00 PM turn movement counts were conducted by Crane Transportation Group (CTG) in April 2017 at the Silverado Trail/Hardman Avenue intersection and in May 2017 at the Atlas Peak Road/Monticello Road (SR 121) and Atlas Peak Road/Project driveway intersections. Resultant April and May 2017 Friday and Saturday peak hour counts are presented in **Appendix Figures A-1 and A-2**.

3. SEASONAL ADJUSTMENTS

Monthly seasonal factors were developed using the Caltrans PeMS data to adjust the May 2017 volumes to harvest 2017 conditions and were utilized to increase May volumes on Silverado Trail/Monticello Road, Atlas Peak Road and Hardman Avenue. Overall, May PM peak hour volumes would be expected to increase by about 3.8 percent on Friday and 6 percent on Saturday to reflect harvest conditions, while April PM peak hour volumes would be expected to increase by about 3.6 percent on Friday and about 7 percent on Saturday to reflect harvest conditions.

Resultant 2017 harvest Friday and Saturday PM peak hour volumes are presented in **Figures 3 & 4**, respectively.

D. INTERSECTION LEVEL OF SERVICE

1. ANALYSIS METHODOLOGY

Transportation engineers and planners commonly use a grading system called level of service (LOS) to measure and describe the operational status of the local roadway network. LOS is a description of the quality of a roadway facility's operation, ranging from LOS A (indicating free-flow traffic conditions with little or no delay) to LOS F (representing oversaturated conditions where traffic flows exceed design capacity, resulting in long queues and delays). Intersections, rather than roadway segments between intersections, are almost always the capacity controlling locations for any circulation system.

Signalized Intersections. For signalized intersections, the 2010 *Highway Capacity Manual* (Transportation Research Board, National Research Council) methodology was utilized. With

¹ Fehr & Peers, December 8, 2014.

this methodology, operations are defined by the level of service and average control delay per vehicle (measured in seconds) for the entire intersection. For a signalized intersection, control delay is the portion of the total delay attributed to traffic signal operation. This includes delay associated with deceleration, acceleration, stopping, and moving up in the queue. **Table 1** summarizes the relationship between delay and LOS for signalized intersections.

Unsignalized Intersections. For unsignalized (all-way stop-controlled and side-street stop-controlled) intersections, the 2010 *Highway Capacity Manual* (Transportation Research Board, National Research Council) methodology for unsignalized intersections was utilized. For side-street stop-controlled intersections, operations are defined by the level of service and average control delay per vehicle (measured in seconds), with delay reported for the stop sign controlled approaches or turn movements, although overall delay is also typically reported for intersections along state highways. For all-way stop-controlled intersections, operations are defined by the average control delay for the entire intersection (measured in seconds per vehicle). The delay at an unsignalized intersection incorporates delay associated with deceleration, acceleration, stopping, and moving up in the queue. **Table 2** summarizes the relationship between delay and LOS for unsignalized intersections.

2. MINIMUM ACCEPTABLE OPERATION

Napa County has recently adopted new minimum acceptable operating condition standards for unsignalized intersections. Based upon the new standards, Level of Service D (LOS D) is the poorest acceptable operation for side street stop sign controlled approaches at two-way stop intersections and for all-way-stop intersections.

E. INTERSECTION SIGNAL WARRANTS

1. ANALYSIS METHODOLOGY

Traffic signals are used to provide an orderly flow of traffic through an intersection. Many times they are needed to offer side street traffic an opportunity to access a major road where high volumes and/or high vehicle speeds block crossing or turn movements. They do not, however, increase the capacity of an intersection (i.e., increase the overall intersection's ability to accommodate additional vehicles) and, in fact, often slightly reduce the number of total vehicles that can pass through an intersection in a given period of time. Signals can also cause an increase in traffic accidents if installed at inappropriate locations.

There are 10 possible tests for determining whether a traffic signal should be considered for installation. These tests, called "warrants", consider criteria such as actual traffic volume, pedestrian volume, presence of school children, and accident history. The intersection volume data together with the available collision histories were compared to warrants contained in the *California Manual on Uniform Traffic Control Devices, 2014, Revision 2 (2014 CMUTCD Rev. 2)*. Section 4C of the 2014 CMUTCD Rev. 2 provides guidelines, or warrants, which may indicate need for a traffic signal at an unsignalized intersection. As indicated in the 2014 CMUTCD Rev. 2, satisfaction of one or more warrants does not necessarily require immediate

installation of a traffic signal. It is merely an indication that the local jurisdiction should begin monitoring conditions at that location and that a signal may ultimately be required.

Warrant 3, the peak hour volume warrant, is often used as an initial check of signalization needs since peak hour volume data is typically available and this warrant is usually the first one to be met. Warrant 3 is based on a logarithmic curve and takes only the hour with the highest volume of the day into account. For intersections in rural locations (with local area population less than 10,000 people or where the posted speed limit or 85th percentile speed on the uncontrolled intersection approaches is greater than 40 miles per hour) a 70 percent warrant is applied. The regular and 70 percent warrants are typically referred to as the urban and rural peak hour warrants. Please see the **Appendix** for the warrant chart.

It should be noted that a “rural” warrant chart is utilized when the uncontrolled intersection approaches have vehicle speeds greater than 40 miles per hour or when the intersection is in a community with less than 10,000 population. The rural chart has been utilized for evaluation of the Silverado Trail intersections with Oak Knoll Avenue, Soda Canyon Road and Hardman Avenue since the speeds along Silverado Trail are greater than 40 miles per hour and the intersections are in rural settings. However, when urban warrant criteria are also exceeded that is also reported.

F. PLANNED IMPROVEMENTS

There are no planned and funded circulation system capacity improvements at any location evaluated in this study.²

VI. FUTURE HORIZON TRAFFIC VOLUME PROJECTIONS

Traffic analysis has been conducted for harvest 2017, year 2020 and cumulative (year 2030) horizons at County request. The 2030 horizon reflects the County General Plan Buildout year, while 2020 reflects a near term horizon the year the proposed winery should be at full production. Traffic modeling for the General Plan shows about a 12 to 13 percent growth in two-way weekday PM peak hour traffic along Silverado Trail near Hardman Avenue between 2017 and 2030. Projecting straight line traffic growth for analysis purposes, this translates into about a 3 percent growth in two-way PM peak hour traffic along Silverado Trail in this area from 2017 to 2020.

Traffic modeling for the General Plan also shows about a 13.3 percent growth in two-way weekday PM peak hour traffic along Monticello Road near Atlas Peak Road between 2017 and 2030. Projecting straight line traffic growth for analysis purposes, this translates into about a 3.1

² Michelle Melonakis, P.E., Napa County Public Works Department, July 2017.

percent growth in two-way PM peak hour traffic along Silverado Trail in this area from 2017 to 2020.

No reliable traffic modeling projections were available for Atlas Peak Road or Hardman Avenue. Therefore, a 1 percent per year growth rate was projected for both roads.

County general plan traffic modeling projections were also not available for Saturday PM peak hour conditions along any analysis roadway. Therefore, volumes on Silverado Trail, Monticello Road, Hardman Avenue and Atlas Peak Road were uniformly increased by the PM percentages detailed above for Friday PM peak hour conditions.

Resultant year 2020 harvest “Without Project” Friday and Saturday PM peak hour volumes are presented in **Figures 5 & 6**, respectively, while cumulative (year 2030) harvest Friday and Saturday “Without Project” PM peak hour volumes are presented in **Figures 7 & 8**, respectively.

VII. OFF-SITE HARVEST CIRCULATION SYSTEM OPERATION – WITHOUT PROJECT

1. EXISTING (2017) HARVEST OPERATING CONDITIONS (WITHOUT PROJECT)

A. INTERSECTION LEVEL OF SERVICE – see Table 3

1. ATLAS PEAK ROAD/MONTICELLO ROAD

a) Friday PM Peak Hour

Acceptable signal controlled operation: LOS B

b) Saturday PM Peak Hour

Acceptable signal controlled operation: LOS B

2. SILVERADO TRAIL/HARDMAN AVENUE

a) Friday PM Peak Hour

Unacceptable Hardman Avenue stop sign controlled operation: LOS F

b) Saturday PM Peak Hour

Unacceptable Hardman Avenue stop sign controlled operation: LOS E

B. INTERSECTION SIGNAL WARRANT #3 EVALUATION – see Table 4

1. SILVERADO TRAIL/HARDMAN AVENUE

a) Friday PM Peak Hour

Volumes exceed Caltrans rural and urban peak hour signal warrant criteria.

b) Saturday PM Peak Hour

Volumes exceed Caltrans rural and urban peak hour signal warrant criteria.

2. YEAR 2020 OPERATING CONDITIONS (WITHOUT PROJECT)

A. INTERSECTION LEVEL OF SERVICE – Table 3

1. ATLAS PEAK ROAD/MONTICELLO ROAD

a) Friday PM Peak Hour

Acceptable signal controlled operation: LOS B

b) Saturday PM Peak Hour

Acceptable signal controlled operation: LOS B

2. SILVERADO TRAIL/HARDMAN AVENUE

a) Friday PM Peak Hour

Unacceptable Hardman Avenue stop sign controlled operation: LOS F

b) Saturday PM Peak Hour

Unacceptable Hardman Avenue stop sign controlled operation: LOS F

B. INTERSECTION SIGNAL WARRANT #3 EVALUATION – see Table 4

1. SILVERADO TRAIL/HARDMAN AVENUE

a) Friday PM Peak Hour

Volumes exceed Caltrans rural and urban peak hour signal warrant criteria.

b) Saturday PM Peak Hour

Volumes exceed Caltrans rural and urban peak hour signal warrant criteria.

3. CUMULATIVE (YEAR 2030) OPERATING CONDITIONS (WITHOUT PROJECT)

A. INTERSECTION LEVEL OF SERVICE – Table 3

1. ATLAS PEAK ROAD/MONTICELLO ROAD

a) Friday PM Peak Hour

Acceptable signal controlled operation: LOS B

b) Saturday PM Peak Hour

Acceptable signal controlled operation: LOS B

2. SILVERADO TRAIL/HARDMAN AVENUE

a) Friday PM Peak Hour

Unacceptable Hardman Avenue stop sign controlled operation: LOS F

b) Saturday PM Peak Hour

Unacceptable Hardman Avenue stop sign controlled operation: LOS F

**B. INTERSECTION SIGNAL WARRANT #3 EVALUATION
– see Table 4**

1. SILVERADO TRAIL/HARDMAN AVENUE

a) Friday PM Peak Hour

Volumes exceed Caltrans rural and urban peak hour signal warrant criteria.

b) Saturday PM Peak Hour

Volumes exceed Caltrans rural and urban peak hour signal warrant criteria.

**VIII. PROJECT IMPACT EVALUATION
SIGNIFICANCE CRITERIA**

A. SIGNIFICANCE CRITERIA

1. COUNTY OF NAPA

The following criteria have recently been developed for traffic impact analyses in Napa County.

EXISTING + PROJECT CONDITIONS

A. ARTERIAL SEGMENTS

A project would cause a significant impact requiring mitigation if:

1. An arterial segment operates at LOS A, B, C or D during the selected peak hours without project trips, and deteriorates to LOS E or F with the addition of project trips, or
2. An arterial segment operates at LOS E or F during the selected peak hours without project trips, and the addition of project trips increases the total segment volume by one percent or more.

For the second criteria, the following equation should be used if the arterial operates at LOS E or F without the project:

$$\textit{Project Contribution \%} = \textit{Project Trips} \div \textit{Existing Volumes}$$

B. SIGNALIZED INTERSECTIONS

A project would cause a significant impact requiring mitigation if:

1. A signalized intersection operates at LOS A, B, C or D during the selected peak hours without project trips, and deteriorates to LOS E or F with the addition of project trips, or
2. A signalized intersection operates at LOS E or F during the selected peak hours without project trips, and the addition of project trips increases the total entering volume by one percent or more.

For the second criteria, the following equation should be used if the signalized intersection operates at LOS E or F without the project:

$$\textit{Project Contribution \%} = \textit{Project Trips} \div \textit{Existing Volumes}$$

Maintaining LOS D or better at all signalized intersections would sometimes require expanding the physical footprint of an intersection. In some locations around the County, expanding physical transportation infrastructure could be in direct conflict with the County's goals of preserving the area's rural character, improving safety, and sustaining the agricultural industry, making these potential improvements infeasible. The County's Circulation Element lists intersections that are slated for improvement or expansion in unincorporated Napa County.³

Transportation studies should individually consider the feasibility of potential mitigation measures with respect to right-of-way acquisition, regardless of the intersection's place in the Circulation Element's identified improvement lists, and present potential alternative mitigation measures that do not require right-of-way acquisition. County staff would then review that information and make the decision about the feasibility of the identified potential mitigations.

For intersections that cannot be improved without substantial additional right-of-way according to both the Circulation Element and the individual transportation impact study, and where other mitigations such as updating signal timing, signal phasing and operations, and/or signing and striping improvements do not improve the LOS, LOS E or F will be considered acceptable and the one percent threshold would not apply. Analysis of signalized intersection LOS should still be presented for informational purposes, and there should still be an evaluation of effects on safety and local access, per Policy CIR-18.

³ According to the Circulation Element dated June 8, 2008, the following intersections can be altered or expanded as a mitigation measure: SR-12/Airport Boulevard/SR-29, SR-221/SR-12/Highway 29, and several intersections along SR-29 and SR-128 north of Napa. The significance criteria shown above should apply to facilities where appropriate based upon the most recent Circulation Element chapter of the General Plan.

C. UNSIGNALIZED INTERSECTIONS (ALL WAY STOP AND SIDE STREET STOP SIGN CONTROLLED)

LOS for all way stop controlled intersections is defined as an average of the delay at all approaches. LOS for side street stop controlled intersections is defined by the delay and LOS for the worst case approach. The recommended interpretation of Policy CIR-16 regarding unsignalized intersection significance criteria is as follows:

1. An unsignalized intersection operates at LOS A, B, C or D during the selected peak hours without project trips, the LOS deteriorates to LOS E or F with the addition of project traffic, and the peak hour traffic signal warrant criteria should also be evaluated and presented for information purposes, or
2. An unsignalized intersection operates at LOS E or F during the selected peak hours without project trips and the project contributes one percent or more of the total entering traffic for all way stop controlled intersections, or 10 percent or more of the traffic on a side street approach for side street stop controlled intersections; the peak hour traffic signal warrant criteria should also be evaluated and presented for informational purposes.

All Way Stop Controlled Intersections

For the second criteria at an all way stop controlled intersection, the following equation should be used if the all way stop controlled intersection operates at LOS E or F without the project.

$$\text{Project Contribution \%} = \text{Project Trips} \div \text{Existing Volumes}$$

Side Street Stop Controlled Intersections

For the second criteria at a side street stop controlled intersection, the following equation should be used if the side street stop controlled intersection operates at LOS E or F without the project.

$$\text{Project Contribution \%} = \text{Project Trips} \div \text{Existing Volumes}$$

Both of those volumes are for the stop controlled approaches only. Each stop controlled approach that operates at LOS E or F should be analyzed individually.

CUMULATIVE+ PROJECT CONDITIONS

A. ARTERIAL SEGMENTS, SIGNALIZED INTERSECTIONS AND UNSIGNALIZED INTERSECTIONS

A project would cause a significant cumulative impact requiring mitigation if:

1. The overall amount of expected traffic growth causes conditions to deteriorate such that any of the significance criteria described above for existing conditions are met, and

2. The project's contribution to a significant cumulative impact would be equal to or greater than five percent of the growth in traffic from existing conditions.

A project's contribution to a cumulative condition would be calculated as the project's percentage contribution to the total growth in traffic from existing conditions.

$$\text{Project Contribution \%} = \text{Project Trips} \div (\text{Cumulative Volumes} - \text{Existing Volumes})$$

- If projected daily volumes on the project driveway in combination with volumes on the roadway providing access to the project driveway meet County warrant criteria for provision of a left turn lane on the approach to the project entrance.
- If sight lines at project access driveways do not meet Caltrans stopping sight distance criteria based upon prevailing vehicle speeds.

IX. PROJECT TRIP GENERATION & DISTRIBUTION

A. TRIP GENERATION

Friday PM peak hour and Saturday afternoon peak hour harvest trip generation projections were developed with the assistance of the project applicant and their representative for all components of the proposed Kitoko Vineyards Winery (see worksheets in the **Appendix**). Results are presented on an hourly basis in **Tables 5 & 6** for harvest Friday and Saturday conditions, respectively. A summary of peak hour trips associated with the winery is presented in **Table 7**. During the harvest Friday PM peak traffic hour there would be a projected 0 new inbound and 3 new outbound vehicles. During the harvest Saturday PM peak traffic hour, there would be a projected 0 new inbound and 3 new outbound vehicles. Traffic during these peak hours would be associated with a combination of the last visitors of the day leaving and the tour/tasting employee going home. The distribution of guest traffic to/from the winery is presented in **Appendix Figure A-3**. Fifty percent of the guest traffic was projected to be at the winery between 2:00 and 4:00 PM.

B. TRIP DISTRIBUTION

Project traffic was distributed to Silverado Trail and Monticello Road in a pattern reflective of existing vehicle distribution patterns.

The harvest Friday and Saturday PM project traffic increments expected on the local circulation system during the times of ambient peak traffic flows through the Silverado Trail/Hardman Avenue intersection are presented in **Figures 9 & 10**. Friday and Saturday Existing "With Project" PM peak hour volumes are presented in **Figures 11 & 12**; Friday and Saturday year 2020 "With Project" PM peak hour volumes are presented in **Figures 13 & 14**, and Friday and Saturday Cumulative (year 2030) "With Project" PM peak hour volumes are presented in **Figures 15 & 16**.

C. PLANNED ROADWAY IMPROVEMENTS

There are no capacity increasing roadway improvements planned by the County on the local roadway network serving the project site.⁴

X. PROJECT IMPACTS

A. EXISTING (YEAR 2017) HARVEST WITH PROJECT CONDITIONS

1. SUMMARY

Project traffic would not result in any significant level of service impacts at the Silverado Trail/Hardman Avenue or Atlas Peak Road/Monticello Road intersections. *Less than significant.*

2. INTERSECTION LEVEL OF SERVICE – see Table 3

a) ATLAS PEAK ROAD/MONTICELLO ROAD

The Atlas Peak Road/Monticello Road intersection would have acceptable “Without Project” signalized operation during both the Friday and Saturday PM peak hours and the addition of project traffic would not result in unacceptable operation during either PM peak traffic hour. *Less than significant.*

b) SILVERADO TRAIL/HARDMAN AVENUE

The Silverado Trail/Hardman Avenue intersection would already have unacceptable “Without Project” stop sign controlled approach operation during both the Friday and Saturday PM peak hours. However, the project would only increase volumes on the stop sign controlled Hardman Avenue approach by 1.3% during the Friday PM peak hour and by 1.4% during the Saturday PM peak hour, which would be less than the maximum acceptable 10 percent traffic added significance criteria limit. *Less than significant.*

3. INTERSECTION SIGNAL WARRANT – see Table 4

a) SILVERADO TRAIL/HARDMAN AVENUE

The Silverado Trail/Hardman Avenue intersection would already have without project Friday and Saturday PM peak hour volumes exceeding Caltrans rural and urban peak hour Warrant #3 criteria levels. However, the project would only increase volumes entering the intersection by

⁴ Michelle Melonakis, P.E., Napa County Public Works Department, July 2017.

0.06% during the Friday PM peak hour and by 0.06% during the Saturday PM peak hour, which would be less than the minimum 1 percent traffic added significance criteria limit. *Less than significant.*

B. YEAR 2020 WITH PROJECT HARVEST CONDITIONS

1) SUMMARY

Project traffic would not result in any significant level of service impacts at the Silverado Trail/Hardman Avenue or Atlas Peak Road/Monticello Road intersections. *Less than significant.*

2. INTERSECTION LEVEL OF SERVICE – see Table 3

a) ATLAS PEAK ROAD/MONTICELLO ROAD

The Atlas Peak Road/Monticello Road intersection would have acceptable “Without Project” signalized operation during both the Friday and Saturday PM peak hours and the addition of project traffic would not result in unacceptable operation during either PM peak traffic hour. *Less than significant.*

b) SILVERADO TRAIL/HARDMAN AVENUE

The Silverado Trail/Hardman Avenue intersection would already have unacceptable “Without Project” stop sign controlled approach operation during both the Friday and Saturday PM peak hours. However, the project would only increase volumes on the stop sign controlled Harman Avenue approach by 1.3% during the Friday PM peak hour and by 1.4% during the Saturday PM peak hour, which would be less than the maximum acceptable 10 percent traffic added significance criteria limit. *Less than significant.*

3. INTERSECTION SIGNAL WARRANT – see Table 4

a) SILVERADO TRAIL/HARDMAN AVENUE

The Silverado Trail/Hardman Avenue intersection would already have without project Friday and Saturday PM peak hour volumes exceeding Caltrans rural and urban peak hour Warrant #3 criteria levels. However, the project would only increase volumes entering the intersection by 0.06% during the Friday PM peak hour and by 0.06% during the Saturday PM peak hour, which would be less than the maximum 1 percent traffic added significance criteria limit. *Less than significant.*

C. CUMULATIVE (YEAR 2030) WITH PROJECT HARVEST CONDITIONS

1) Summary

Project traffic would not result in any significant level of service impact at the Atlas Peak Road/Monticello Road intersections. However, the project would result in a significant impact at the Silverado Trail/Hardman Avenue stop sign controlled intersection. *Significant impact.*

2. INTERSECTION LEVEL OF SERVICE – see Table 3

a) ATLAS PEAK ROAD/MONTICELLO ROAD

The Atlas Peak Road/Monticello Road intersection would have acceptable “Without Project” signalized operation during both the Friday and Saturday PM peak hours and the addition of project traffic would not result in unacceptable operation during either PM peak traffic hour. *Less than significant.*

b) SILVERADO TRAIL/HARDMAN AVENUE

The Silverado Trail/Hardman Avenue intersection would already have unacceptable “Without Project” stop sign controlled approach operation during both the Friday and Saturday PM peak hours. In addition, the project would increase the growth in traffic (between existing and cumulative conditions) on the stop sign controlled Hardman Avenue approach by 14.3% during the Friday PM peak hour and by 11.1% during the Saturday PM peak hour, which would be greater than the maximum acceptable 5 percent traffic added significance criteria limit. *Potentially significant impact.*

3. INTERSECTION SIGNAL WARRANT – see Table 4

a) SILVERADO TRAIL/HARDMAN AVENUE

The Silverado Trail/Hardman Avenue intersection would already have without project Friday and Saturday PM peak hour volumes exceeding Caltrans rural and urban peak hour Warrant #3 criteria levels. However, the project would only increase volumes entering the intersection by 0.05% during the Friday PM peak hour and by 0.06% during the Saturday PM peak hour, which would be less than the maximum 1 percent traffic added significance criteria limit. *Less than significant.*

XI. PROJECT ACCESS IMPACTS

A. SIGHT LINE ADEQUACY AT PROJECT DRIVEWAYS

Project Driveway Connection to Atlas Peak Road

Sight lines for drivers turning from the project driveway to see Atlas Peak Road traffic are about 200 feet to the north (uphill) and south (downhill). Although there is no posted speed limit in the project vicinity, vehicles were observed by Crane Transportation Group to be traveling between 25 and 30 miles per hour, particularly in the downhill direction. Corner sight line criteria at a private driveway connection to a public road are based upon minimum stopping sight distance. Shown below are Caltrans minimum stopping sight distance 2014 Highway Design Manual criteria.⁵

SPEED (MPH)	MINIMUM STOPPING SIGHT DISTANCE
25	150'
30	200'

Caltrans stopping sight criteria.

Based upon available sight lines and observed vehicle speeds along Silverado Trail at the project entrance, sight lines are acceptable in both directions. However, brush will need to be trimmed along the project frontage on a regular basis in order to maintain the acceptable sight lines.

Potentially significant impact.

XII. LEFT TURN LANE WARRANT EVALUATION

A left turn lane is not proposed by the project on the Atlas Peak Road northbound (uphill) approach to the project driveway. As shown in **Appendix Figure A-4**, even after the addition of project traffic, volumes would be much less than County left turn lane warrant criteria levels. Based upon four days of 24-hour counts in May 2017 on Atlas Peak road and the site driveway (Tuesday through Friday), the average two-way ADT on Atlas Peak Road was 268 vehicles, while the maximum daily volume on the project driveway was 6 vehicles. ***Less than Significant.***

⁵ Caltrans *Highway Design Manual*, 2014.

XIII. MARKETING EVENTS

Table 8 presents details of the number of guests, employees and hired event staffing that would likely be present for the project's 11 proposed marketing events.

- 10 events with 30 guests (11-12 guest vehicles) – any day of the week
- 1 event with 100 guests (36 guest vehicles) – Saturday or Sunday

All events will occur between 10:00 AM and 6:00 PM, but will not be adding traffic to the local roadway system between 3:00 and 5:30 PM. Also, there will be no marketing events during the evening.

There will be no regular visitation allowed during any marketing events. *Less than Significant.*

XIV. MITIGATION MEASURES

- Remove brush on a regular basis along the project's Atlas Peak Road frontage to the north and south of the project driveway in order to maintain acceptable sight lines to accommodate 30 mile per hour traffic speeds on Atlas Peak Road.
- Provide a sign along the project driveway for exiting traffic directing drivers desiring to travel up the Napa Valley to make a right turn at the signalized Atlas Peak road/Monticello (SR 121) intersection to access either Silverado Trail or SR 29.

All potentially significant impacts reduced to a less than significant level.

XV. CONCLUSIONS & RECOMMENDATIONS

- The project will result in no significant off-site circulation system operational impacts at the signalized Atlas Peak Road/Monticello Road intersection, but will result in a significant cumulative impact at the unsignalized Silverado Trail/Hardman Avenue intersection.
- Marketing events will be scheduled to preclude any new traffic on the valley roadway network between 3:00 and 5:30 PM.
- Sight lines at the project driveway connection to Atlas Peak Road are currently acceptable in both directions based upon prevailing vehicle speeds, but will require regular brush removal or trimming along the project frontage in order to maintain acceptable sight lines for exiting drivers.

- Provide a sign along the project driveway for exiting traffic directing drivers desiring to travel up the Napa Valley to make a right turn at the signalized Atlas Peak road/Monticello (SR 121) intersection to access either Silverado Trail or SR 29.

This Report is intended for presentation and use in its entirety, together with all of its supporting exhibits, schedules, and appendices. Crane Transportation Group will have no liability for any use of the Report other than in its entirety, such as providing an excerpt to a third party or quoting a portion of the Report. If you provide a portion of the Report to a third party, you agree to hold CTG harmless against any liability to such third parties based upon their use of or reliance upon a less than complete version of the Report.

Figures



Kitoko Winery Traffic Study

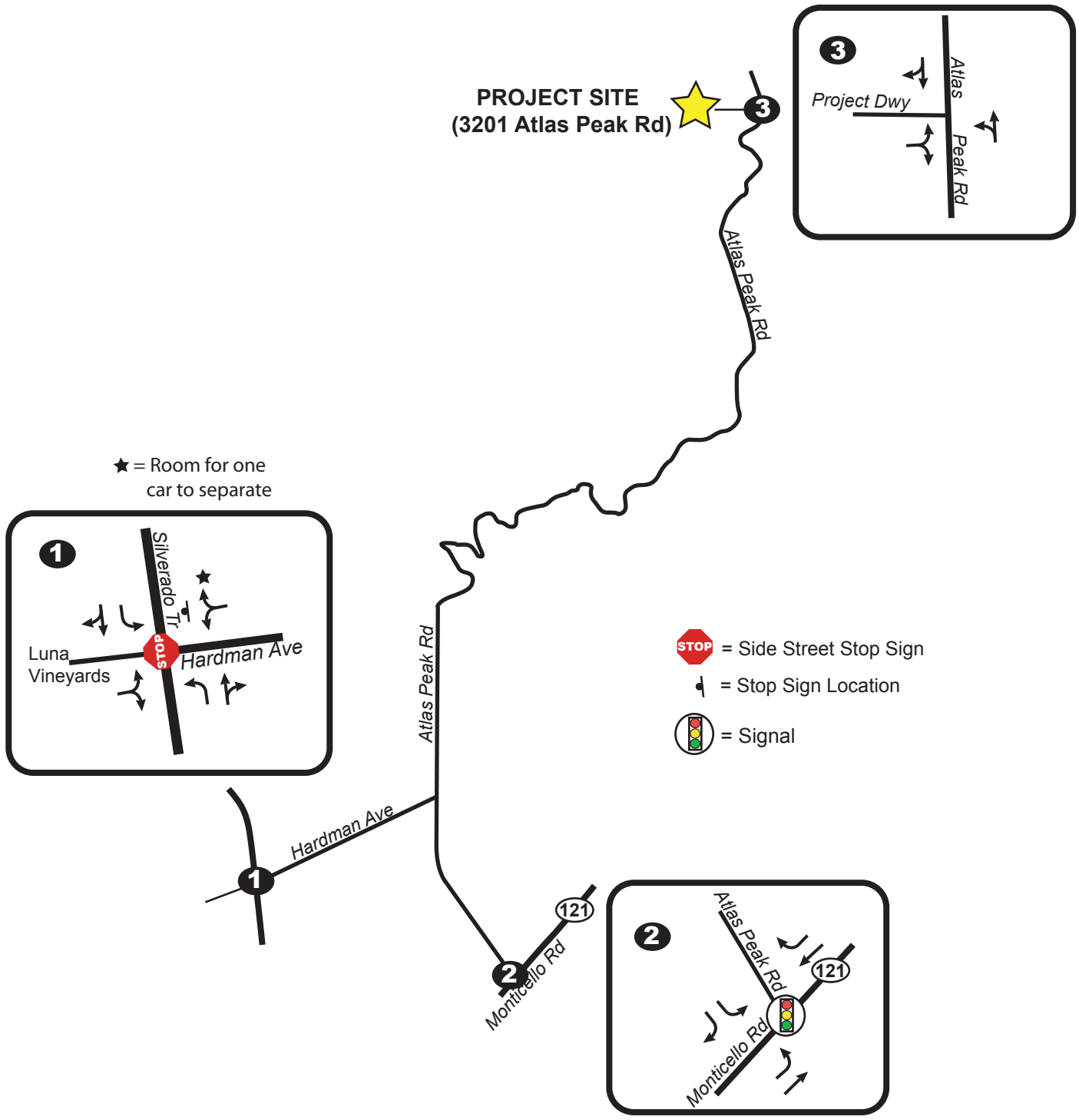
Map data ©2016Google

Figure 1
Area Map

Not To Scale



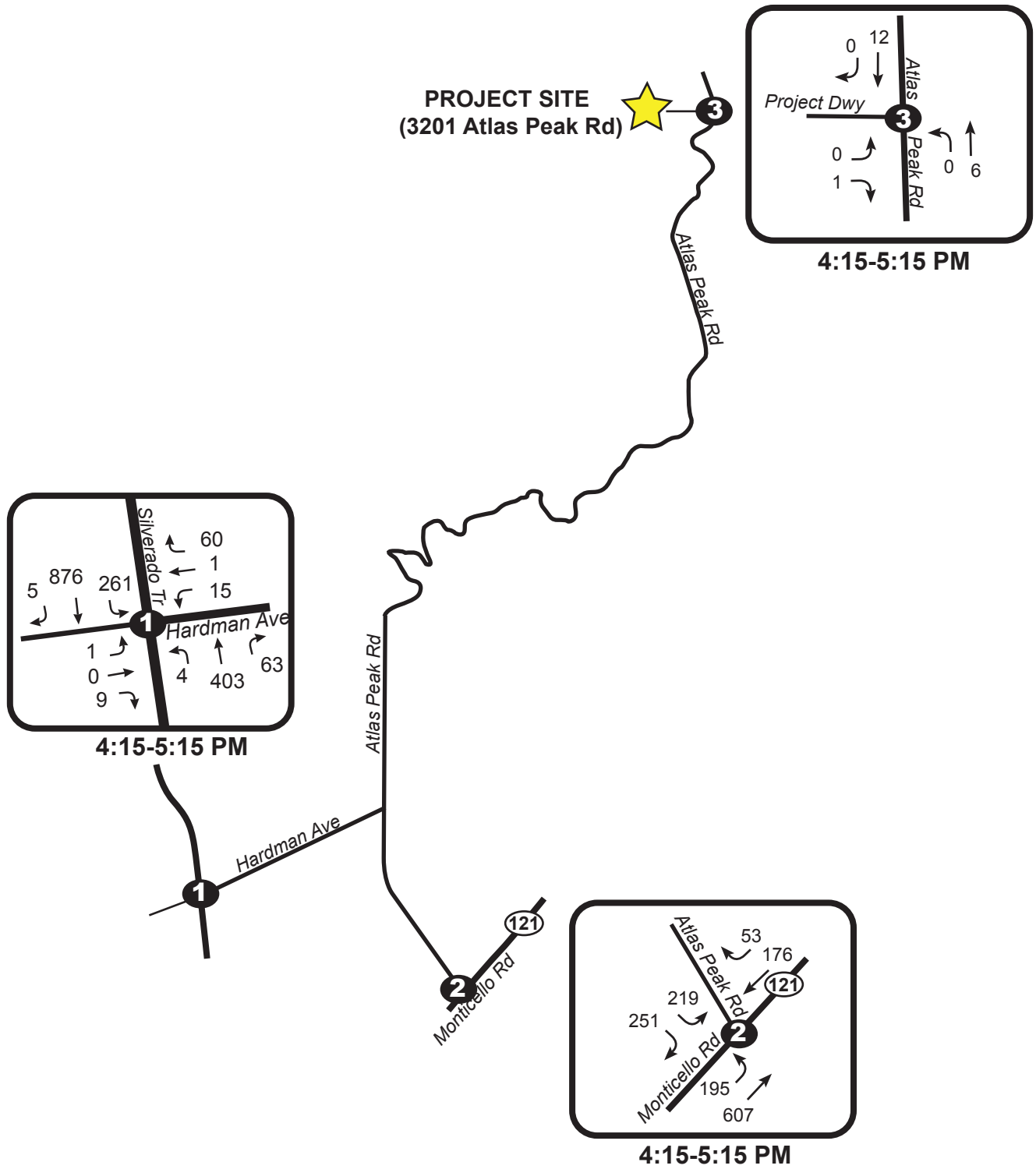
NORTH



Kitoko Winery Traffic Study

Figure 2
Lane Geometrics and Intersection Control

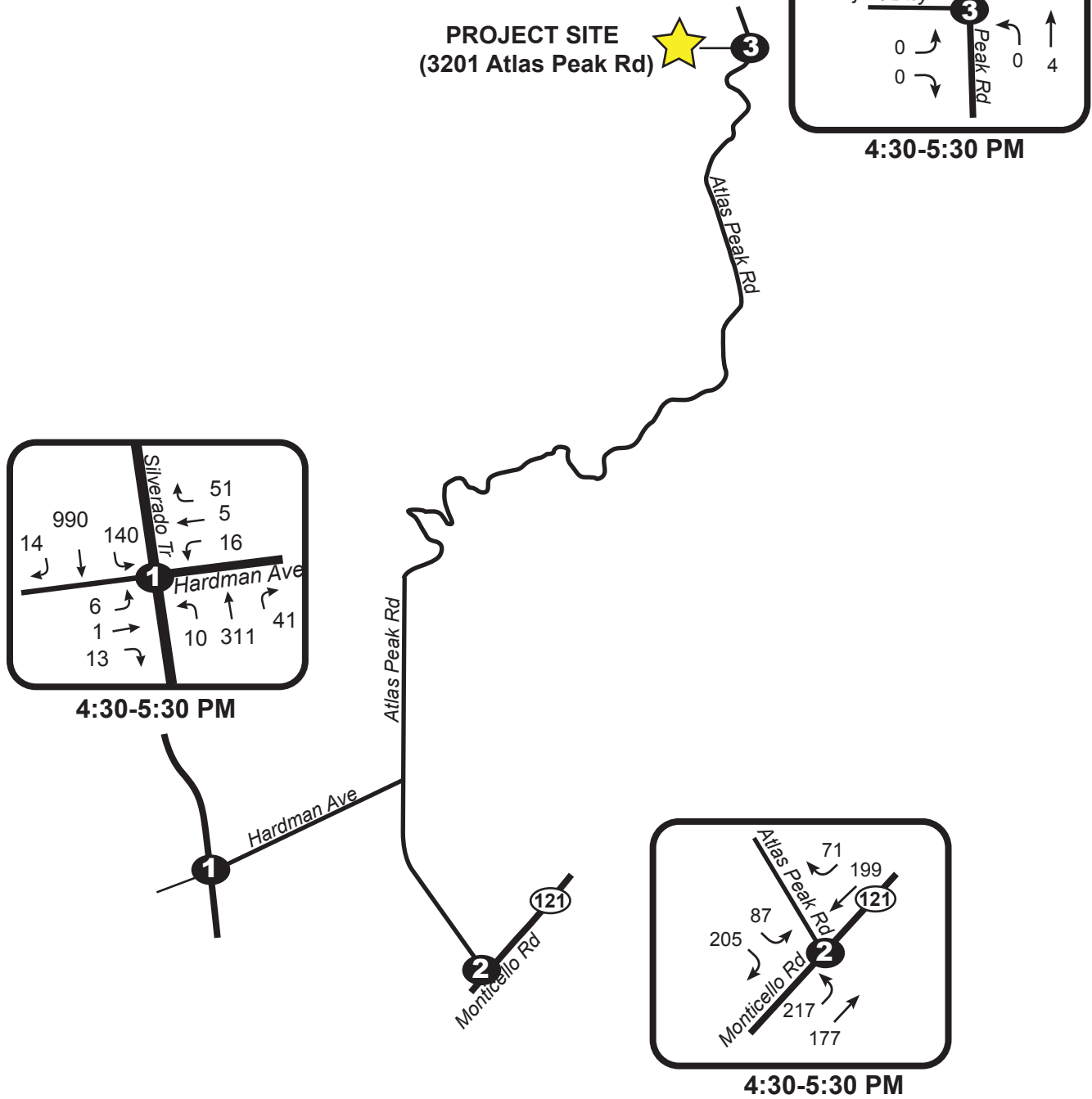
Not To Scale



Kitoko Winery Traffic Study

Figure 3
Existing (without project) Harvest Friday
PM Peak Hour Traffic Volumes

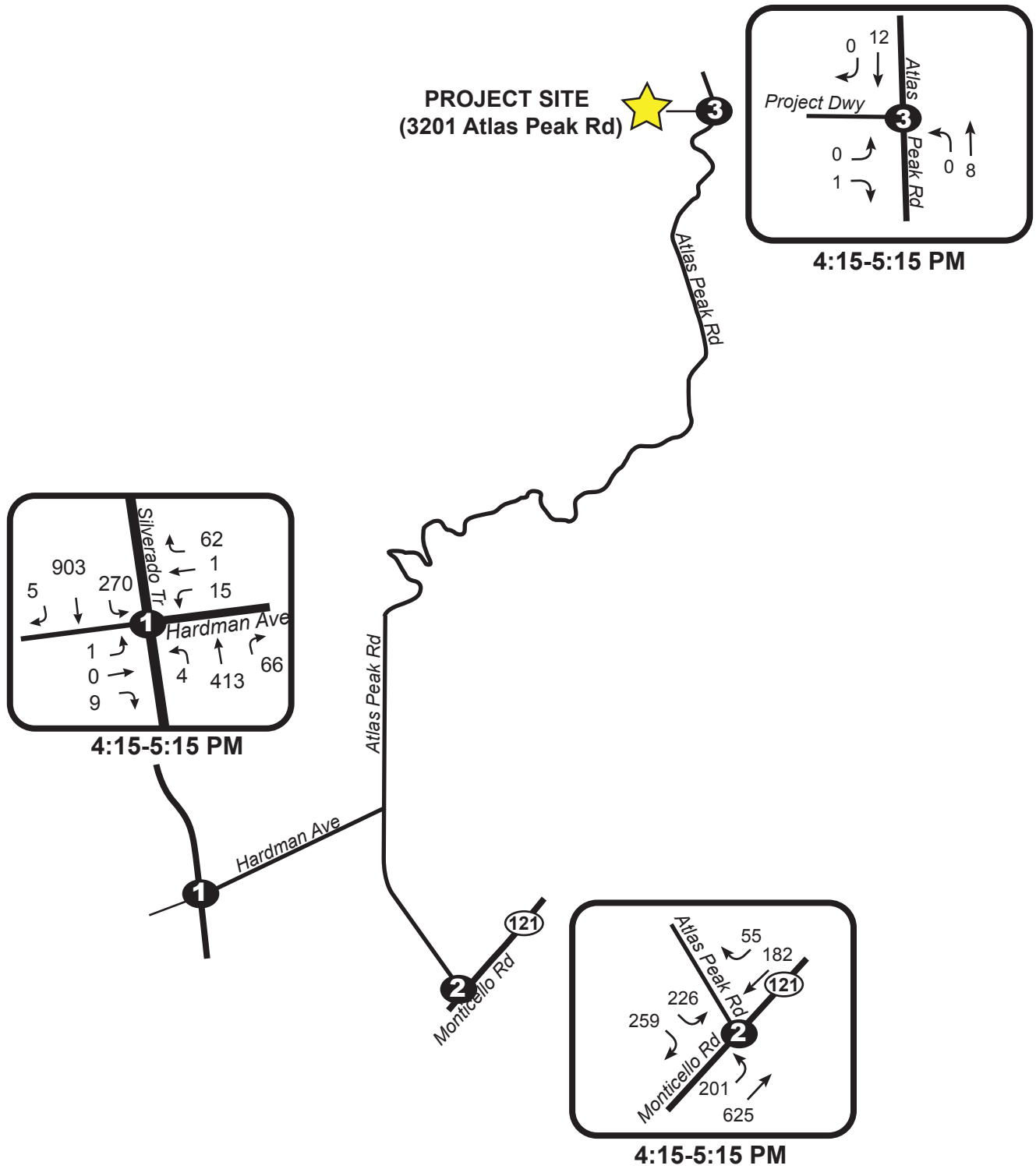
Not To Scale



Kitoko Winery Traffic Study

Figure 4
Existing (without Project) Harvest Saturday
PM Peak Hour Traffic Volumes

Not To Scale



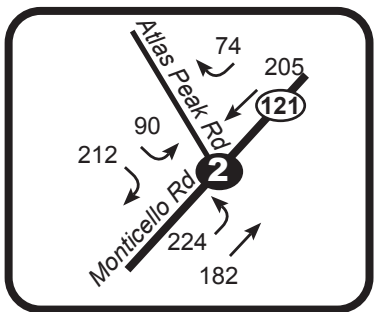
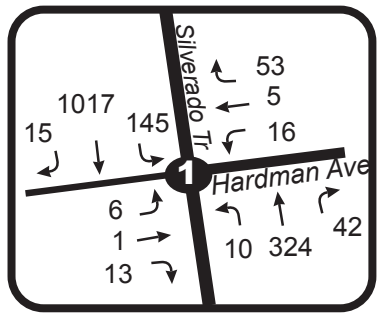
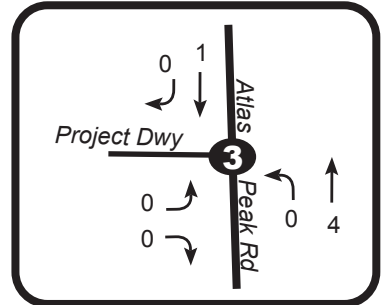
Kitoko Winery Traffic Study

Figure 5
2020 (without Project) Harvest Friday
PM Peak Hour Traffic Volumes

Not To Scale



PROJECT SITE
(3201 Atlas Peak Rd)



Kitoko Winery Traffic Study

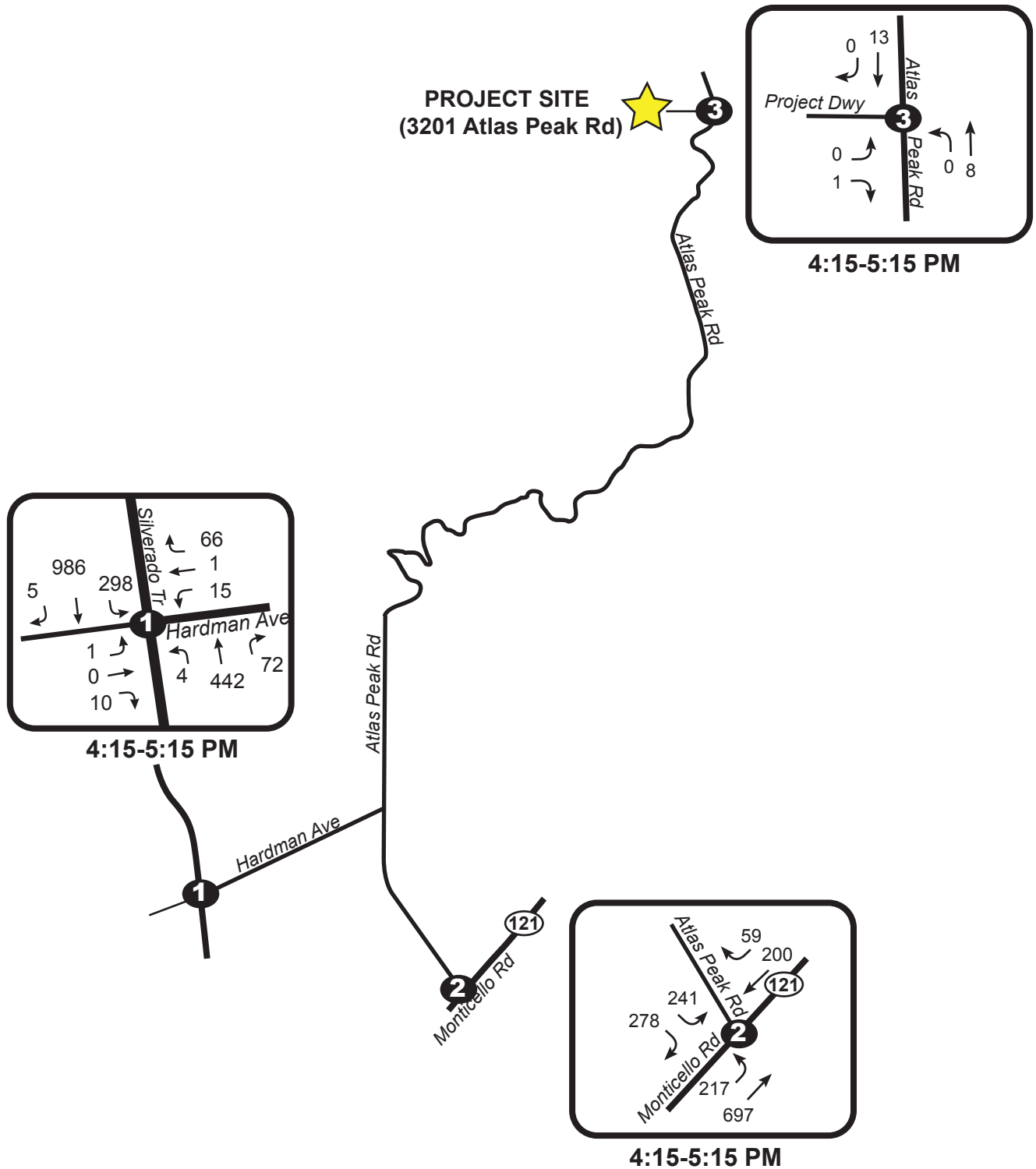


CRANE TRANSPORTATION GROUP

Figure 6

2020 (without Project) Harvest Saturday
PM Peak Hour Traffic Volumes

Not To Scale



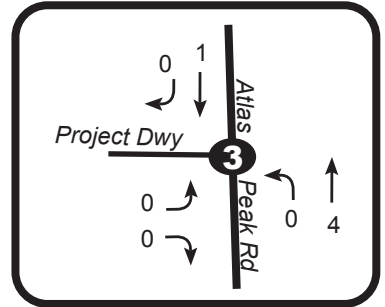
Kitoko Winery Traffic Study

Figure 7
2030 (without Project) Harvest Friday
PM Peak Hour Traffic Volumes

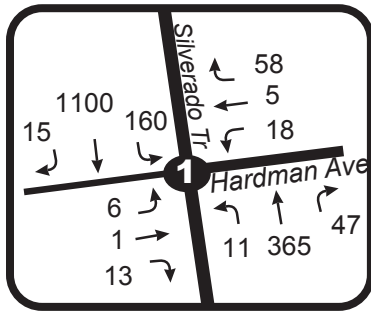
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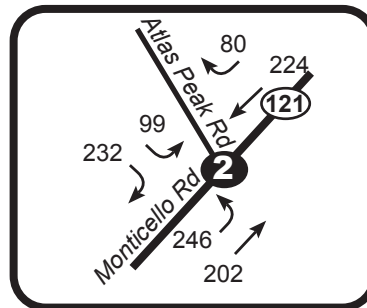
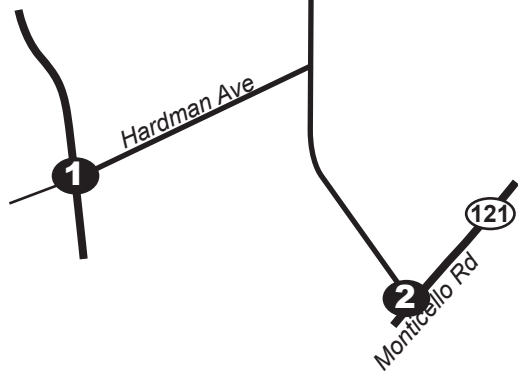
PROJECT SITE
(3201 Atlas Peak Rd)



4:30-5:30 PM



4:30-5:30 PM



4:30-5:30 PM

Kitoko Winery Traffic Study



CRANE TRANSPORTATION GROUP

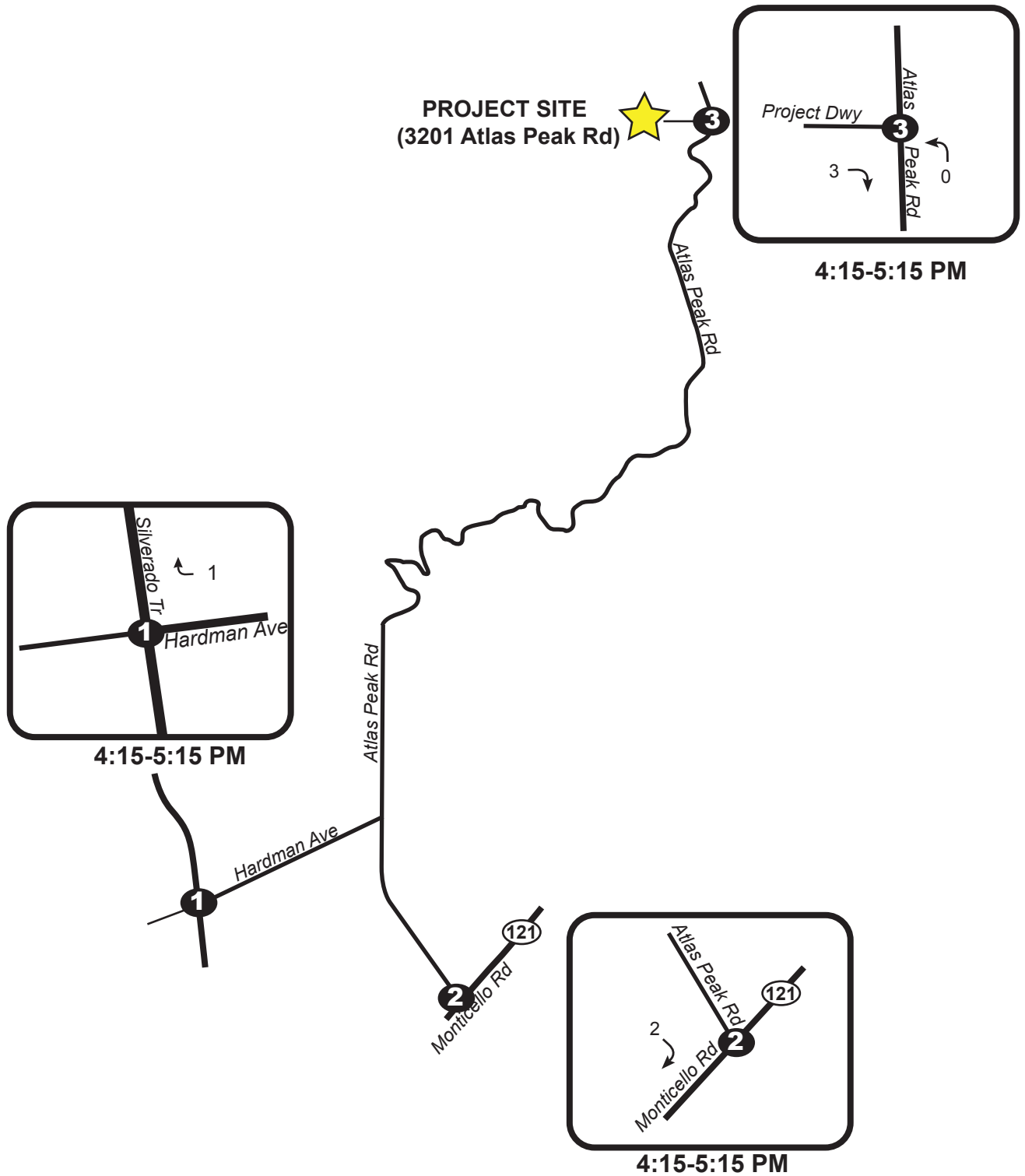
Figure 8

2030 (without Project) Harvest Saturday
PM Peak Hour Traffic Volumes

Not To Scale



NORTH



Kitoko Winery Traffic Study



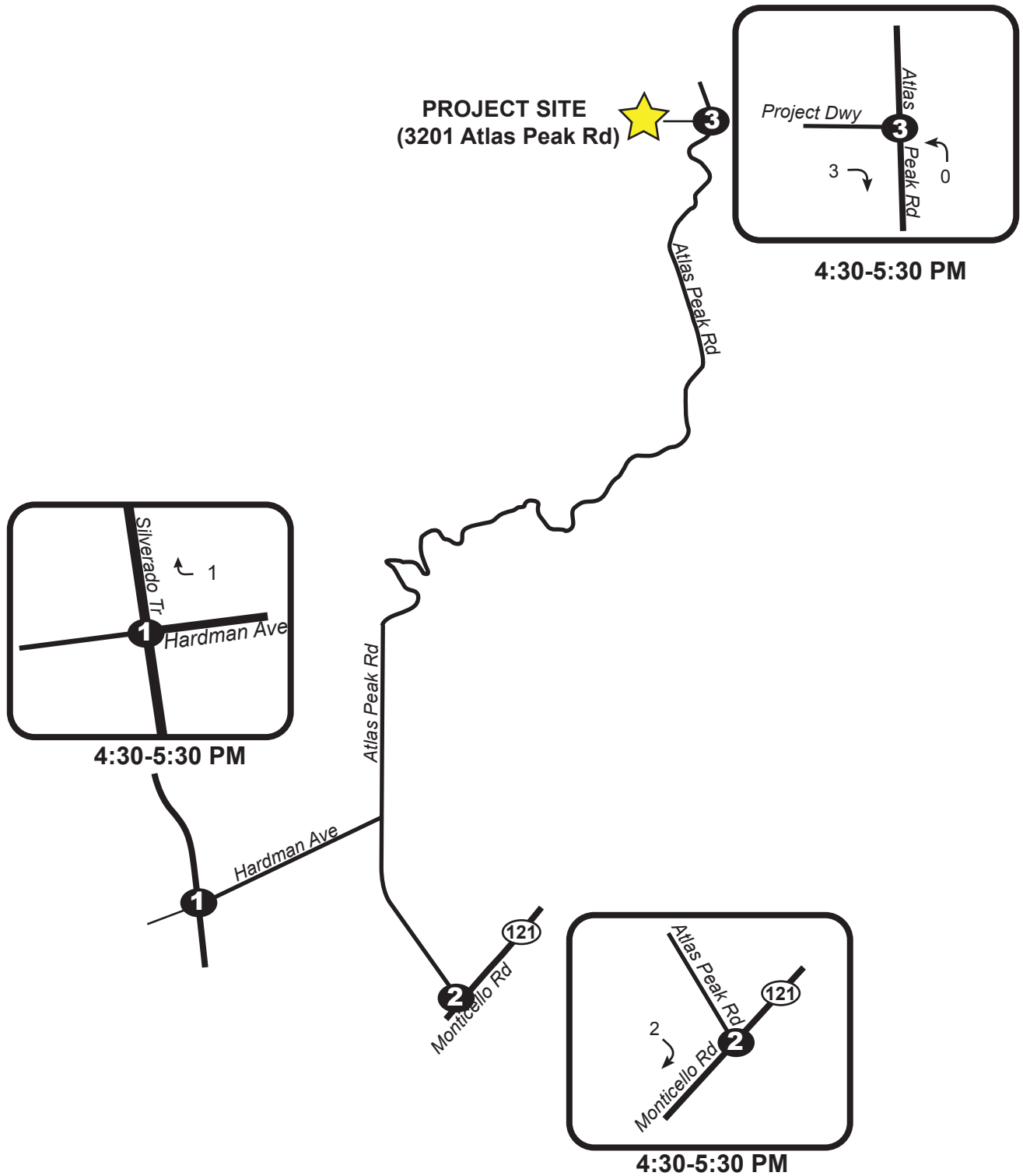
CRANE TRANSPORTATION GROUP

Figure 9
Harvest Friday PM Peak Hour
Project Traffic Distribution

Not To Scale



NORTH



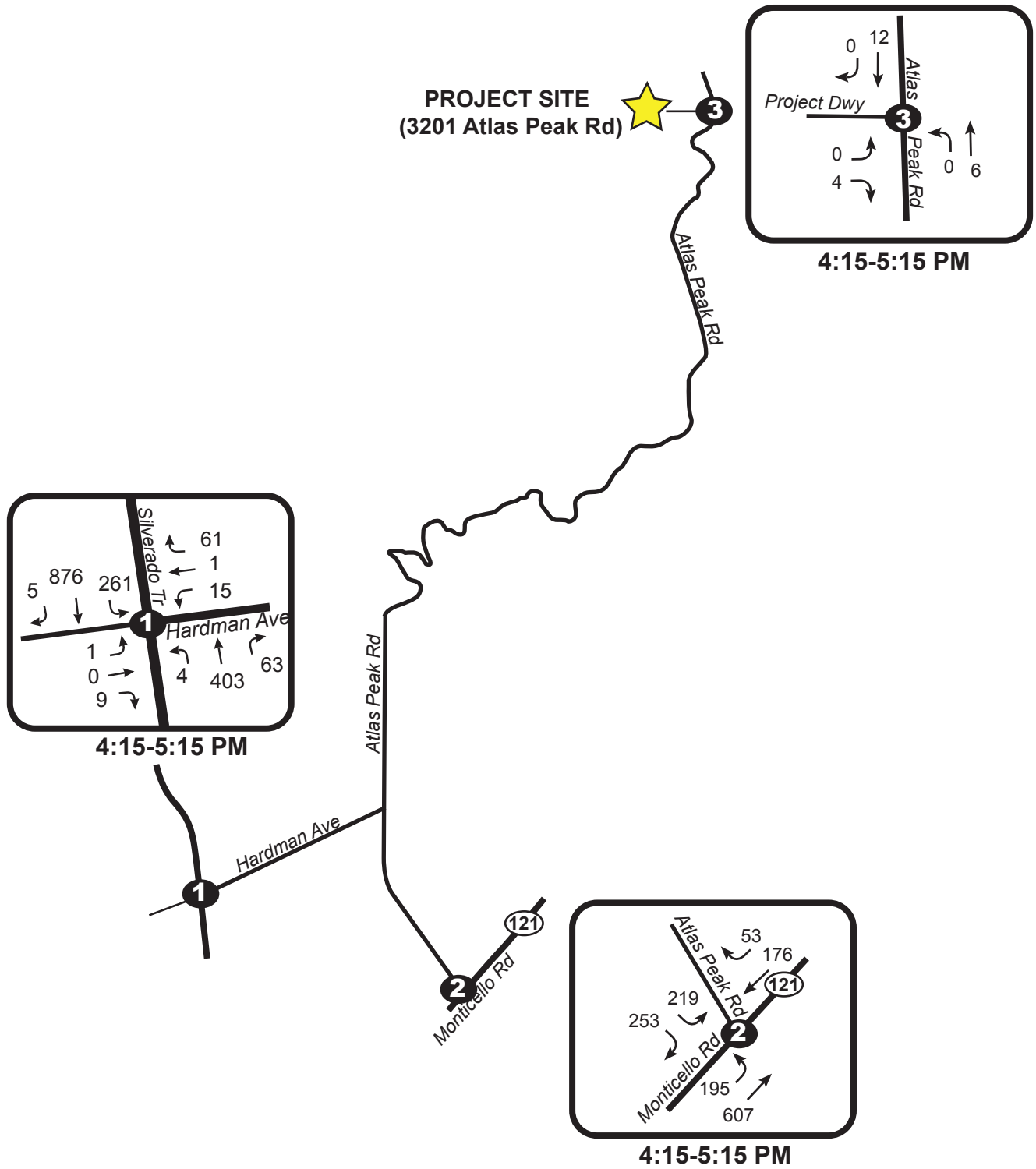
Kitoko Winery Traffic Study



CRANE TRANSPORTATION GROUP

Figure 10
Harvest Saturday PM Peak Hour
Project Traffic Distribution

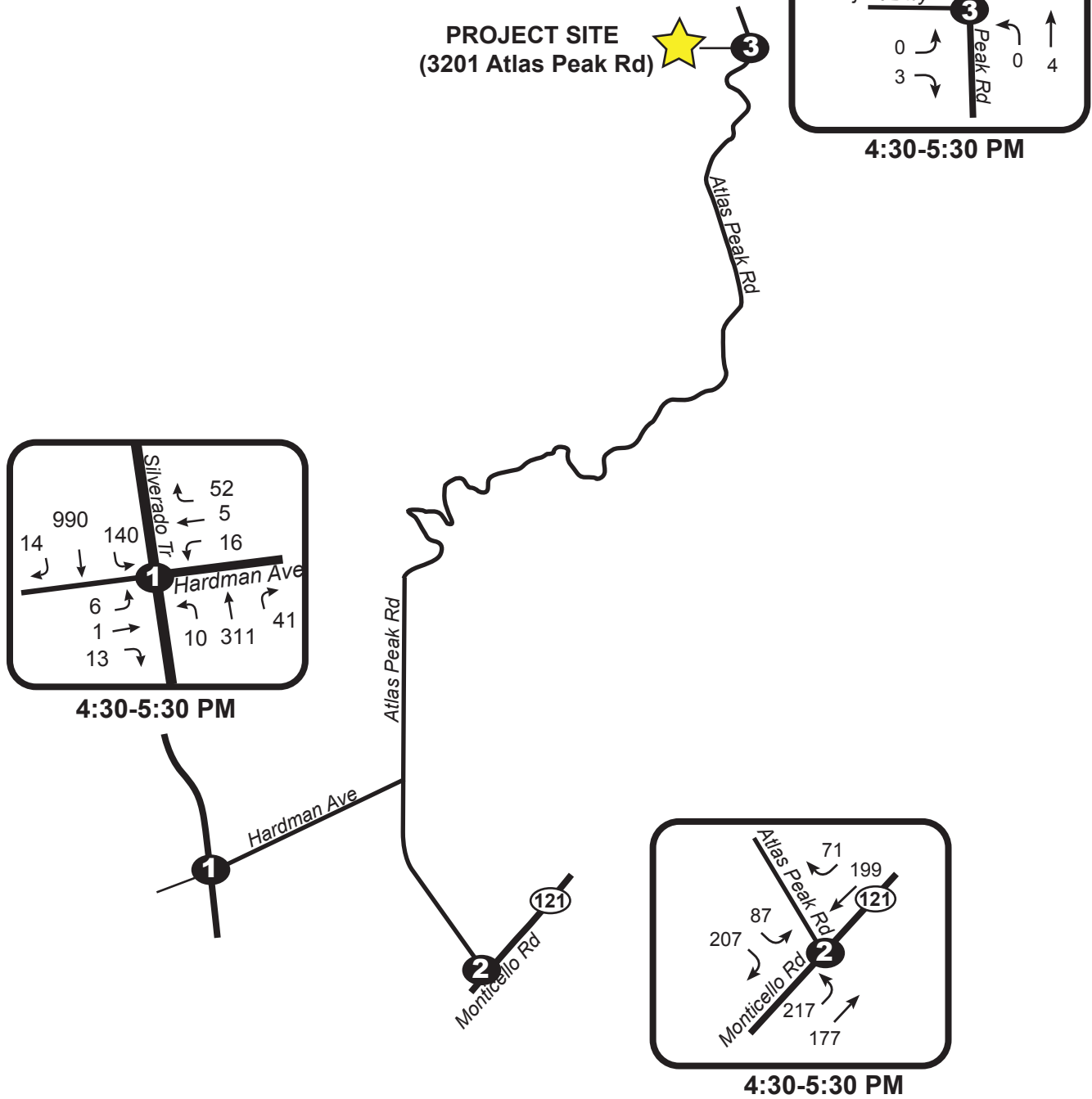
Not To Scale



Kitoko Winery Traffic Study

Figure 11
Existing (with Project) Harvest Friday
PM Peak Hour Traffic Volumes

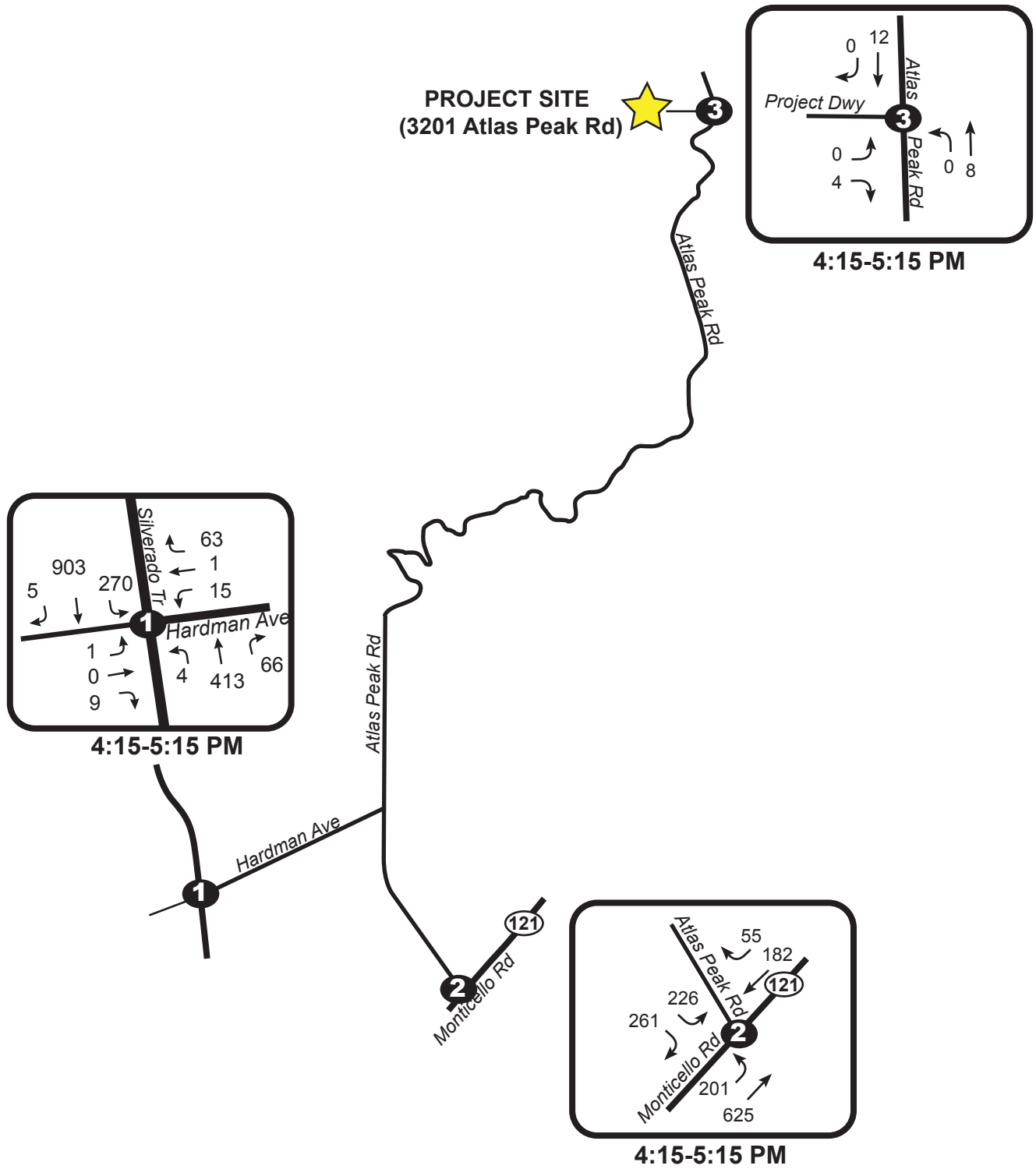
Not To Scale



Kitoko Winery Traffic Study

Figure 12
Existing (with Project) Harvest Saturday
PM Peak Hour Traffic Volumes

Not To Scale



Kitoko Winery Traffic Study



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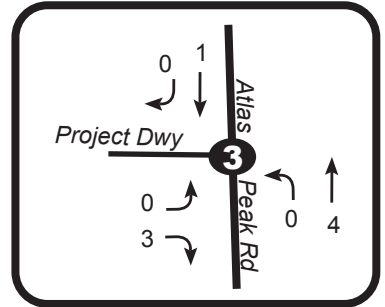
Figure 13

**2020 (with Project) Harvest Friday
PM Peak Hour Traffic Volumes**

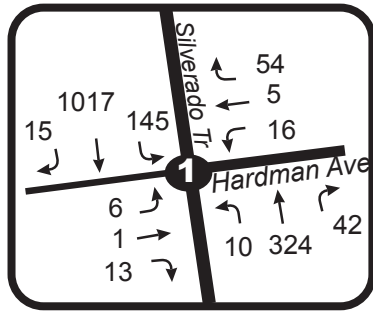
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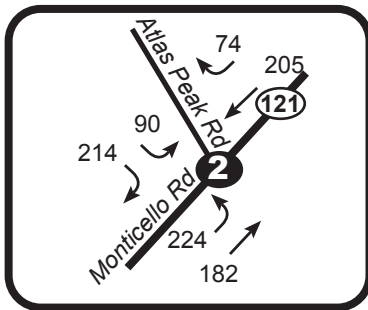
PROJECT SITE
(3201 Atlas Peak Rd)



4:30-5:30 PM



4:30-5:30 PM



4:30-5:30 PM

Kitoko Winery Traffic Study

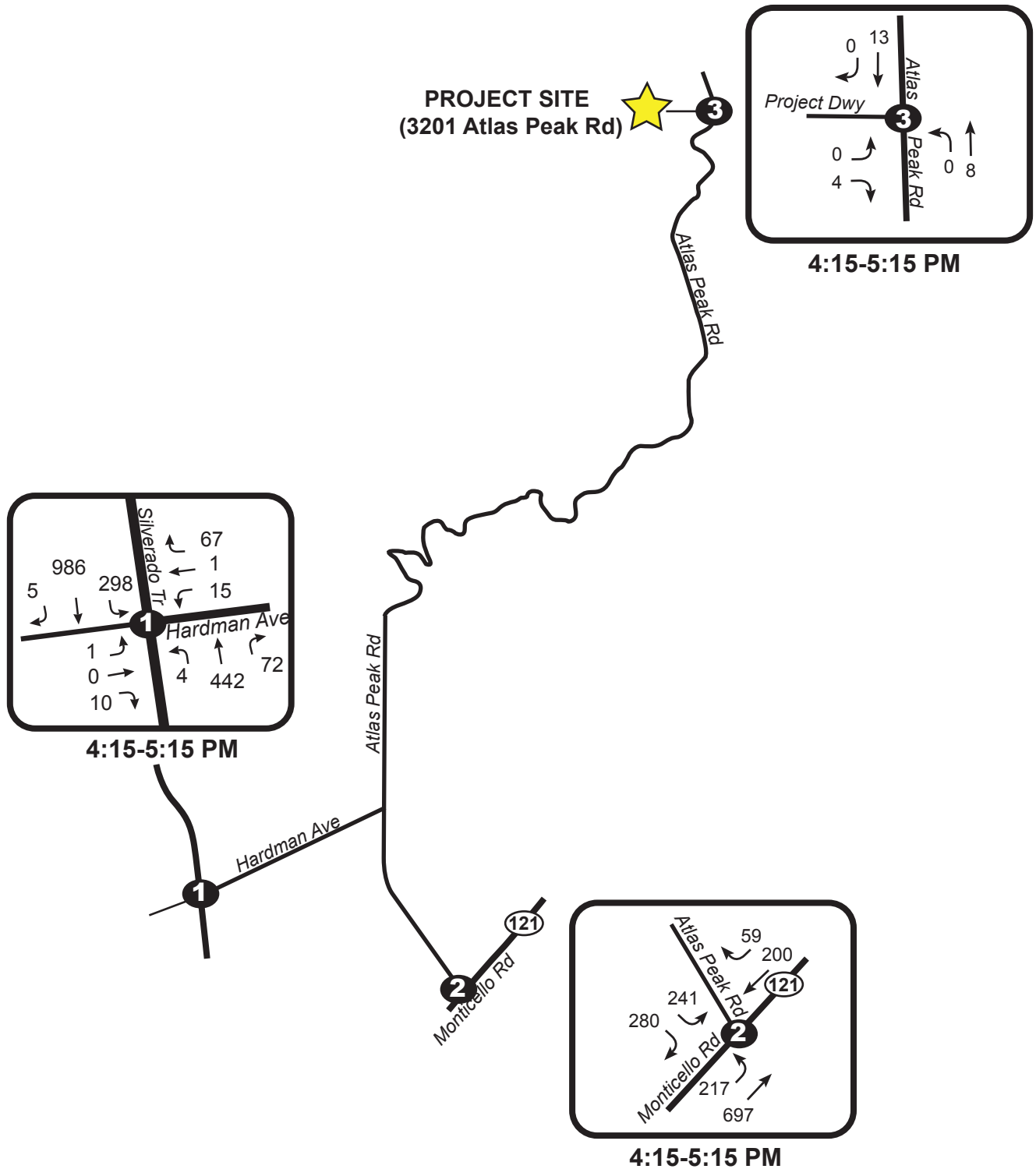


CRANE TRANSPORTATION GROUP

Figure 14

2020 (with Project) Harvest Saturday
PM Peak Hour Traffic Volumes

Not To Scale



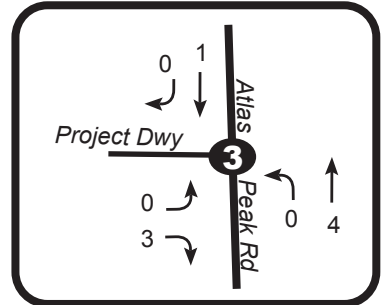
Kitoko Winery Traffic Study

Figure 15
2030 (with Project) Harvest Friday
PM Peak Hour Traffic Volumes

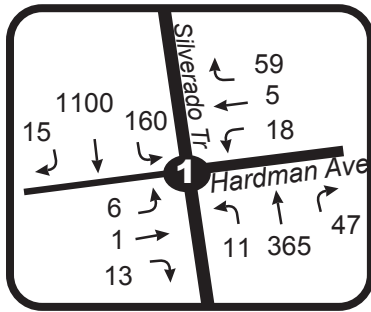
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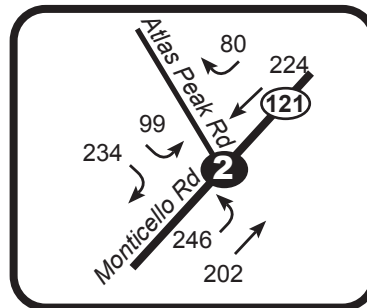
PROJECT SITE
(3201 Atlas Peak Rd)



4:30-5:30 PM



4:30-5:30 PM



4:30-5:30 PM

Kitoko Winery Traffic Study



CRANE TRANSPORTATION GROUP

Figure 16

2030 (with Project) Harvest Saturday
PM Peak Hour Traffic Volumes

Tables

Table 1**SIGNALIZED INTERSECTION LOS CRITERIA**

Level of Service	Description	Average Control Delay (Seconds Per Vehicle)
A	Operations with very low delay occurring with favorable progression and/or short cycle lengths.	≤ 10.0
B	Operations with low delay occurring with good progression and/or short cycle lengths.	10.1 to 20.0
C	Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.	20.1 to 35.0
D	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, and/or high volume-to-capacity (V/C) ratios. Many vehicles stop and individual cycle failures are noticeable.	35.1 to 55.0
E	Operations with high delay values indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences. This is considered to be the limit of acceptable delay.	55.1 to 80.0
F	Operation with delays unacceptable to most drivers occurring due to oversaturation, poor progression, or very long cycle lengths.	> 80.0

Source: 2010 Highway Capacity Manual (Transportation Research Board).

Table 2**UNSIGNALIZED INTERSECTION LOS CRITERIA**

Level of Service	Description	Average Control Delay (Seconds Per Vehicle)
A	Little or no delays	≤ 10.0
B	Short traffic delays	10.1 to 15.0
C	Average traffic delays	15.1 to 25.0
D	Long traffic delays	25.1 to 35.0
E	Very long traffic delays	35.1 to 50.0
F	Extreme traffic delays with intersection capacity exceeded (for an all-way stop), or with approach/turn movement capacity exceeded (for a side street stop controlled intersection)	> 50.0

Source: 2010 Highway Capacity Manual (Transportation Research Board).

Table 3

INTERSECTION LEVEL OF SERVICE

EXISTING – 2017 HARVEST

LOCATION	FRIDAY PM PEAK HOUR		SATURDAY PM PEAK HOUR	
	W/O PROJECT	WITH PROJECT	W/O PROJECT	WITH PROJECT
Silverado Trail/Hardman Ave./Luna Winery (Luna Winery/Hardman Ave. Stop Sign Controlled Approaches)	D-26.4/ F-53.0 ⁽¹⁾	D-26.4/ F-53.0 [1.3%]*	E-43.9/ E-45.1	E-43.9/ E-45.1 [1.4%]*
Monticello Rd/Atlas Peak Rd	B-16.8 ⁽²⁾	B-16.8	B-16.9	B-16.9

YEAR 2020 HARVEST

LOCATION	FRIDAY PM PEAK HOUR		SATURDAY PM PEAK HOUR	
	W/O PROJECT	WITH PROJECT	W/O PROJECT	WITH PROJECT
Silverado Trail/Hardman Ave./Luna Winery (Luna Winery/Hardman Ave. Stop Sign Controlled Approaches)	D-28.0/ F-61.1 ⁽¹⁾	D-28.0/ F-61.1 [1.3%]*	E-48.1/ F-50.4	E-48.1/ F-50.4 [1.4%]*
Monticello Rd/Atlas Peak Rd	B-17.1 ⁽²⁾	B-17.1	B-17.1	B-17.1

CUMULATIVE (YEAR 2030) HARVEST

LOCATION	FRIDAY PM PEAK HOUR		SATURDAY PM PEAK HOUR	
	W/O PROJECT	WITH PROJECT	W/O PROJECT	WITH PROJECT
Silverado Trail/Hardman Ave./Luna Winery (Luna Winery/Hardman Ave. Stop Sign Controlled Approaches)	D-33.4/ F-118.4 ⁽¹⁾	D-33.4/ F-118.4 [14.3%]**	F-64.7/ F-96.4	F-64.7/ F-96.4 [11.1%]**
Monticello Rd/Atlas Peak Rd	B-17.2 ⁽²⁾	B-17.2	B-17.7	B-17.7

⁽¹⁾ Unsignalized level of service – control delay in seconds. Luna Winery stop sign controlled eastbound approach/Hardman Avenue stop sign controlled westbound approach.

⁽²⁾ Signalized level of service – control delay in seconds

* Percent traffic added by the project to the Hardman Avenue stop sign controlled approach. Less than a 10% increase is not considered a significant impact for existing and 2020 conditions.

** Percent traffic added by the project to the growth in traffic between the existing and cumulative horizons on the Hardman Avenue stop sign controlled approach. Less than a 5% increase is not considered a significant impact for cumulative (year 2030) conditions.

Bolded result = significant impact.

Year 2010 Highway Capacity Manual (HCM) Analysis Methodology

Source: Crane Transportation Group

Table 4

INTERSECTION SIGNAL WARRANT EVALUATION

Do Volumes Meet Caltrans Peak Hour Warrant #3 Volume Criteria Levels?

EXISTING – 2017 HARVEST

INTERSECTION	FRIDAY PM PEAK HOUR		SATURDAY PM PEAK HOUR	
	W/O PROJECT	WITH PROJECT	W/O PROJECT	WITH PROJECT
Silverado Trail/Hardman Ave.	Yes – R, U	Yes [0.06%]	Yes – R, U	Yes [0.06%]

YEAR 2020 HARVEST

INTERSECTION	FRIDAY PM PEAK HOUR		SATURDAY PM PEAK HOUR	
	W/O PROJECT	WITH PROJECT	W/O PROJECT	WITH PROJECT
Silverado Trail/Hardman Ave.	Yes – R, U	Yes [0.06%]	Yes – R, U	Yes [0.06%]

CUMULATIVE (YEAR 2030) HARVEST

INTERSECTION	FRIDAY PM PEAK HOUR		SATURDAY PM PEAK HOUR	
	W/O PROJECT	WITH PROJECT	W/O PROJECT	WITH PROJECT
Silverado Trail/Hardman Ave.	Yes – R, U	Yes [0.05%]	Yes – R, U	Yes [0.06%]

R = Rural warrant met; U = Urban warrant met

[xx] – Percent project traffic added to intersection. Less than a 1% increase is not considered a significant impact.

Source: Crane Transportation Group

Table 5

PROJECT TRIP GENERATION KITOKO VINEYARDS WINERY

HARVEST

FRIDAY

	TOTAL	HOURS	TRIPS							
			3-4 PM		4-5 PM		5-6 PM		4:15-5:15 PM*	
			IN	OUT	IN	OUT	IN	OUT	IN	OUT
Admin Employees – Full Time	2	8:30 AM-6:00 PM	0	0	0	0	0	0	0	0
Production Employees – Full Time	2	8:30 AM-6:00 PM	0	0	0	0	0	0	0	0
Production Employees – Part Time	1	8:30 AM-6:00 PM	0	0	0	0	0	0	0	0
Tours/Testing Employees	1	9:00 AM-5:00 PM	0	0	0	0	0	1	0	1
Visitors	20/day (8 vehicles/day) ⁽¹⁾	9:00 AM-5:00 PM	2	2	0	2	0	0	0	2
Grape Delivery Trucks	2 (over 10 days)	7:00 AM-4:00 PM	0	0	0	0	0	0	0	0
Other Trucks	5	7:00 AM-4:00 PM	1	1	0	0	0	0	0	0
TOTAL			3	3	0	2	0	1	0	3

* Peak traffic hour at the Silverado Trail intersection with Hardman Avenue.

⁽¹⁾ 2.6 visitors/vehicle average on weekdays per County data.

Source: Kitoko Vineyards Winery project applicant; Compiled by: Crane Transportation Group

Table 6

PROJECT TRIP GENERATION KITOKO VINEYARDS WINERY

HARVEST

SATURDAY

NEW OR ADJUSTED ACTIVITIES	NET NEW	HOURS	TRIPS												
			1-2 PM		2-3 PM		3-4 PM		4-5 PM		5-6 PM		4:30-5:30 PM*		
			IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	
Employees – Part Time	2	9:00 AM- 6:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Tours/Tasting Employees	1	9:00 AM- 5:00 PM	0	0	0	0	0	0	0	0	0	1	0	1	
Visitors	20/day (8 vehicles/day) ⁽¹⁾	9:00 AM- 5:00 PM	2	1	2	2	2	2	0	2	0	0	0	2	
Grape Delivery Trucks	2/day	7:00 AM- 4:00 PM	0	0	1	1	0	0	0	0	0	0	0	0	
Other Trucks	2	7:00 AM- 4:00 PM	1	1	0	0	0	0	0	0	0	0	0	0	
TOTAL			3	2	3	3	2	2	0	2	0	1	0	3	

* Peak traffic hour at the Silverado Trail intersection with Hardman Avenue.

⁽¹⁾ 2.8 visitors/vehicle average on weekend days per County data.

Source: Kitoko Vineyards Winery project applicant; Compiled by: Crane Transportation Group

Table 7

SUMMARY OF KITOKO VINEYARDS WINERY TRIP GENERATION

HARVEST

FRIDAY PM PEAK HOUR* (4:15-5:15)		SATURDAY PM PEAK HOUR* (4:30-5:30)	
INBOUND TRIPS	OUTBOUND TRIPS	INBOUND TRIPS	OUTBOUND TRIPS
0	3	0	3

* Peak traffic hours at the Silverado Trail intersection with Hardman Avenue.

Source: Kitoko Vineyards Winery; compiled by Crane Transportation Group

Table 8

**KITOKO VINEYARDS WINERY
MARKETING EVENT TRAFFIC DETAILS**

MARKETING EVENT	STAFF/GUEST CATEGORY	# OF PEOPLE	# OF VEHICLES	TIMES	REGULAR VISITATION ELIMINATED DURING MARKETING EVENT?
Marketing Event #1 #/year: 10	Guests	30	11-12		Yes
	Extra winery staff	2	1		
	Caterers	1	1		
	Entertainers	0	0		
	Delivery vehicles	2	1		
	Other?				
Marketing Event #2 #/year: 1	Guests	100	36		Yes
	Extra winery staff	4	2		
	Caterers	4	2		
	Entertainers				
	Delivery vehicles	2	2		
	Other?				

Source: Kitoko Vineyards Winery applicant

Appendix

Appendix
KITOKO VINEYARDS WINERY
EXPECTED PROJECT TRAFFIC ACTIVITY DETAILS -
HARVEST

Gallons/Year Production: 40,000
1st Year of Expected Full Production: 2027

<p>A. Full-time admin employees # on Weekdays <u> 2 </u> # on Saturday <u> 0 </u> # on Sunday <u> 0 </u> Work hours: Weekday 8:30 AM to 6:00 PM Saturday N/A Sunday N/A</p>	<p>B. Part-time admin employees # on Weekdays <u> 0 </u> # on Saturday <u> 0 </u> # on Sunday <u> 0 </u> Work hours: Weekday N/A Saturday N/A Sunday N/A</p>
<p>C. Full-time production employees # on Weekdays <u> 2 </u> # on Saturday <u> 0 </u> # on Sunday <u> 0 </u> Work hours: Weekday 8:30 AM to 6:00 PM Saturday N/A Sunday N/A</p>	<p>D. Part-time production employees # on Weekdays <u> 1 </u> # on Saturday <u> 0 </u> # on Sunday <u> 0 </u> Work hours: Weekday 8:30 AM to 6:00 PM Saturday N/A Sunday N/A</p>
<p>E. Tours & tasting employees # on Weekdays <u> 1 </u> # on Saturday <u> 1 </u> # on Sunday <u> 1 </u> Work hours: Weekday 9:00 AM to 5:00 PM Saturday 9:00 AM to 5:00 PM Sunday 9:00 AM to 5:00 PM</p>	<p>F. Other employees # on Weekdays <u> 0 </u> # on Saturday <u> 2 </u> # on Sunday <u> 2 </u> Work hours: Weekday N/A Saturday 9:00 AM to 6:00 PM Sunday 9:00 AM to 6:00 PM</p>
<p>G. Maximum tours/tasting visitors # on Weekdays <u> 5/20 </u> # on Saturday <u> 6/20 </u> # on Sunday <u> 6/20 </u> Tasting hours: Weekday 9:00 AM to 5:00 PM Saturday 9:00 AM to 5:00 PM Sunday 9:00 AM to 5:00 PM</p>	<p>H. Grape delivery trucks # on Weekdays <u> 2 </u> # on Saturday <u> 2 </u> # on Sunday <u> 0 </u> Delivery hours: Weekday 7:00 AM to 4:00 PM Saturday 7:00 AM to 4:00 PM Sunday N/A # days of grape delivery: 10</p>

Appendix
KITOKO VINEYARDS WINERY
EXPECTED PROJECT TRAFFIC ACTIVITY DETAILS -
HARVEST

<p>I. Other trucks # on Weekdays <u> 5 </u> # on Saturday <u> 2 </u> # on Sunday <u> 0 </u> Delivery hours: Weekday 7:00 AM to 4:00 PM Saturday 7:00 AM to 4:00 PM Sunday 7:00 AM to 4:00 PM</p>

J. Grape Source & Trucks

Percent grapes grown on site: 17%

Grapes grown off site – access route to winery entrance

 Hardman Avenue & Silverado Trail: 50%

 Monticello/Atlas Peak Road: 50%

Number of existing grape haul truck trips eliminated due to use of on-site grapes for proposed winery: 9

Appendix
KITOKO VINEYARDS WINERY
EXPECTED PROJECT TRAFFIC ACTIVITY DETAILS

K. Marketing Events During the Year

Marketing Event #1 # events/year: 10
 maximum # people/event: 30
 typical days: any day of the week
 typical hours: 3-hour event between 10:00 AM & 6:00 PM

Marketing Event #2 # events/year: 1
 maximum # people/event: 100
 typical days: Saturday or Sunday
 typical hours: between 10:00 AM & 6:00 PM

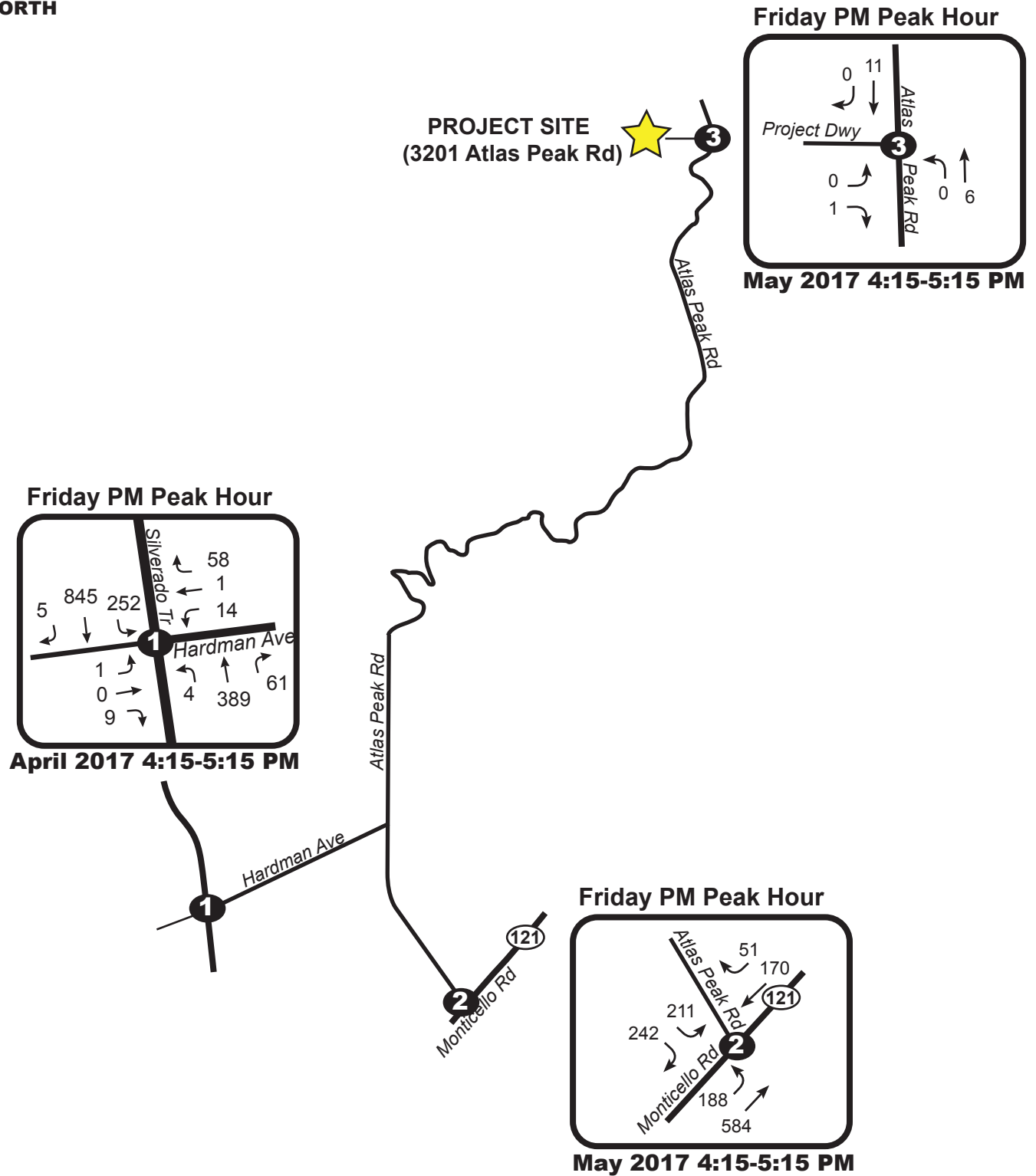
L. Bottling

Days of on-site bottling per year: 8

Not To Scale



NORTH



Kitoko Winery Traffic Study



CRANE TRANSPORTATION GROUP

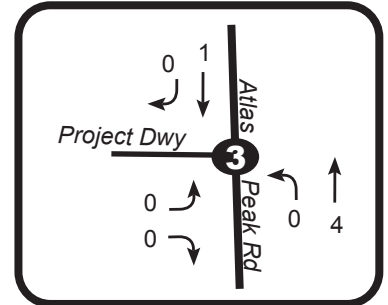
Figure A1

Existing (April & May 2017) Friday PM Peak Hour Traffic Volumes

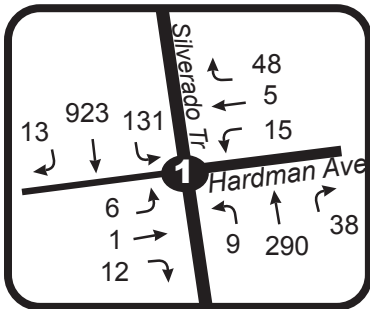
Not To Scale



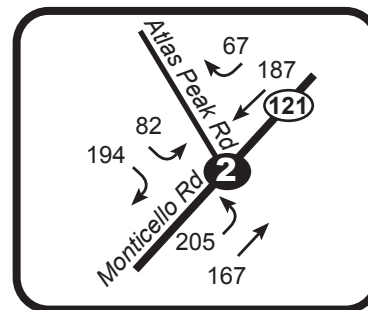
PROJECT SITE
(3201 Atlas Peak Rd)



May 2017 Saturday
430-530 PM



April 2017 Saturday
430-530 PM



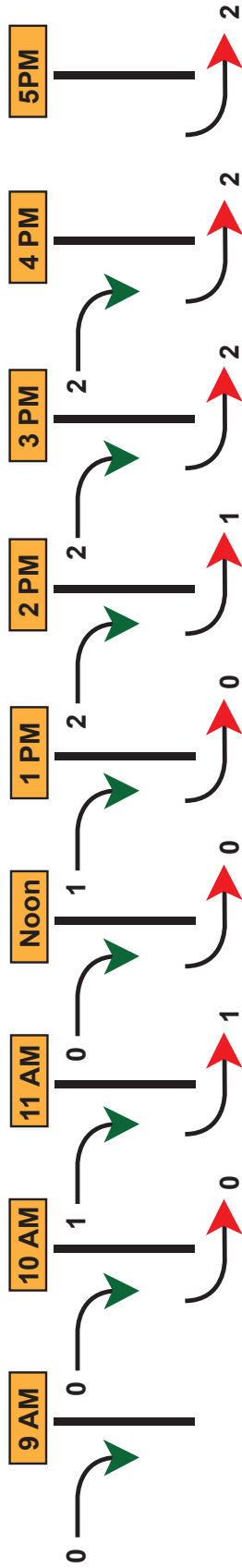
May 2017 Saturday
430-530 PM

Kitoko Winery Traffic Study

Figure A2
Existing (April & May 2017) Saturday
PM Peak Hour Traffic Volumes

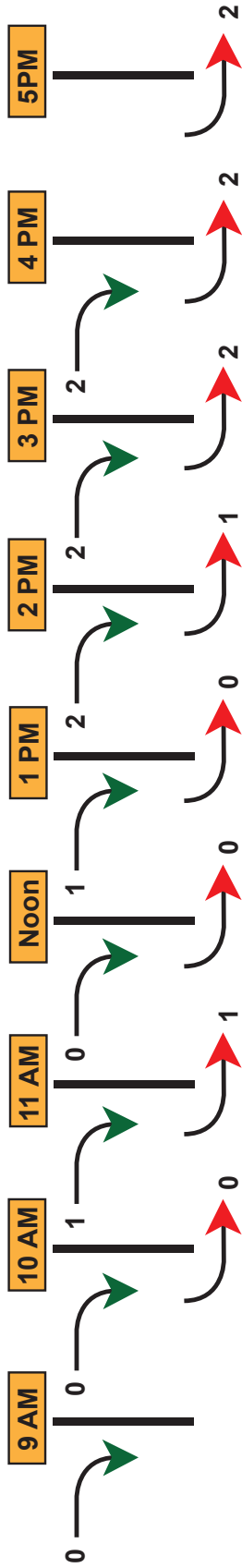
FRIDAY

8 Vehicles



SATURDAY

8 Vehicles



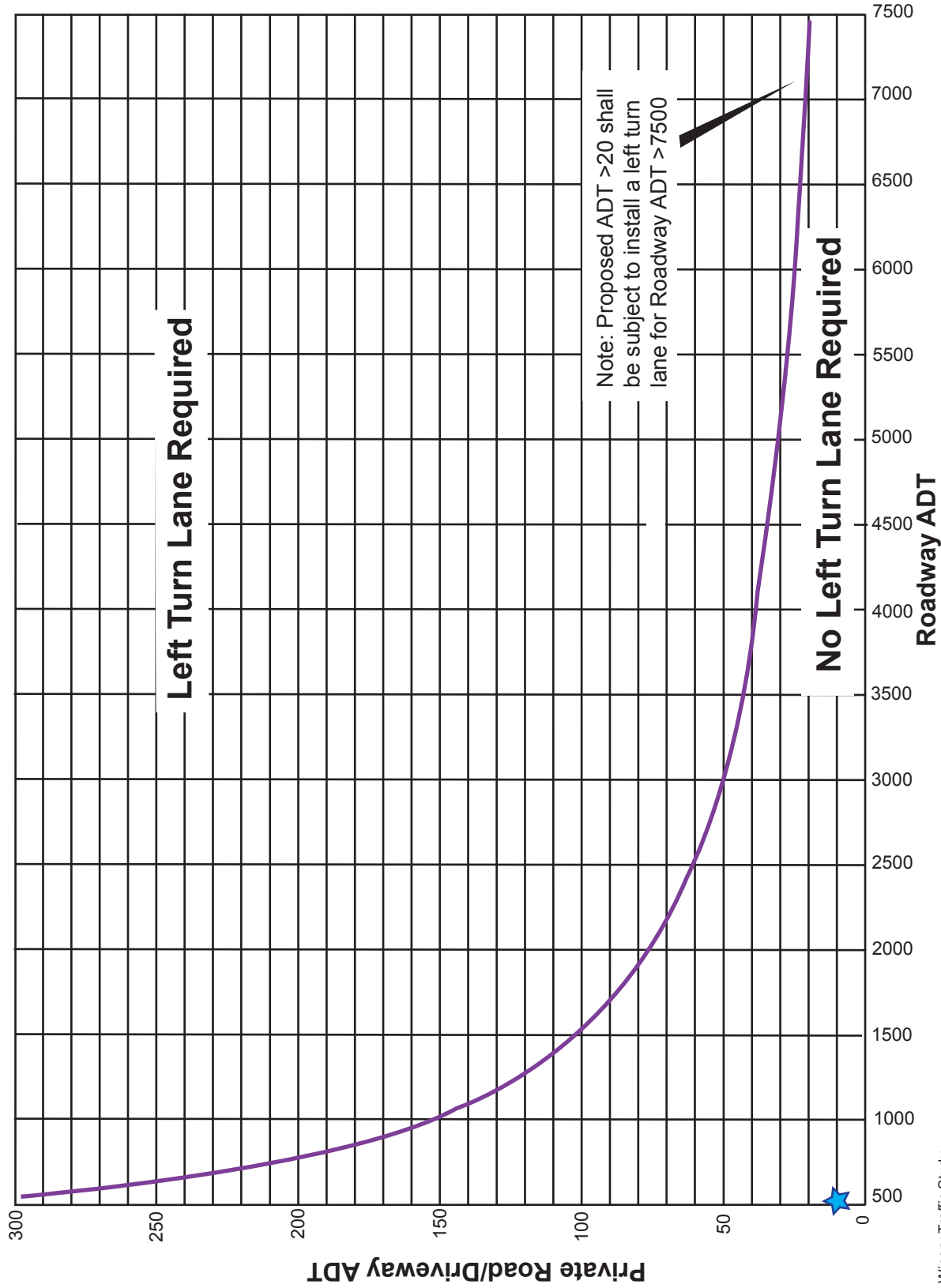
 = Arrivals

 = Departures

Kitoko Winery Traffic Study

Figure A-3
Kitoko Winery
Distribution of Guests

COUNTY OF NAPA LEFT TURN LANE WARRANT GRAPH at Private Road and Driveway Intersections



Kitoko Winery Traffic Study



= 8 Vehicles In/Out of Project Driveway
268 Trips on Atlas Peak Rd

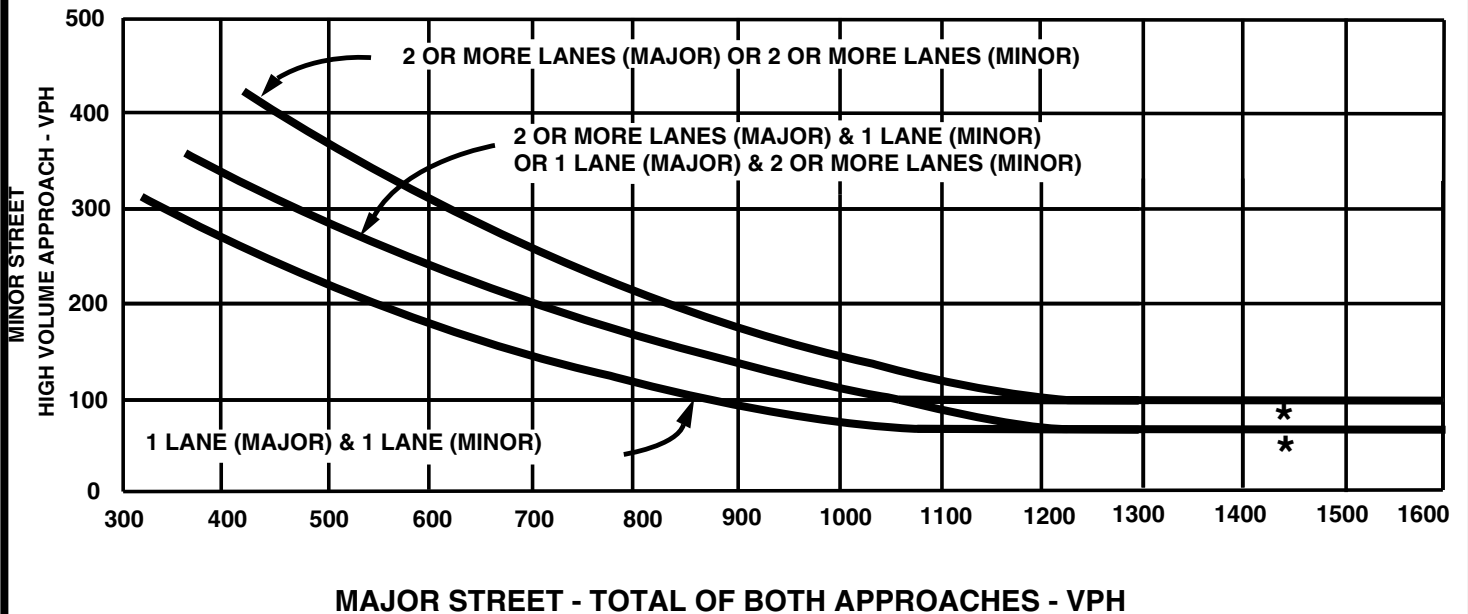
Figure A-4

COUNTY OF NAPA LEFT TURN LANE WARRANT GRAPH
for Atlas Peak Rd at Kitoko Winery Driveway
Existing without Project Volumes



CRANE TRANSPORTATION GROUP

PEAK HOUR VOLUME WARRANT #3 (Rural Area)



*** NOTE**

100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A 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

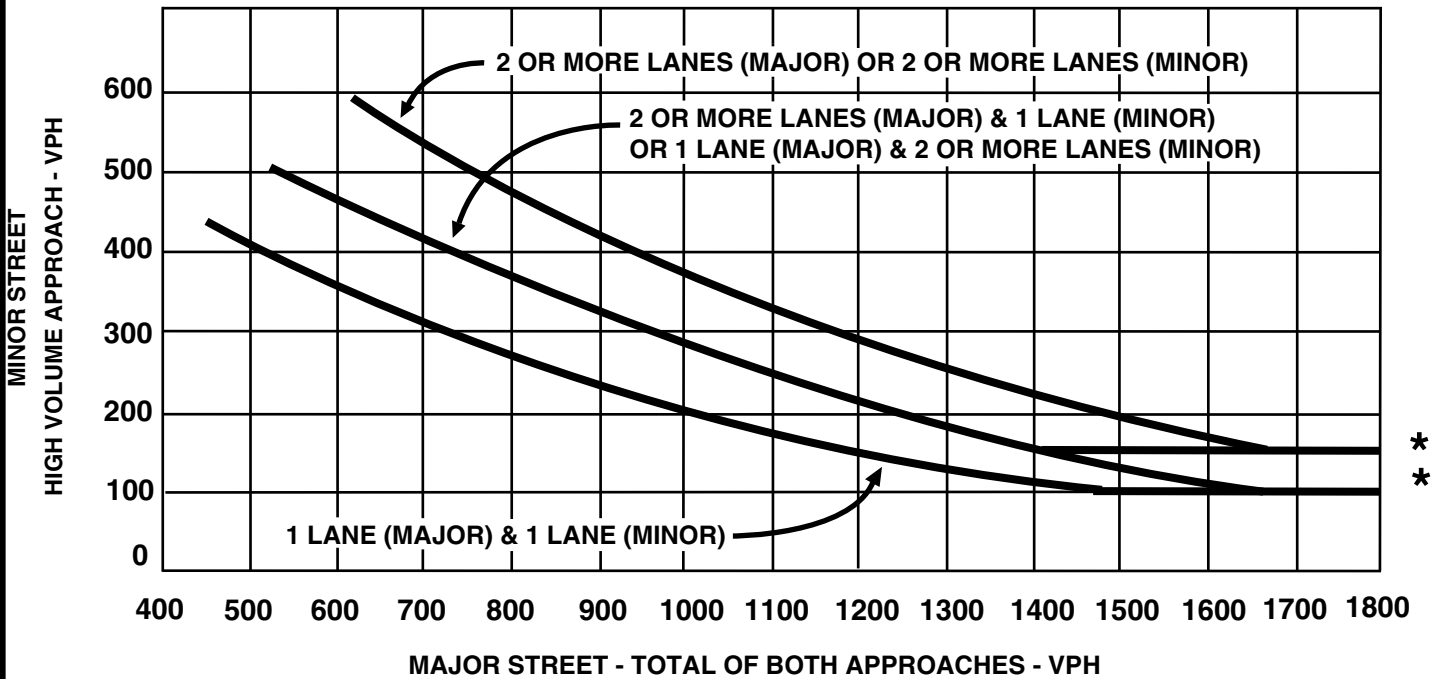
Source: California Manual on Uniform Traffic Control Devices, 2010



CRANE TRANSPORTATION GROUP

Rural Area Peak Hour Volume Warrant #3

PEAK HOUR VOLUME WARRANT #3 (Urban Area)



*** NOTE**

150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE

Source: California Manual on Uniform Traffic Control Devices, 2010



CRANE TRANSPORTATION GROUP

Urban Area Peak Hour Volume Warrant #3

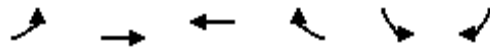
TECHNICAL APPENDIX

Capacity Worksheets

Existing Level of Service

HCM 2010 Signalized Intersection Summary
 12: Monticello Rd & Atlas Peak Rd

08/08/2017



Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations								
Traffic Volume (veh/h)	195	607	176	53	219	251		
Future Volume (veh/h)	195	607	176	53	219	251		
Number	7	4	8	18	1	16		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900		
Adj Flow Rate, veh/h	203	632	183	55	228	261		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96		
Percent Heavy Veh, %	0	0	0	0	0	0		
Cap, veh/h	262	776	340	289	765	683		
Arrive On Green	0.14	0.41	0.18	0.18	0.42	0.42		
Sat Flow, veh/h	1810	1900	1900	1615	1810	1615		
Grp Volume(v), veh/h	203	632	183	55	228	261		
Grp Sat Flow(s),veh/h/ln	1810	1900	1900	1615	1810	1615		
Q Serve(g_s), s	5.8	15.7	4.7	1.5	4.4	5.9		
Cycle Q Clear(g_c), s	5.8	15.7	4.7	1.5	4.4	5.9		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	262	776	340	289	765	683		
V/C Ratio(X)	0.78	0.81	0.54	0.19	0.30	0.38		
Avail Cap(c_a), veh/h	629	1553	732	622	765	683		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	21.9	14.0	19.9	18.6	10.1	10.6		
Incr Delay (d2), s/veh	4.9	2.2	1.3	0.3	1.0	1.6		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	3.2	8.5	2.6	0.7	2.4	6.4		
LnGrp Delay(d),s/veh	26.8	16.1	21.2	18.9	11.1	12.2		
LnGrp LOS	C	B	C	B	B	B		
Approach Vol, veh/h		835	238		489			
Approach Delay, s/veh		18.7	20.6		11.7			
Approach LOS		B	C		B			
Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				26.2		27.0	12.2	14.0
Change Period (Y+Rc), s				4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s				43.5		22.5	18.5	20.5
Max Q Clear Time (g_c+l1), s				17.7		7.9	7.8	6.7
Green Ext Time (p_c), s				3.3		1.2	0.4	2.9
Intersection Summary								
HCM 2010 Ctrl Delay			16.8					
HCM 2010 LOS			B					

Intersection

Int Delay, s/veh 4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↖	↗		↕		↖	↗		↖	↗	
Traffic Vol, veh/h	1	0	9	15	1	60	4	403	63	261	876	5
Future Vol, veh/h	1	0	9	15	1	60	4	403	63	261	876	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	-	75	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	1	0	9	16	1	63	4	424	66	275	922	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1972	1973	925	1940	1943	457	927	0	0	491	0	0
Stage 1	1474	1474	-	466	466	-	-	-	-	-	-	-
Stage 2	498	499	-	1474	1477	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	47	63	329	50	66	608	746	-	-	1083	-	-
Stage 1	159	192	-	581	566	-	-	-	-	-	-	-
Stage 2	558	547	-	159	192	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	33	47	329	39	49	608	746	-	-	1083	-	-
Mov Cap-2 Maneuver	33	47	-	39	49	-	-	-	-	-	-	-
Stage 1	158	143	-	578	563	-	-	-	-	-	-	-
Stage 2	496	544	-	115	143	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	26.4	53	0.1	2.2
HCM LOS	D	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	746	-	-	33	329	151	1083	-	-
HCM Lane V/C Ratio	0.006	-	-	0.032	0.029	0.53	0.254	-	-
HCM Control Delay (s)	9.9	-	-	117.7	16.3	53	9.4	-	-
HCM Lane LOS	A	-	-	F	C	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	2.6	1	-	-

HCM 2010 Signalized Intersection Summary
 4: Monticello Rd & Atlas Peak Rd

08/08/2017



Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations								
Traffic Volume (veh/h)	217	177	199	71	87	205		
Future Volume (veh/h)	217	177	199	71	87	205		
Number	7	4	8	18	1	16		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900		
Adj Flow Rate, veh/h	231	188	212	76	93	218		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94		
Percent Heavy Veh, %	0	0	0	0	0	0		
Cap, veh/h	297	800	321	273	728	650		
Arrive On Green	0.16	0.42	0.17	0.17	0.40	0.40		
Sat Flow, veh/h	1810	1900	1900	1615	1810	1615		
Grp Volume(v), veh/h	231	188	212	76	93	218		
Grp Sat Flow(s),veh/h/ln	1810	1900	1900	1615	1810	1615		
Q Serve(g_s), s	6.2	3.2	5.3	2.1	1.7	4.8		
Cycle Q Clear(g_c), s	6.2	3.2	5.3	2.1	1.7	4.8		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	297	800	321	273	728	650		
V/C Ratio(X)	0.78	0.23	0.66	0.28	0.13	0.34		
Avail Cap(c_a), veh/h	728	1696	764	650	728	650		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	20.4	9.5	19.8	18.5	9.6	10.5		
Incr Delay (d2), s/veh	4.4	0.1	2.3	0.5	0.4	1.4		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	3.4	1.7	3.0	1.0	0.9	5.1		
LnGrp Delay(d),s/veh	24.8	9.6	22.1	19.0	10.0	11.9		
LnGrp LOS	C	A	C	B	A	B		
Approach Vol, veh/h		419	288		311			
Approach Delay, s/veh		18.0	21.3		11.3			
Approach LOS		B	C		B			
Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				26.0		25.0	12.9	13.1
Change Period (Y+Rc), s				4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s				45.5		20.5	20.5	20.5
Max Q Clear Time (g_c+l1), s				5.2		6.8	8.2	7.3
Green Ext Time (p_c), s				1.6		0.7	0.4	1.3
Intersection Summary								
HCM 2010 Ctrl Delay			16.9					
HCM 2010 LOS			B					

Intersection

Int Delay, s/veh 3.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↖	↗		↕		↖	↗		↖	↗	
Traffic Vol, veh/h	6	1	13	16	5	51	10	311	41	140	990	14
Future Vol, veh/h	6	1	13	16	5	51	10	311	41	140	990	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	-	75	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	7	1	14	17	5	55	11	338	45	152	1076	15

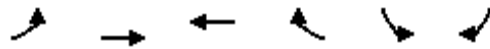
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1801	1792	1084	1771	1778	360	1091	0	0	383	0	0
Stage 1	1388	1388	-	382	382	-	-	-	-	-	-	-
Stage 2	413	404	-	1389	1396	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	62	82	266	66	83	689	647	-	-	1187	-	-
Stage 1	178	212	-	645	616	-	-	-	-	-	-	-
Stage 2	620	603	-	178	210	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	48	70	266	55	71	689	647	-	-	1187	-	-
Mov Cap-2 Maneuver	48	70	-	55	71	-	-	-	-	-	-	-
Stage 1	175	185	-	634	606	-	-	-	-	-	-	-
Stage 2	555	593	-	146	183	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	43.9	45.1	0.3	1
HCM LOS	E	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn	EBLn1	WBLn	SBL	SBT	SBR
Capacity (veh/h)	647	-	-	50	266	165	1187	-	-
HCM Lane V/C Ratio	0.017	-	-	0.152	0.053	0.474	0.128	-	-
HCM Control Delay (s)	10.7	-	-	89.5	19.3	45.1	8.5	-	-
HCM Lane LOS	B	-	-	F	C	E	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.5	0.2	2.2	0.4	-	-

HCM 2010 Signalized Intersection Summary
 12: Monticello Rd & Atlas Peak Rd

08/08/2017



Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations								
Traffic Volume (veh/h)	195	607	176	53	219	253		
Future Volume (veh/h)	195	607	176	53	219	253		
Number	7	4	8	18	1	16		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900		
Adj Flow Rate, veh/h	203	632	183	55	228	264		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96		
Percent Heavy Veh, %	0	0	0	0	0	0		
Cap, veh/h	262	776	340	289	765	683		
Arrive On Green	0.14	0.41	0.18	0.18	0.42	0.42		
Sat Flow, veh/h	1810	1900	1900	1615	1810	1615		
Grp Volume(v), veh/h	203	632	183	55	228	264		
Grp Sat Flow(s),veh/h/ln	1810	1900	1900	1615	1810	1615		
Q Serve(g_s), s	5.8	15.7	4.7	1.5	4.4	6.0		
Cycle Q Clear(g_c), s	5.8	15.7	4.7	1.5	4.4	6.0		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	262	776	340	289	765	683		
V/C Ratio(X)	0.78	0.81	0.54	0.19	0.30	0.39		
Avail Cap(c_a), veh/h	629	1553	732	622	765	683		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	21.9	14.0	19.9	18.6	10.1	10.6		
Incr Delay (d2), s/veh	4.9	2.2	1.3	0.3	1.0	1.7		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	3.2	8.5	2.6	0.7	2.4	6.5		
LnGrp Delay(d),s/veh	26.8	16.1	21.2	18.9	11.1	12.3		
LnGrp LOS	C	B	C	B	B	B		
Approach Vol, veh/h		835	238		492			
Approach Delay, s/veh		18.7	20.6		11.7			
Approach LOS		B	C		B			
Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				26.2		27.0	12.2	14.0
Change Period (Y+Rc), s				4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s				43.5		22.5	18.5	20.5
Max Q Clear Time (g_c+l1), s				17.7		8.0	7.8	6.7
Green Ext Time (p_c), s				3.3		1.2	0.4	2.9
Intersection Summary								
HCM 2010 Ctrl Delay			16.8					
HCM 2010 LOS			B					

Intersection

Int Delay, s/veh 4.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↔		↔		↔	↔		↔	↔	
Traffic Vol, veh/h	1	0	9	15	1	61	4	403	63	261	876	5
Future Vol, veh/h	1	0	9	15	1	61	4	403	63	261	876	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	-	75	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	1	0	9	16	1	64	4	424	66	275	922	5

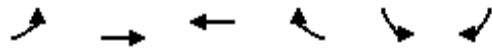
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1972	1973	925	1940	1943	457	927	0	0	491	0	0
Stage 1	1474	1474	-	466	466	-	-	-	-	-	-	-
Stage 2	498	499	-	1474	1477	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	47	63	329	50	66	608	746	-	-	1083	-	-
Stage 1	159	192	-	581	566	-	-	-	-	-	-	-
Stage 2	558	547	-	159	192	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	33	47	329	39	49	608	746	-	-	1083	-	-
Mov Cap-2 Maneuver	33	47	-	39	49	-	-	-	-	-	-	-
Stage 1	158	143	-	578	563	-	-	-	-	-	-	-
Stage 2	495	544	-	115	143	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	26.4	52.9	0.1	2.2
HCM LOS	D	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	746	-	-	33	329	152	1083	-	-
HCM Lane V/C Ratio	0.006	-	-	0.032	0.029	0.533	0.254	-	-
HCM Control Delay (s)	9.9	-	-	117.7	16.3	52.9	9.4	-	-
HCM Lane LOS	A	-	-	F	C	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	2.6	1	-	-

HCM 2010 Signalized Intersection Summary
 4: Monticello Rd & Atlas Peak Rd

08/08/2017



Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations								
Traffic Volume (veh/h)	217	177	199	71	87	207		
Future Volume (veh/h)	217	177	199	71	87	207		
Number	7	4	8	18	1	16		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900		
Adj Flow Rate, veh/h	231	188	212	76	93	220		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94		
Percent Heavy Veh, %	0	0	0	0	0	0		
Cap, veh/h	297	800	321	273	728	650		
Arrive On Green	0.16	0.42	0.17	0.17	0.40	0.40		
Sat Flow, veh/h	1810	1900	1900	1615	1810	1615		
Grp Volume(v), veh/h	231	188	212	76	93	220		
Grp Sat Flow(s),veh/h/ln	1810	1900	1900	1615	1810	1615		
Q Serve(g_s), s	6.2	3.2	5.3	2.1	1.7	4.8		
Cycle Q Clear(g_c), s	6.2	3.2	5.3	2.1	1.7	4.8		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	297	800	321	273	728	650		
V/C Ratio(X)	0.78	0.23	0.66	0.28	0.13	0.34		
Avail Cap(c_a), veh/h	728	1696	764	650	728	650		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	20.4	9.5	19.8	18.5	9.6	10.5		
Incr Delay (d2), s/veh	4.4	0.1	2.3	0.5	0.4	1.4		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	3.4	1.7	3.0	1.0	0.9	5.2		
LnGrp Delay(d),s/veh	24.8	9.6	22.1	19.0	10.0	12.0		
LnGrp LOS	C	A	C	B	A	B		
Approach Vol, veh/h		419	288		313			
Approach Delay, s/veh		18.0	21.3		11.4			
Approach LOS		B	C		B			
Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				26.0		25.0	12.9	13.1
Change Period (Y+Rc), s				4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s				45.5		20.5	20.5	20.5
Max Q Clear Time (g_c+l1), s				5.2		6.8	8.2	7.3
Green Ext Time (p_c), s				1.6		0.7	0.4	1.3
Intersection Summary								
HCM 2010 Ctrl Delay			16.9					
HCM 2010 LOS			B					

Intersection

Int Delay, s/veh 3.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↔		↔		↔	↔		↔	↔	
Traffic Vol, veh/h	6	1	13	16	5	52	10	311	41	140	990	14
Future Vol, veh/h	6	1	13	16	5	52	10	311	41	140	990	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	-	75	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	7	1	14	17	5	57	11	338	45	152	1076	15

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1801	1792	1084	1771	1778	360	1091	0	0	383	0	0
Stage 1	1388	1388	-	382	382	-	-	-	-	-	-	-
Stage 2	413	404	-	1389	1396	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	62	82	266	66	83	689	647	-	-	1187	-	-
Stage 1	178	212	-	645	616	-	-	-	-	-	-	-
Stage 2	620	603	-	178	210	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	48	70	266	55	71	689	647	-	-	1187	-	-
Mov Cap-2 Maneuver	48	70	-	55	71	-	-	-	-	-	-	-
Stage 1	175	185	-	634	606	-	-	-	-	-	-	-
Stage 2	554	593	-	146	183	-	-	-	-	-	-	-

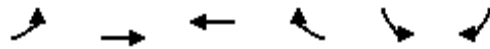
Approach	EB	WB	NB	SB
HCM Control Delay, s	43.9	44.7	0.3	1
HCM LOS	E	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn	EBLn	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	647	-	-	50	266	167	1187	-	-
HCM Lane V/C Ratio	0.017	-	-	0.152	0.053	0.475	0.128	-	-
HCM Control Delay (s)	10.7	-	-	89.5	19.3	44.7	8.5	-	-
HCM Lane LOS	B	-	-	F	C	E	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.5	0.2	2.3	0.4	-	-

Year 2020 Level of Service

HCM 2010 Signalized Intersection Summary
 12: Monticello Rd & Atlas Peak Rd

08/08/2017



Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations								
Traffic Volume (veh/h)	201	625	182	55	226	259		
Future Volume (veh/h)	201	625	182	55	226	259		
Number	7	4	8	18	1	16		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900		
Adj Flow Rate, veh/h	209	651	190	57	235	270		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96		
Percent Heavy Veh, %	0	0	0	0	0	0		
Cap, veh/h	268	788	348	296	756	675		
Arrive On Green	0.15	0.41	0.18	0.18	0.42	0.42		
Sat Flow, veh/h	1810	1900	1900	1615	1810	1615		
Grp Volume(v), veh/h	209	651	190	57	235	270		
Grp Sat Flow(s),veh/h/ln	1810	1900	1900	1615	1810	1615		
Q Serve(g_s), s	6.0	16.4	4.9	1.6	4.7	6.3		
Cycle Q Clear(g_c), s	6.0	16.4	4.9	1.6	4.7	6.3		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	268	788	348	296	756	675		
V/C Ratio(X)	0.78	0.83	0.55	0.19	0.31	0.40		
Avail Cap(c_a), veh/h	622	1535	724	615	756	675		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	22.1	14.0	20.0	18.6	10.5	10.9		
Incr Delay (d2), s/veh	4.9	2.3	1.3	0.3	1.1	1.8		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	3.3	9.0	2.7	0.7	2.5	6.7		
LnGrp Delay(d),s/veh	26.9	16.3	21.3	18.9	11.5	12.7		
LnGrp LOS	C	B	C	B	B	B		
Approach Vol, veh/h		860	247		505			
Approach Delay, s/veh		18.9	20.8		12.2			
Approach LOS		B	C		B			
Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				26.8		27.0	12.5	14.4
Change Period (Y+Rc), s				4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s				43.5		22.5	18.5	20.5
Max Q Clear Time (g_c+l1), s				18.4		8.3	8.0	6.9
Green Ext Time (p_c), s				3.5		1.3	0.4	3.0
Intersection Summary								
HCM 2010 Ctrl Delay			17.1					
HCM 2010 LOS			B					

Intersection

Int Delay, s/veh 4.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↔		↔		↔	↔		↔	↔	
Traffic Vol, veh/h	1	0	9	15	1	62	4	413	66	270	903	5
Future Vol, veh/h	1	0	9	15	1	62	4	413	66	270	903	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	-	75	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	1	0	9	16	1	65	4	435	69	284	951	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2033	2035	953	2000	2002	469	956	0	0	504	0	0
Stage 1	1522	1522	-	478	478	-	-	-	-	-	-	-
Stage 2	511	513	-	1522	1524	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	43	58	317	45	60	598	727	-	-	1071	-	-
Stage 1	149	182	-	572	559	-	-	-	-	-	-	-
Stage 2	549	539	-	149	182	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	30	42	317	35	44	598	727	-	-	1071	-	-
Mov Cap-2 Maneuver	30	42	-	35	44	-	-	-	-	-	-	-
Stage 1	148	134	-	569	556	-	-	-	-	-	-	-
Stage 2	485	536	-	106	134	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	28	61.1	0.1	2.2
HCM LOS	D	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	727	-	-	30	317	141	1071	-	-
HCM Lane V/C Ratio	0.006	-	-0.035	0.030	0.582	0.265	-	-	-
HCM Control Delay (s)	10	-	-129.3	16.7	61.1	9.6	-	-	-
HCM Lane LOS	A	-	F	C	F	A	-	-	-
HCM 95th %tile Q(veh)	0	-	-0.1	0.1	3	1.1	-	-	-

HCM 2010 Signalized Intersection Summary
 4: Monticello Rd & Atlas Peak Rd

08/08/2017



Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations								
Traffic Volume (veh/h)	224	182	205	74	90	212		
Future Volume (veh/h)	224	182	205	74	90	212		
Number	7	4	8	18	1	16		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900		
Adj Flow Rate, veh/h	238	194	218	79	96	226		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94		
Percent Heavy Veh, %	0	0	0	0	0	0		
Cap, veh/h	304	812	327	278	720	643		
Arrive On Green	0.17	0.43	0.17	0.17	0.40	0.40		
Sat Flow, veh/h	1810	1900	1900	1615	1810	1615		
Grp Volume(v), veh/h	238	194	218	79	96	226		
Grp Sat Flow(s),veh/h/ln	1810	1900	1900	1615	1810	1615		
Q Serve(g_s), s	6.5	3.4	5.5	2.2	1.7	5.0		
Cycle Q Clear(g_c), s	6.5	3.4	5.5	2.2	1.7	5.0		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	304	812	327	278	720	643		
V/C Ratio(X)	0.78	0.24	0.67	0.28	0.13	0.35		
Avail Cap(c_a), veh/h	720	1678	756	643	720	643		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	20.5	9.4	19.9	18.6	9.9	10.9		
Incr Delay (d2), s/veh	4.4	0.2	2.3	0.6	0.4	1.5		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	3.6	1.8	3.1	1.0	0.9	5.4		
LnGrp Delay(d),s/veh	24.9	9.6	22.3	19.1	10.2	12.4		
LnGrp LOS	C	A	C	B	B	B		
Approach Vol, veh/h		432	297		322			
Approach Delay, s/veh		18.0	21.4		11.7			
Approach LOS		B	C		B			
Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				26.5		25.0	13.2	13.4
Change Period (Y+Rc), s				4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s				45.5		20.5	20.5	20.5
Max Q Clear Time (g_c+l1), s				5.4		7.0	8.5	7.5
Green Ext Time (p_c), s				1.6		0.8	0.5	1.3
Intersection Summary								
HCM 2010 Ctrl Delay			17.1					
HCM 2010 LOS			B					

Intersection

Int Delay, s/veh 3.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↖	↗		↕		↖	↗		↖	↗	
Traffic Vol, veh/h	6	1	13	16	5	53	10	324	42	145	1017	15
Future Vol, veh/h	6	1	13	16	5	53	10	324	42	145	1017	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	-	75	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	7	1	14	17	5	58	11	352	46	158	1105	16

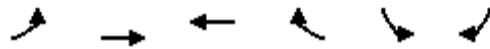
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1857	1849	1114	1826	1834	375	1122	0	0	398	0	0
Stage 1	1429	1429	-	397	397	-	-	-	-	-	-	-
Stage 2	428	420	-	1429	1437	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	57	75	256	60	77	676	630	-	-	1172	-	-
Stage 1	169	202	-	633	607	-	-	-	-	-	-	-
Stage 2	609	593	-	169	201	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	43	64	256	50	65	676	630	-	-	1172	-	-
Mov Cap-2 Maneuver	43	64	-	50	65	-	-	-	-	-	-	-
Stage 1	166	175	-	622	596	-	-	-	-	-	-	-
Stage 2	542	583	-	137	174	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	48.1	50.4	0.3	1.1
HCM LOS	E	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn	EBLn1	WBLn	SBL	SBT	SBR
Capacity (veh/h)	630	-	-	45	256	156	1172	-	-
HCM Lane V/C Ratio	0.017	-	-	0.169	0.055	0.516	0.134	-	-
HCM Control Delay (s)	10.8	-	-	100.6	19.9	50.4	8.5	-	-
HCM Lane LOS	B	-	-	F	C	F	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.5	0.2	2.5	0.5	-	-

HCM 2010 Signalized Intersection Summary
 12: Monticello Rd & Atlas Peak Rd

08/08/2017



Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations								
Traffic Volume (veh/h)	201	625	182	55	226	261		
Future Volume (veh/h)	201	625	182	55	226	261		
Number	7	4	8	18	1	16		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900		
Adj Flow Rate, veh/h	209	651	190	57	235	272		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96		
Percent Heavy Veh, %	0	0	0	0	0	0		
Cap, veh/h	268	788	348	296	756	675		
Arrive On Green	0.15	0.41	0.18	0.18	0.42	0.42		
Sat Flow, veh/h	1810	1900	1900	1615	1810	1615		
Grp Volume(v), veh/h	209	651	190	57	235	272		
Grp Sat Flow(s),veh/h/ln	1810	1900	1900	1615	1810	1615		
Q Serve(g_s), s	6.0	16.4	4.9	1.6	4.7	6.3		
Cycle Q Clear(g_c), s	6.0	16.4	4.9	1.6	4.7	6.3		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	268	788	348	296	756	675		
V/C Ratio(X)	0.78	0.83	0.55	0.19	0.31	0.40		
Avail Cap(c_a), veh/h	622	1535	724	615	756	675		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	22.1	14.0	20.0	18.6	10.5	11.0		
Incr Delay (d2), s/veh	4.9	2.3	1.3	0.3	1.1	1.8		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	3.3	9.0	2.7	0.7	2.5	6.7		
LnGrp Delay(d),s/veh	26.9	16.3	21.3	18.9	11.5	12.8		
LnGrp LOS	C	B	C	B	B	B		
Approach Vol, veh/h		860	247		507			
Approach Delay, s/veh		18.9	20.8		12.2			
Approach LOS		B	C		B			
Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				26.8		27.0	12.5	14.4
Change Period (Y+Rc), s				4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s				43.5		22.5	18.5	20.5
Max Q Clear Time (g_c+l1), s				18.4		8.3	8.0	6.9
Green Ext Time (p_c), s				3.5		1.3	0.4	3.0
Intersection Summary								
HCM 2010 Ctrl Delay			17.1					
HCM 2010 LOS			B					

Intersection

Int Delay, s/veh 4.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↔		↔		↔	↔		↔	↔	
Traffic Vol, veh/h	1	0	9	15	1	63	4	413	66	270	903	5
Future Vol, veh/h	1	0	9	15	1	63	4	413	66	270	903	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	-	75	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	1	0	9	16	1	66	4	435	69	284	951	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2034	2035	953	2000	2002	469	956	0	0	504	0	0
Stage 1	1522	1522	-	478	478	-	-	-	-	-	-	-
Stage 2	512	513	-	1522	1524	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	43	58	317	45	60	598	727	-	-	1071	-	-
Stage 1	149	182	-	572	559	-	-	-	-	-	-	-
Stage 2	548	539	-	149	182	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	30	42	317	35	44	598	727	-	-	1071	-	-
Mov Cap-2 Maneuver	30	42	-	35	44	-	-	-	-	-	-	-
Stage 1	148	134	-	569	556	-	-	-	-	-	-	-
Stage 2	484	536	-	106	134	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	28	61.1	0.1	2.2
HCM LOS	D	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	727	-	-	30	317	142	1071	-	-
HCM Lane V/C Ratio	0.006	-	-0.035	0.030	0.586	0.265	-	-	-
HCM Control Delay (s)	10	-	-129.3	16.7	61.1	9.6	-	-	-
HCM Lane LOS	A	-	-	F	C	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	3	1.1	-	-

HCM 2010 Signalized Intersection Summary
 4: Monticello Rd & Atlas Peak Rd

08/08/2017



Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations	↖	→	←	↗	↙	↘		
Traffic Volume (veh/h)	224	182	205	74	90	214		
Future Volume (veh/h)	224	182	205	74	90	214		
Number	7	4	8	18	1	16		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900		
Adj Flow Rate, veh/h	238	194	218	79	96	228		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94		
Percent Heavy Veh, %	0	0	0	0	0	0		
Cap, veh/h	304	812	327	278	720	643		
Arrive On Green	0.17	0.43	0.17	0.17	0.40	0.40		
Sat Flow, veh/h	1810	1900	1900	1615	1810	1615		
Grp Volume(v), veh/h	238	194	218	79	96	228		
Grp Sat Flow(s),veh/h/ln	1810	1900	1900	1615	1810	1615		
Q Serve(g_s), s	6.5	3.4	5.5	2.2	1.7	5.1		
Cycle Q Clear(g_c), s	6.5	3.4	5.5	2.2	1.7	5.1		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	304	812	327	278	720	643		
V/C Ratio(X)	0.78	0.24	0.67	0.28	0.13	0.35		
Avail Cap(c_a), veh/h	720	1678	756	643	720	643		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	20.5	9.4	19.9	18.6	9.9	10.9		
Incr Delay (d2), s/veh	4.4	0.2	2.3	0.6	0.4	1.5		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	3.6	1.8	3.1	1.0	0.9	5.5		
LnGrp Delay(d),s/veh	24.9	9.6	22.3	19.1	10.2	12.4		
LnGrp LOS	C	A	C	B	B	B		
Approach Vol, veh/h		432	297		324			
Approach Delay, s/veh		18.0	21.4		11.8			
Approach LOS		B	C		B			
Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				26.5		25.0	13.2	13.4
Change Period (Y+Rc), s				4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s				45.5		20.5	20.5	20.5
Max Q Clear Time (g_c+l1), s				5.4		7.1	8.5	7.5
Green Ext Time (p_c), s				1.6		0.8	0.5	1.3
Intersection Summary								
HCM 2010 Ctrl Delay			17.1					
HCM 2010 LOS			B					

Intersection

Int Delay, s/veh 3.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↔		↔		↔	↔		↔	↔	
Traffic Vol, veh/h	6	1	13	16	5	54	10	324	42	145	1017	15
Future Vol, veh/h	6	1	13	16	5	54	10	324	42	145	1017	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	-	75	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	7	1	14	17	5	59	11	352	46	158	1105	16

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1858	1849	1114	1826	1834	375	1122	0	0	398	0	0
Stage 1	1429	1429	-	397	397	-	-	-	-	-	-	-
Stage 2	429	420	-	1429	1437	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	57	75	256	60	77	676	630	-	-	1172	-	-
Stage 1	169	202	-	633	607	-	-	-	-	-	-	-
Stage 2	608	593	-	169	201	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	43	64	256	50	65	676	630	-	-	1172	-	-
Mov Cap-2 Maneuver	43	64	-	50	65	-	-	-	-	-	-	-
Stage 1	166	175	-	622	596	-	-	-	-	-	-	-
Stage 2	541	583	-	137	174	-	-	-	-	-	-	-













Approach	EB	WB	NB	SB
HCM Control Delay, s	48.1	50.4	0.3	1.1
HCM LOS	E	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn	EBLn	WBLn	SBL	SBT	SBR
Capacity (veh/h)	630	-	-	45	256	157	1172	-	-
HCM Lane V/C Ratio	0.017	-	-	0.169	0.055	0.519	0.134	-	-
HCM Control Delay (s)	10.8	-	-	100.6	19.9	50.4	8.5	-	-
HCM Lane LOS	B	-	-	F	C	F	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.5	0.2	2.6	0.5	-	-

Year 2030 Level of Service

HCM 2010 Signalized Intersection Summary
 4: Monticello Rd & Atlas Peak Rd

08/08/2017

								
Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations								
Traffic Volume (veh/h)	217	697	200	59	241	278		
Future Volume (veh/h)	217	697	200	59	241	278		
Number	7	4	8	18	1	16		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900		
Adj Flow Rate, veh/h	226	726	208	61	251	290		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96		
Percent Heavy Veh, %	0	0	0	0	0	0		
Cap, veh/h	288	857	396	337	690	616		
Arrive On Green	0.16	0.45	0.21	0.21	0.38	0.38		
Sat Flow, veh/h	1810	1900	1900	1615	1810	1615		
Grp Volume(v), veh/h	226	726	208	61	251	290		
Grp Sat Flow(s),veh/h/ln	1810	1900	1900	1615	1810	1615		
Q Serve(g_s), s	6.5	18.2	5.2	1.7	5.4	7.3		
Cycle Q Clear(g_c), s	6.5	18.2	5.2	1.7	5.4	7.3		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	288	857	396	337	690	616		
V/C Ratio(X)	0.79	0.85	0.53	0.18	0.36	0.47		
Avail Cap(c_a), veh/h	623	1609	796	676	690	616		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	21.7	13.1	18.9	17.5	11.9	12.5		
Incr Delay (d2), s/veh	4.7	2.4	1.1	0.3	1.5	2.6		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	3.6	10.1	2.8	0.8	2.9	7.4		
LnGrp Delay(d),s/veh	26.5	15.5	20.0	17.8	13.4	15.1		
LnGrp LOS	C	B	B	B	B	B		
Approach Vol, veh/h		952	269		541			
Approach Delay, s/veh		18.1	19.5		14.3			
Approach LOS		B	B		B			
Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				28.7		25.0	13.0	15.7
Change Period (Y+Rc), s				4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s				45.5		20.5	18.5	22.5
Max Q Clear Time (g_c+l1), s				20.2		9.3	8.5	7.2
Green Ext Time (p_c), s				4.0		1.3	0.4	3.5
Intersection Summary								
HCM 2010 Ctrl Delay			17.2					
HCM 2010 LOS			B					

Intersection

Int Delay, s/veh 7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↕		↕		↕	↕		↕	↕	
Traffic Vol, veh/h	1	0	10	16	1	66	4	441	72	298	984	5
Future Vol, veh/h	1	0	10	16	1	66	4	441	72	298	984	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	-	75	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	1	0	11	17	1	69	4	464	76	314	1036	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2212	2214	1038	2177	2179	502	1041	0	0	540	0	0
Stage 1	1666	1666	-	511	511	-	-	-	-	-	-	-
Stage 2	546	548	-	1666	1668	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	32	44	283	34	47	573	676	-	-	1039	-	-
Stage 1	123	155	-	549	540	-	-	-	-	-	-	-
Stage 2	526	520	-	123	155	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	21	31	283	25	33	573	676	-	-	1039	-	-
Mov Cap-2 Maneuver	21	31	-	25	33	-	-	-	-	-	-	-
Stage 1	122	108	-	546	537	-	-	-	-	-	-	-
Stage 2	459	517	-	83	108	-	-	-	-	-	-	-













Approach	EB	WB	NB	SB
HCM Control Delay, s	33.4	118.4	0.1	2.3
HCM LOS	D	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn	EBLn1	WBLn	SBL	SBT	SBR
Capacity (veh/h)	676	-	-	21	283	106	1039	-	-
HCM Lane V/C Ratio	0.006	-	-	0.05	0.037	0.824	0.302	-	-
HCM Control Delay (s)	10.4	-	-	185.3	18.2	118.4	10	-	-
HCM Lane LOS	B	-	-	F	C	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	4.7	1.3	-	-

HCM 2010 Signalized Intersection Summary

4:

08/08/2017

								
Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations								
Traffic Volume (veh/h)	246	202	224	80	99	232		
Future Volume (veh/h)	246	202	224	80	99	232		
Number	7	4	8	18	1	16		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900		
Adj Flow Rate, veh/h	262	215	238	85	105	247		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94		
Percent Heavy Veh, %	0	0	0	0	0	0		
Cap, veh/h	329	850	344	293	695	620		
Arrive On Green	0.18	0.45	0.18	0.18	0.38	0.38		
Sat Flow, veh/h	1810	1900	1900	1615	1810	1615		
Grp Volume(v), veh/h	262	215	238	85	105	247		
Grp Sat Flow(s),veh/h/ln	1810	1900	1900	1615	1810	1615		
Q Serve(g_s), s	7.4	3.8	6.3	2.4	2.0	5.9		
Cycle Q Clear(g_c), s	7.4	3.8	6.3	2.4	2.0	5.9		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	329	850	344	293	695	620		
V/C Ratio(X)	0.80	0.25	0.69	0.29	0.15	0.40		
Avail Cap(c_a), veh/h	729	1620	694	590	695	620		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	20.9	9.2	20.5	18.9	10.8	12.0		
Incr Delay (d2), s/veh	4.4	0.2	2.5	0.5	0.5	1.9		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	4.0	2.0	3.5	1.1	1.1	6.2		
LnGrp Delay(d),s/veh	25.3	9.3	23.0	19.4	11.2	13.9		
LnGrp LOS	C	A	C	B	B	B		
Approach Vol, veh/h		477	323		352			
Approach Delay, s/veh		18.1	22.0		13.1			
Approach LOS		B	C		B			
Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				28.4		25.0	14.2	14.2
Change Period (Y+Rc), s				4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s				45.5		20.5	21.5	19.5
Max Q Clear Time (g_c+l1), s				5.8		7.9	9.4	8.3
Green Ext Time (p_c), s				1.8		0.8	0.5	1.4
Intersection Summary								
HCM 2010 Ctrl Delay			17.7					
HCM 2010 LOS			B					

Intersection

Int Delay, s/veh 5.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↕		↕		↕	↕		↕	↕	
Traffic Vol, veh/h	6	1	13	18	5	58	11	365	47	160	1098	15
Future Vol, veh/h	6	1	13	18	5	58	11	365	47	160	1098	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	-	75	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	7	1	14	20	5	63	12	397	51	174	1193	16

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2029	2021	1202	1996	2004	422	1210	0	0	448	0	0
Stage 1	1549	1549	-	446	446	-	-	-	-	-	-	-
Stage 2	480	472	-	1550	1558	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	43	59	227	45	60	636	584	-	-	1123	-	-
Stage 1	144	177	-	595	577	-	-	-	-	-	-	-
Stage 2	571	562	-	144	175	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	31	49	227	36	50	636	584	-	-	1123	-	-
Mov Cap-2 Maneuver	31	49	-	36	50	-	-	-	-	-	-	-
Stage 1	141	150	-	583	565	-	-	-	-	-	-	-
Stage 2	499	550	-	113	148	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	64.7	96.4	0.3	1.1
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn	EBLn1	WBLn	SBL	SBT	SBR
Capacity (veh/h)	584	-	-	33	227	117	1123	-	-
HCM Lane V/C Ratio	0.02	-	-	0.231	0.062	0.753	0.155	-	-
HCM Control Delay (s)	11.3	-	-	144.2	21.9	96.4	8.8	-	-
HCM Lane LOS	B	-	-	F	C	F	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.7	0.2	4.2	0.5	-	-

HCM 2010 Signalized Intersection Summary
 4: Monticello Rd & Atlas Peak Rd

08/08/2017



Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations								
Traffic Volume (veh/h)	217	697	200	59	241	280		
Future Volume (veh/h)	217	697	200	59	241	280		
Number	7	4	8	18	1	16		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900		
Adj Flow Rate, veh/h	226	726	208	61	251	292		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96		
Percent Heavy Veh, %	0	0	0	0	0	0		
Cap, veh/h	288	857	396	337	690	616		
Arrive On Green	0.16	0.45	0.21	0.21	0.38	0.38		
Sat Flow, veh/h	1810	1900	1900	1615	1810	1615		
Grp Volume(v), veh/h	226	726	208	61	251	292		
Grp Sat Flow(s),veh/h/ln	1810	1900	1900	1615	1810	1615		
Q Serve(g_s), s	6.5	18.2	5.2	1.7	5.4	7.3		
Cycle Q Clear(g_c), s	6.5	18.2	5.2	1.7	5.4	7.3		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	288	857	396	337	690	616		
V/C Ratio(X)	0.79	0.85	0.53	0.18	0.36	0.47		
Avail Cap(c_a), veh/h	623	1609	796	676	690	616		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	21.7	13.1	18.9	17.5	11.9	12.5		
Incr Delay (d2), s/veh	4.7	2.4	1.1	0.3	1.5	2.6		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	3.6	10.1	2.8	0.8	2.9	7.4		
LnGrp Delay(d),s/veh	26.5	15.5	20.0	17.8	13.4	15.2		
LnGrp LOS	C	B	B	B	B	B		
Approach Vol, veh/h		952	269		543			
Approach Delay, s/veh		18.1	19.5		14.4			
Approach LOS		B	B		B			
Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				28.7		25.0	13.0	15.7
Change Period (Y+Rc), s				4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s				45.5		20.5	18.5	22.5
Max Q Clear Time (g_c+l1), s				20.2		9.3	8.5	7.2
Green Ext Time (p_c), s				4.0		1.3	0.4	3.5
Intersection Summary								
HCM 2010 Ctrl Delay			17.2					
HCM 2010 LOS			B					

Intersection

Int Delay, s/veh 7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↔		↔		↔	↔		↔	↔	
Traffic Vol, veh/h	1	0	10	16	1	67	4	441	72	298	984	5
Future Vol, veh/h	1	0	10	16	1	67	4	441	72	298	984	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	-	75	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	1	0	11	17	1	71	4	464	76	314	1036	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2212	2214	1038	2177	2179	502	1041	0	0	540	0	0
Stage 1	1666	1666	-	511	511	-	-	-	-	-	-	-
Stage 2	546	548	-	1666	1668	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	32	44	283	34	47	573	676	-	-	1039	-	-
Stage 1	123	155	-	549	540	-	-	-	-	-	-	-
Stage 2	526	520	-	123	155	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	21	31	283	25	33	573	676	-	-	1039	-	-
Mov Cap-2 Maneuver	21	31	-	25	33	-	-	-	-	-	-	-
Stage 1	122	108	-	546	537	-	-	-	-	-	-	-
Stage 2	458	517	-	83	108	-	-	-	-	-	-	-













Approach	EB	WB	NB	SB
HCM Control Delay, s	33.4	118.1	0.1	2.3
HCM LOS	D	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn	EBLn	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	676	-	-	21	283	107	1039	-	-
HCM Lane V/C Ratio	0.006	-	-	0.05	0.037	0.826	0.302	-	-
HCM Control Delay (s)	10.4	-	-	185.3	18.2	118.1	10	-	-
HCM Lane LOS	B	-	-	F	C	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	4.7	1.3	-	-

HCM 2010 Signalized Intersection Summary

4:

08/08/2017

								
Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations								
Traffic Volume (veh/h)	246	202	224	80	99	234		
Future Volume (veh/h)	246	202	224	80	99	234		
Number	7	4	8	18	1	16		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900		
Adj Flow Rate, veh/h	262	215	238	85	105	249		
Adj No. of Lanes	1	1	1	1	1	1		
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94		
Percent Heavy Veh, %	0	0	0	0	0	0		
Cap, veh/h	329	850	344	293	695	620		
Arrive On Green	0.18	0.45	0.18	0.18	0.38	0.38		
Sat Flow, veh/h	1810	1900	1900	1615	1810	1615		
Grp Volume(v), veh/h	262	215	238	85	105	249		
Grp Sat Flow(s),veh/h/ln	1810	1900	1900	1615	1810	1615		
Q Serve(g_s), s	7.4	3.8	6.3	2.4	2.0	6.0		
Cycle Q Clear(g_c), s	7.4	3.8	6.3	2.4	2.0	6.0		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	329	850	344	293	695	620		
V/C Ratio(X)	0.80	0.25	0.69	0.29	0.15	0.40		
Avail Cap(c_a), veh/h	729	1620	694	590	695	620		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	1.00		
Uniform Delay (d), s/veh	20.9	9.2	20.5	18.9	10.8	12.0		
Incr Delay (d2), s/veh	4.4	0.2	2.5	0.5	0.5	1.9		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	4.0	2.0	3.5	1.1	1.1	6.3		
LnGrp Delay(d),s/veh	25.3	9.3	23.0	19.4	11.2	13.9		
LnGrp LOS	C	A	C	B	B	B		
Approach Vol, veh/h		477	323		354			
Approach Delay, s/veh		18.1	22.0		13.1			
Approach LOS		B	C		B			
Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6	7	8
Phs Duration (G+Y+Rc), s				28.4		25.0	14.2	14.2
Change Period (Y+Rc), s				4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s				45.5		20.5	21.5	19.5
Max Q Clear Time (g_c+l1), s				5.8		8.0	9.4	8.3
Green Ext Time (p_c), s				1.8		0.8	0.5	1.4
Intersection Summary								
HCM 2010 Ctrl Delay			17.7					
HCM 2010 LOS			B					

Intersection

Int Delay, s/veh 6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↕		↕		↕	↕		↕	↕	
Traffic Vol, veh/h	6	1	13	18	5	59	11	365	47	160	1098	15
Future Vol, veh/h	6	1	13	18	5	59	11	365	47	160	1098	15
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	-	75	-	-	75	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	7	1	14	20	5	64	12	397	51	174	1193	16

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2030	2021	1202	1996	2004	422	1210	0	0	448	0	0
Stage 1	1549	1549	-	446	446	-	-	-	-	-	-	-
Stage 2	481	472	-	1550	1558	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	43	59	227	45	60	636	584	-	-	1123	-	-
Stage 1	144	177	-	595	577	-	-	-	-	-	-	-
Stage 2	570	562	-	144	175	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	31	49	227	36	50	636	584	-	-	1123	-	-
Mov Cap-2 Maneuver	31	49	-	36	50	-	-	-	-	-	-	-
Stage 1	141	150	-	583	565	-	-	-	-	-	-	-
Stage 2	497	550	-	113	148	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	64.7	96.2	0.3	1.1
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn	EBLn	WBLn	SBL	SBT	SBR
Capacity (veh/h)	584	-	-	33	227	118	1123	-	-
HCM Lane V/C Ratio	0.02	-	-	0.231	0.062	0.755	0.155	-	-
HCM Control Delay (s)	11.3	-	-	144.2	21.9	96.2	8.8	-	-
HCM Lane LOS	B	-	-	F	C	F	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.7	0.2	4.3	0.5	-	-