Appendix 2
Traffic Impact Analysis
(Crane Transportation Group)

TRAFFIC REPORT

HEADWATERS

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I. INTRODUCTION

This report has been prepared at the request of the Headwaters Development Company, LLC (Headwaters) to detail the expected circulation impacts due to a proposed winery warehousing development adjacent to the Napa County Airport. The project would contain 645,000 square feet of facilities and would be built and in full operation by year 2010. The project site is located west of State Route 29 (S.R.29) within the Napa County Airport Industrial Park Specific Plan area,[1] west of the future southerly extension of Devlin Road to the south of South Kelly Road and south of an existing railroad line. Access would be gained via the future Devlin Road extension. May 2007 AM and PM peak period traffic counts have been conducted at all major intersections in the project vicinity to determine existing traffic volumes as well as the existing vehicle mix. Near term project impacts have been determined for year 2010 traffic conditions, while long term horizon project impacts have been determined for year 2030 traffic conditions. Measures have then been proposed, where needed, to mitigate any existing operational problems as well as to mitigate any near and long term horizon unacceptable operation both with and without the proposed project. The previously proposed nearby Panattoni Napa Airport Corporate Center – Phases 1 & 2 have been assumed completed and in operation as part of both 2010 and 2030 Base Case conditions for the Headwaters project.

II. SUMMARY OF FINDINGS

A. EXISTING CONDITIONS

The circulation system providing access to the Headwaters site is currently operating at LOS D or better with the following exception.

- The two-lane section of Jameson Canyon Road at the Napa/Solano County line is currently operating at LOS E during PM commute peak hour conditions.

  Needed Improvement:
  Jameson Canyon Road should be widened to a four-lane divided highway.

B. YEAR 2010 BASE CASE (WITHOUT PROJECT) OPERATING CONDITIONS

- By 2010, the following intersections providing access to the Headwaters site will be operating at LOS E or poorer, while the following roadway segment will be operating at LOS F.

[1] For ease of reference in this report, "Napa County Airport Industrial Park Specific Plan" area is shortened to "Airport Industrial Park" or "Specific Plan" area.

Intersections
AM Peak Hour

- S.R.29/Jameson Canyon Road (S.R.12)/Airport Boulevard Intersection: LOS E
- S.R.29/Napa Junction Road Intersection: LOS E

PM Peak Hour

- S.R.29//South Kelly Road Intersection: LOS E

Roadways
Jameson Canyon Road at Napa-Solano County Line

- AM Peak Hour: LOS F
- PM Peak Hour: LOS F

Needed Improvement:

- S.R.29/Napa Junction Road intersection: No improvement in operation would be possible until the widening of S.R.29 to six lanes through the intersection or completion or Newell Road as an alternate north-south route to S.R.29. Neither improvement is planned by 2010.

- S.R.29/Jameson Canyon Road/Airport Boulevard intersection: Restripe the three-lane westbound intersection approach to provide one right turn lane, one through lane and one combined through/left turn lane.

- S.R.29/South Kelly Road intersection: Provide three lanes on the eastbound South Kelly Road intersection approach and stripe for one left turn lane, one through lane and one right turn lane.

- Jameson Canyon Road should be widened to a four-lane divided highway.

C. YEAR 2030 BASE CASE (WITHOUT PROJECT) OPERATING CONDITIONS)

- By 2030, the circulation system providing access to the Headwaters site will have all intersections operating at LOS D or better after all planned circulation system improvements. However, the S.R.29/South Kelly intersection may experience LOS E or F operation at some point between 2010 and 2030 before S.R.29 is widened from four to six lanes in the project vicinity. In addition, during the AM peak hour the left turn lane on the northbound S.R.29 approach to South Kelly Road will have 95th percentile queuing demands beyond available storage and a queuing demand in the southbound S.R.29 right turn lane at the storage capacity limit.

Needed Improvement:
S.R.29/South Kelly Road intersection: Provide a second lane on the eastbound South Kelly Road intersection approach. Construction of this lane should be included in the area-wide set of circulation system improvements for the Napa Airport Industrial Area.

In addition, the left turn lane on the northbound S.R.29 approach to South Kelly Road should be lengthened from 250 up to at least 400 feet (and preferably 450 feet).

D. PROJECT IMPACTS

- The proposed 645,000-square-foot winery warehouse project would be expected to generate about 1,100 daily two-way trips (550 inbound and 550 outbound), with 65 inbound and 39 outbound trips during the AM peak hour, and 32 inbound and 65 outbound trips during the PM peak hour.

- The project would produce one significant intersection level of service impact by 2010: at the S.R.29/South Kelly Road intersection during the PM peak hour. The project would also produce one significant level of service impact by 2030: at the S.R.29/Green Island Road/Newell Road intersection in American Canyon, where PM peak operation would change from LOS D to LOS E.

- The project would not be expected to produce any significant merge impacts by 2010 at either the Green Island Road or Paoli Loop Road ramp connections to S.R.29 in American Canyon. In addition, the project would not provide any significant impact to Jameson Canyon Road in 2010 or 2030.

- The project would produce a significant 95th percentile queuing impact by 2010. During the AM peak hour, queuing in the left turn lane on the northbound S.R.29 approach to South Kelly Road would extend beyond available storage. Between 2010 and 2030 the project would continue producing a significant 95th percentile queuing impact in the left turn lane on the northbound S.R.29 approach to South Kelly Road. In addition, before 2030 the project would be producing a significant queuing impact in the right turn lane on the southbound S.R.29 approach to South Kelly Road.

E. PROJECT MITIGATIONS

1. Year 2010

a. S.R.29/South Kelly Road

1. The Headwaters project should provide a fair share contribution towards improvements recommended for South Kelly Road as part of the Panattoni Phases 1 & 2 developments. This includes construction of an additional lane on the eastbound approach to S.R.29 when needed between 2010 and 2030. Theoretical projections indicate mitigated LOS D PM peak hour operation of the S.R.29/South Kelly Road intersection in 2010, and LOS D operation in 2030 with six lanes on S.R.29. However, there potentially will be a period after 2010 and before the widening of S.R.29 from four to six lanes when the intersection will be operating at LOS E or F. Provision of an additional lane on the eastbound South Kelly Road intersection approach would improve operation, accommodate vehicle queuing on the eastbound intersection approach and provide an overall area traffic

benefit. Construction of this additional lane should be included in the area-wide set of improvements for the Napa Airport Industrial Area.

2. The Headwaters project should provide a fair share contribution to lengthening of the left turn lane on the northbound S.R.29 approach to South Kelly Road (from 250 feet up to at least 450 feet).

2. Year 2030

a. S.R.29/Green Island Road/Newell Road

1. The Headwaters project should provide a right turn lane on the northbound S.R.29 approach to the Green Island Road/Newell Road intersection. Although project traffic would not use this particular lane, this would be the lowest cost alternative to improve operating conditions back to LOS D operation.

b. S.R.29/South Kelly Road

2. The Headwaters project should provide a fair share contribution to lengthening of the left turn lane on the northbound S.R.29 approach to South Kelly Road (from 250 feet up to at least 450 feet). In addition, the project should lengthen the right turn on the southbound S.R.29 approach to South Kelly Road from 50 up to at least 100 feet.

III. PROPOSED PROJECT

The Headwaters project will be located on the west side of S.R.29 in the Napa County Airport Industrial Park, south of the City of Napa and north of the City of American Canyon – see **Figures 1** and **2**. The site is located southeast of the Napa County Airport on the west side of the future extension of Devlin Road south of South Kelly Road and just south of an existing railroad line. The project will be accessed from the southward extension of Devlin Road, which will be completed as a two-lane road adjacent to the project frontage. Ultimately, Devlin Road will be extended farther south to Green Island Road in American Canyon in conjunction with other area development. The project site is currently undeveloped.

The Headwaters project will contain 645,000 square feet of winery warehouse uses in one building. It is scheduled to be built in 2009 with full occupancy by no later than 2010. The project is projected to have the same traffic activity for both the near term (2010) and long term (2030) horizons.

IV. EXISTING CIRCULATION SYSTEM

A. ROADWAYS

Roadways providing access to the site are briefly described below. Intersection geometrics and control are shown on **Figure 3**.

The ***State Route 29 (S.R.29)*** highway runs in a north-south direction between Vallejo and American Canyon to the south, and the City of Napa and other Napa County communities to the north. In the project site vicinity it has two travel lanes in each direction, separated by a grass and dirt median. As shown on **Figure 3**, within Napa County it has separate left turn lanes at its signalized intersection with South Kelly Road and separate left and right turn lanes at its signalized intersections with Airport Boulevard/Jameson Canyon Road (S.R.12).[2] The posted speed limit in the site vicinity is 55 miles per hour in both directions. S.R.29 is also designated S.R.12 north of Jameson Canyon Road.

South Kelly Road is a 34-foot-wide, two-lane roadway with narrow shoulders from Devlin Road to S.R.29. The west leg of the Devlin Road/South Kelly Road intersection is the entrance/exit to a Waste Transfer Station. South Kelly Road continues east and north of S.R.29 to Jameson Canyon Road and changes names to North Kelly Road to the north of Jameson Canyon Road.

Devlin Road is a 48-foot-wide, three-lane roadway that extends south of Tower Road (an east-west roadway within the Airport Industrial Park) about one half mile to a dead-end at South Kelly Road. It has one lane in each direction and a center two-way left turn lane that transitions to an exclusive left turn lane at the Tower Road and South Kelly Road intersections. Numerous businesses front or have access to Devlin Road. Devlin Road is planned to eventually be extended as a north-south three- to four-lane arterial roadway through the Airport Industrial Park between Soscol Ferry Road and Green Island Road (see Planned Improvements, below).

B. VOLUMES

Napa County staff requested analysis at the following locations for this study.

- S.R.12-29/Jameson Canyon Road (S.R.12)/Airport Boulevard (Napa County)
- Jameson Canyon Road (S.R.12)/North Kelly Road-South Kelly Road (Napa County)
- S.R.29/South Kelly Road (Napa County)
- S.R.29/Green Island Road-Paoli Loop Road hook ramps (American Canyon)
- S.R.29/Napa Junction Road intersection (American Canyon)

Traffic counts were conducted by Crane Transportation Group at the following Napa County locations in May 2007.

- S.R.12-29/Jameson Canyon Road (S.R.12)/Airport Boulevard: May 23, 2007
- Jameson Canyon Road (S.R.12)/North Kelly Road-South Kelly Road: May 22, 2007

[2] Southbound S.R.29 at the Airport Boulevard intersection has *two* left turn lanes.

- S.R.29/South Kelly Road: May 23, 2007
- S.R.29/Tower Road: May 23, 2007 (count required in order to provide complete traffic distribution pattern from area jointly served by Tower Road and South Kelly Road)

American Canyon traffic counts for the S.R.29 hook ramp connections with Green Island Road and Paoli Loop Road as well as the Napa Junction Road intersection were obtained from the City of American Canyon traffic consultant (Omni Means) and are from 2005. AM and PM peak hour traffic volumes at all locations are presented in **Figures 4** and **5**, respectively.

During the AM peak hour, the two-way traffic volume on South Kelly Road between S.R.29 and Devlin Road was about 205 vehicles per hour (vph). During the same time period, two-way volumes on S.R.29 just north and south of South Kelly Road were about 3,490 vph and 4,125 vph, respectively.

During the PM peak hour, the two-way traffic volume on South Kelly Road between S.R.29 and Devlin Road was 250 vph. For the same time period, two-way volumes on S.R.29 just north and south of South Kelly Road were 3,935 vph and 4,110 vph, respectively.

C. INTERSECTION OPERATION

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 2000 *Highway Capacity Manual* (Transportation Research Board, National Research Council) methodology was utilized. With 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 2000 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 typically represented for the stop sign controlled approaches or turn movements. 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

a. County of Napa

Based upon criteria established in the County's New General Plan, LOS D is the poorest acceptable operation during peak traffic periods at the signalized intersections analyzed within Specific Plan Area for this study.

b. City of American Canyon

The City of American Canyon uses LOS D as the poorest acceptable operation at signalized or unsignalized intersections.

3. Existing Operation

Tables 3 and **4** show existing operation at analyzed intersections for AM and PM peak hour conditions, respectively. As shown, all intersections are operating at LOS D or better during the AM and PM peak hours. This result includes the recently completed (September 2007) signalization of the S.R.29/Napa Junction Road intersection.

D. MERGE ANALYSIS AT S.R.29/GREEN ISLAND ROAD & S.R.29/PAOLI LOOP ROAD

1. Methodology

On-ramp merge operation from the Green Island Road and Paoli Loop Road Hook Ramps to S.R.29 has been evaluated using planning level methodology contained in the *Year 2000 Highway Capacity Manual.* Level of service is dependent upon both vehicle speed as well as vehicle density (in passenger cars per lane per mile) in the merge area.

2. Minimum Acceptable Operation

Caltrans' Guide for the Preparation of Traffic Impacts Studies (December 2002) is intended to provide a consistent basis for evaluating traffic impacts to state facilities. *Caltrans endeavors to maintain a target LOS at the transition between LOS C and LOS D... on state highway facilities; however, Caltrans acknowledges that this may not always be feasible and recommends that the lead agency consult with Caltrans to determine the appropriate target LOS.*[3]

[3] California Department of Transportation, December 2002, *Caltrans Guide for the Preparation of Traffic Impact Studies.*

3. Existing Operation

Table 5 shows that during the AM peak hour the southbound merge to S.R.29 from Green Island Road is currently operating at LOS B, while the northbound merge to S.R.29 from Paoli Loop Road is operating at LOS C. During the PM peak hour, the southbound merge to S.R.29 from Green Island Road is operating at LOS C, while the northbound merge to S.R.29 from Paoli Loop Road is operating at LOS B.

E. 95TH PERCENTILE VEHICLE QUEUING – S.R.29 TURN LANES APPROACHING SOUTH KELLY ROAD

1. Methodology

The Synchro software intersection level of service program has been utilized to obtain the 95th percentile vehicle queuing expected in the left turn lane on the northbound S.R.29 approach to South Kelly Road and in the right turn lane on the southbound S.R.29 approach to South Kelly Road.

2. Minimum Acceptable Operation

Caltrans requires that the 95th percentile vehicle queuing be contained within the available turn lane storage distance.

3. Existing Operation

May 2007 field observations by Crane Transportation Group at the S.R.29/South Kelly Road intersection showed no queues in the 250-foot-long northbound S.R.29 left turn lane or in the 50-foot-long southbound S.R.29 right turn lane on the approaches to South Kelly Road extending beyond the storage limits of the existing turn lanes. In addition, **Table 6** shows that the existing theoretical 95th percentile queuing demand should not be exceeding available storage during either the AM and PM peak traffic hours in either turn lane.

F. JAMESON CANYON ROAD OPERATING CONDITIONS

1. Methodology

The year 2000 *Highway Capacity Manual* two-lane highway analysis methodology has been utilized to determine existing peak hour operating conditions of Jameson Canyon Road at the Napa/Solano county line. Input data includes volume levels, directional split of traffic, road and shoulder widths, percent no passing, rolling versus flat terrain and the percent truck and RVs.

2. Minimum Acceptable Criteria

The County of Napa has determined that LOS E is the minimum acceptable operation for Jameson Canyon Road (within Napa County).

3. Existing Operation

Table 7 shows that currently, Jameson Canyon Road at the Napa/Solano county line is operating at level of service E (LOS E) conditions during the AM peak hour and at LOS F conditions during the PM peak hour.

G. PLANNED IMPROVEMENTS

1. Near Term Improvements (to be completed by 2010)

a. County of Napa

There are no near term capacity improvements planned by Napa County or Caltrans along Jameson Canyon Road nor at any of the S.R.29 or S.R.12 intersections within Napa County evaluated for this study.[4] However, South Kelly Road between S.R.29 and Devlin Road will be widened from two to three lanes as part of the Panattoni Phase 1 development. This new lane will be striped midblock as a continuous two-way left turn lane, and as standard left turn pockets on the approaches to S.R.29 and Devlin Road. In addition, right-of-way will be reserved along the south side of South Kelly Road between S.R.29 and Devlin Road for provision of an exclusive right turn lane on the eastbound approach to S.R.29. The Panattoni Phase 2 development will be providing a 200- to 250-foot right turn lane on the eastbound South Kelly Road approach to S.R.29 within this right-of-way.

b. City of American Canyon

Minor geometric improvements are planned at the Green Island Road and Paoli Loop Road connections to S.R.29.[5]

2. Long Term Improvements (to be completed by 2030)

a. County of Napa

The Napa County Board of Supervisors has adopted a resolution listing planned improvements for the Airport Industrial Park for local roadways and state highway.[6] New development projects within the Specific Plan area are required to contribute to these improvements according to a mitigation fee schedule tied to PM peak hour vehicle trips generated by new projects. Listed projects that affect roadways analyzed in this report are improvements to Devlin Road (construction of extensions and widenings).

Devlin Road is ultimately planned to be a continuous road between Soscol Ferry Road (on the north) and Green Island Road (on the south). The section between Soscol Ferry Road and

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[4] Mr. John Ponte, Napa County Transportation Planning Agency (April 2008) and Mr. Drew Lander, Napa County Public Works Department (April 2008).

[5] Omni Means, Inc. (September 2007).

[6] County Board of Supervisors Resolution Number 90-152, adjusted by Resolution Number 98-117, adopting a traffic mitigation fee for new development projects in the Airport Industrial Park Specific Plan.

Airport Boulevard will ultimately have two travel lanes in each direction separated by a median. The section south of Airport Boulevard will have single travel lanes in each direction and a median continuous turn lane. For new segments of road, the median and travel lanes adjacent to the median (one each direction for the four-lane sections) will be financed through the off-site traffic fee collected from all new developments within the Airport Specific Plan Area. The curb travel lanes will be the financial responsibility of the landowners or subgroup of landowners who front on, or are directly served by, the collector street.[7]

b. Caltrans

A full diamond interchange is planned for the S.R.12-29/Jameson Canyon Road (S.R.12)/Airport Boulevard intersection. There is no specific date for the interchange improvements at S.R.12-29/Jameson Canyon Road (S.R.12)/Airport Boulevard, although Caltrans and the Napa County Transportation Planning Agency[8] (NCTPA) both agree that it will be in place before 2030. In addition, Jameson Canyon Road is planned to be widened to a four-lane divided highway between S.R.29 and I-80, with construction to start in 2010 or 2011 and completion by 2013 to 2015.[9]

c. City of American Canyon

S.R.29 widening to three through lanes in each direction through the City of American Canyon has been discussed. However, it is not currently programmed, funded or shown in the regional transportation plan.[10]

The Napa County Transportation Authority, County of Napa and American Canyon have developed numerous plans for the potential extension of Flosden Road north of American Canyon Road (named Newell Road) to connect to either S.R.29 (at a variety of locations) or to South Kelly Road (east of S.R.29). For purposes of this study, the Napa County Planning Department has directed that the South County Corridor Study Alternative 5 roadway system (and year 2030 traffic projections) be utilized for long term horizon analysis. Improvements projected to be in place for this alternative are as follows.

- A diamond interchange will be built at the S.R.12-29/Jameson Canyon Road (S.R.12)/Airport Boulevard intersection.
- Newell Road will extend north of American Canyon Road and intersect S.R.29 opposite Green Island Road. The S.R.29/Green Island Road/Newell Road intersection will be signalized.

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[7] Mr. Larry Bogner, Napa County Public Works Department (personal communication, July 2005).
[8] Mr. John Ponte (personal communication in April 2008).
[9] Mr. John Ponte (personal communication in April 2008).
[10] Omni Means, Inc.

- S.R.29 will have three through lanes each direction from the Jameson Canyon intersection to south of the Green Island Road/Newell Road intersection.

- Jameson Canyon Road will be widened to four lanes.

V. YEAR 2010 BASE CASE (WITHOUT PROJECT) CONDITIONS

A. VOLUMES

The Headwaters project is planned to be constructed and occupied by the year 2010. For this reason, year 2010 ambient Base Case (without project) volumes were developed for analysis purposes using a straight line growth projection between existing volumes and year 2030 projections from the County's South County Corridor Alternative 5 Traffic Model. Adjustments were then made to reflect recently approved projects such as the Hanna Court Warehouses in American Canyon as well as the Montalcino and Gateway projects in Napa County, which would add more traffic to select through and turn movements at specific intersections than the straight line growth rate would produce. In addition, traffic from the proposed Panattoni Napa Airport Corporate Center Phases 1 & 2 winery warehousing development (south of South Kelly Road and both east and west of the future southerly extension of Devlin Road) was included in the 2010 Base Case projections. Resultant 2010 Base Case AM and PM peak hour volumes are presented in **Figures 6** and **7**, respectively.

B. OPERATING CONDITIONS AND NEEDED IMPROVEMENT

1. Intersection Operation

Tables 3 and **4** show year 2010 Base Case (without project) AM and PM peak hour operating conditions at analyzed intersections. As shown, during the AM and PM peak hours all analyzed intersections would be operating at or better than LOS D, with the following exceptions.

AM Peak Hour

- S.R.29/Jameson Canyon Road (S.R.12)/Airport Boulevard: LOS E
- S.R.29/Napa Junction Road: LOS E

PM Peak Hour

- S.R.29//South Kelly Road: LOS E

Needed Improvement:

S.R.29/Napa Junction Road intersection: No improvement in operation would be possible until the widening of S.R.29 to six lanes through the intersection or completion or Newell Road as an alternate north-south route to S.R.29. Neither improvement is planned by 2010.

S.R.29/Jameson Canyon Road (S.R.12)/Airport Boulevard: Restripe the three-lane westbound intersection approach to provide one right turn lane, one through lane and one combined through/left turn lane.

Resultant Operation:
AM Peak Hour: LOS D-50.9 seconds control delay
PM Peak Hour: LOS D-47.4 seconds control delay

S.R.29/South Kelly Road: Provide three lanes on the eastbound South Kelly Road intersection approach and stripe for one left turn lane, one through lane and one right turn lane.

Resultant Operation:
AM Peak Hour: LOS C-29.0 seconds control delay
PM Peak Hour: LOS D-54.8 seconds control delay

2. Merge Operation at S.R.29/Green Island Road & S.R.29/Paolo Loop Road

Table 5 shows that year 2010 Base Case (without project) AM and PM peak hour merge operation at the Green Island Road and Paoli Loop Road hook ramp connections to S.R.29 would both be operating at LOS B or C conditions during the AM and PM peak traffic hours.

3. 95th Percentile Vehicle Queuing at the S.R.29/South Kelly Road Intersection

Table 6 shows that the left turn lane on the northbound S.R.29 approach to South Kelly Road (which is 250 feet long) and the right turn lane on the southbound S.R.29 approach to South Kelly Road (which is 50 feet long) would not be expected to experience 95th percentile storage demands greater than available capacity. It should be noted, however, that elimination of potential queuing problems in both turn lanes depends upon Caltrans' signal timing parameters, which may not necessarily optimize clearing traffic from the turn lanes, particularly the northbound left turn lane.

4. Jameson Canyon Road

Table 7 shows that Jameson Canyon Road at the Napa/Solano County line would be operating at LOS F conditions during both the AM and PM peak traffic hours.

Needed Improvement:
Jameson Canyon Road should be widened to a four-lane divided highway.

VI. YEAR 2030 BASE CASE (WITHOUT PROJECT) CONDITIONS

A. VOLUMES

Year 2030 Base Case AM and PM peak hour traffic volumes for all analysis intersections except S.R.29/Napa Junction Road (in American Canyon) have been obtained from the County's South County Corridor traffic model (Alternative 5). The South County Corridor model is consistent with the earlier traffic model developed for the County's General Plan update. Year 2030 volumes at the S.R.29/Napa Junction Road intersection have been obtained from traffic modeling projections supplied by the City of American Canyon's traffic engineering consultant Omni Means, Inc. These projections have been balanced with those at the S.R.29/Green Island Road-Newell Road intersection. Based upon input of County Planning staff, the 2030 traffic needs projections did not include traffic from the Panattoni Napa Airport Corporate Center Phase 1 or Phase 2 developments nor the Headwaters development. However, volumes from the Panattoni Phases 1 & 2 developments have been added into the 2030 Base Case projections. Resultant 2030 Base Case (without Phase 2) AM and PM peak hour volumes are presented in **Figures 8** and **9**.

B. OPERATING CONDITIONS AND NEEDED IMPROVEMENTS

1. Intersection Operation

Tables 3 and **4** show year 2030 Base Case AM and PM peak hour operating conditions at analyzed intersections, while **Figure 10** presents approach geometrics and control at all analyzed intersections. As shown, all analyzed intersections are projected to be operating at LOS D or better in 2030. This includes the S.R.12-29 ramp intersections with Jameson Canyon Road-Airport Boulevard at the new diamond interchange, as well as at the new S.R.29/Green Island Road-Newell Road signalized intersection. However, the S.R.29/South Kelly Road intersection may experience LOS E or F operation at some point between 2010 and 2030 before S.R.29 is widened from four to six lanes in the project vicinity.

Needed Improvement:
S.R.29/South Kelly Road intersection: Provide an exclusive right turn lane on the eastbound South Kelly Road intersection approach. Construction of this right turn lane should be included in the area-wide set of circulation system improvements for the Napa Airport Industrial Area. Construction of a 200- to 250-foot right turn lane has been recommended as an improvement to be provided by the Panattoni Phase 2 development.

2. 95th Percentile Vehicle Queuing at the S.R.29/South Kelly Road Intersection

Table 6 shows that as development occurs within the Airport Industrial Park, the 95th percentile storage demand in the left turn lane on the northbound S.R.29 approach to South Kelly Road will be exceeding storage capacity during the AM peak hour, while the southbound right turn lane

will be at the storage capacity limit. This would be a significant safety issue and exacerbated if Caltrans controlled signal timing and phasing is not optimized to clear traffic from the northbound left turn lane.

Needed Improvement:
S.R.29/South Kelly Road Northbound Left Turn Lane – Lengthen the existing 250-foot turn lane to at least 400 feet (and preferably 450 feet) or to the length required based upon signal timing restrictions that may be imposed by Caltrans. In addition, the southbound right turn lane may also require lengthening based upon signal timing restrictions that may be imposed by Caltrans. Benefiting projects should pay for the cost of lengthening both lanes, when needed.

3. Jameson Canyon Road

Table 7 shows that a divided four-lane Jameson Canyon Road at the Napa/Solano County line would be operating at LOS B eastbound and LOS D westbound during the AM peak hour and at LOS D eastbound and LOS B westbound during the PM peak hour.

VII. PROJECT IMPACT SIGNIFICANCE CRITERIA

An impact is considered to be significant if any of the following conditions are met.

- If a signalized intersection with Base Case (without project) volumes in Napa County or the City of American Canyon is operating at LOS A, B, C or D and deteriorates to LOS E or F operation with the addition of project traffic, the impact is considered significant and would require mitigation.

- If the Base Case LOS at a signalized intersection in Napa County or the City of American Canyon is already at LOS E or F, an increase in traffic passing through the intersection of 1 percent or more due to the project is considered to be significant and would require mitigation.

- If traffic volume levels at a Base Case unsignalized intersection increase above Peak Hour Warrant #3 criteria levels with the addition of project traffic, the impact is considered significant and would require mitigation.

- If Base Case traffic volume levels at an unsignalized intersection already exceed peak hour signal warrant criteria levels, an increase in traffic passing through the intersection of 1 percent or more due to the project is considered significant and would require mitigation.

- If Base Case operation of the Green Island Road or Paoli Loop Road hook ramp merge to S.R.29 is operating at LOS A, B or C and deteriorates to LOS D, E or F with the addition of project traffic, the impact is considered significant and would require mitigation.

- If 95th percentile queuing in the turn lanes on the S.R.29 approaches to South Kelly Road are operating within the available storage distance and the addition of project traffic increases queuing beyond available storage, the impact is considered significant and would require mitigation.

- If Base Case volumes on Jameson Canyon Road change from LOS E to LOS F operation with the addition of project traffic, the impact is significant and would require mitigation.

- If Base Case traffic volumes on Jameson Canyon Road are already operating at LOS F conditions, an increase in traffic of 1 percent or more due to the project is considered to be significant and would require mitigation.

- If, in the opinion of the EIR registered traffic engineer, certain project-related traffic changes would substantially increase safety concerns, the impact is considered significant and would require mitigation.

- If 95th percentile Base Case queuing in the turn lanes on the S.R.29 approaches to South Kelly Road already exceed available storage, an increase in traffic of 1 percent or more in the turn lane due to the project is considered significant and would require mitigation.

VIII. PROJECT TRIP GENERATION

Table 8 shows that the proposed Headwaters 645,000-square-foot winery warehouse project would generate about 1,100 daily two-way trips (550 inbound and 550 outbound), with 65 inbound and 39 outbound trips during the AM peak hour and 32 inbound and 65 outbound trips during the PM peak hour. Trip rates are based upon recent trip generation surveys of four winery warehouse facilities at the Napa Airport Industrial Park by Crane Transportation Group. Trip rates utilized reflect peak seasonal activity at the warehouses. **Appendix A** provides results of the winery warehouse trip generation surveys.

IX. PROJECT TRIP DISTRIBUTION

Table 9 shows project trip distribution based upon existing turn movements at the S.R.29/Tower, S.R.29/South Kelly and S.R.12-29/Airport Boulevard intersections. The project traffic increment distributed to the near term horizon 2010 roadway network is presented in **Figure 11**, while the project traffic increment distributed to the long term horizon year 2030 roadway network is presented in **Figure 12**. Year 2010 Base Case + Project AM and PM peak hour traffic volumes are presented in **Figures 13** and **14**, while year 2030 Base Case + Project AM and PM peak hour traffic volumes are presented in **Figures 15** and **16**.

X. PROJECT TRAFFIC IMPACTS

A. YEAR 2010

1. Intersection Level of Service

Tables 3 and 4 show that the proposed project would not change LOS D or better Base Case operation to LOS E or F conditions at any analyzed location. AM peak hour operation at S.R.12-29/Jameson Canyon Road (S.R.12)/Airport Boulevard would remain LOS E, as would PM peak hour operation at S.R.29/South Kelly Road. At S.R.12-29/Jameson Canyon Road (S.R.12)/ Airport Boulevard, the proposed project would increase AM peak hour volumes by 0.85%, less than the 1% significance criteria level. However, at S.R.29/South Kelly Road, the proposed project would increase PM peak hour volumes by 1.9%, above the significance criteria level.

The project would slightly increase traffic at the S.R.29/Napa Junction Road intersection in American Canyon, which would be operating at LOS E during the AM peak hour. The project would be expected to add 41 vehicles to this location during this period. Project traffic would increase average control delay by about 2.6 seconds and the overall intersection volume level by 0.8 percent, which would be less than the impact criteria level.

There would be a significant impact at the S.R.29/South Kelly Road intersection.

2. Merge Operation at S.R.29/Green Island Road & S.R.29/Paoli Loop Road Ramps

Table 5 shows that the Green Island Road and Paoli Loop Road hook ramp merges to S.R.29 would remain with LOS D or better AM and PM peak hour operation after the addition of project traffic.

This would be a less than significant impact.

3. 95th Percentile Queuing in the S.R.29 Turn Lanes Approaching South Kelly Road

Table 6 shows the right turn lane on the S.R.29 southbound approach to South Kelly Road would have theoretical 95th percentile AM and PM peak hour queues remaining less than the available storage length with the addition of project traffic. The 95th percentile queue in the left turn lane on the S.R.29 northbound approach to South Kelly Road, while remaining less than available storage during the PM peak hour, would, however, be increased slightly beyond available storage during the AM peak traffic hour (increasing from 200 up to 256 feet with a 250-foot storage length).

This would be a significant impact.

4. Jameson Canyon Road Operation

AM Peak Hour

Table 7 shows that project traffic would increase volumes less than 1% (0.9%) along the two-lane section of Jameson Canyon Road, which would be experiencing Base Case LOS F operation.

This would be a less than significant impact.

PM Peak Hour

Table 7 shows that project traffic would increase volumes by less than 1% (0.8%) along the two-lane section of Jameson Canyon Road, which would be experiencing Base Case LOS F operation.

This would be a less than significant impact.

B. YEAR 2030

1. Intersection Level of Service

Tables 3 and **4** show that the proposed project would not change LOS D or better Base Case operation to LOS E or F conditions at any analyzed location, with the exception of the S.R.29/Green Island Road/Newell Road signalized intersection, where the project would change PM peak hour operation from LOS D to LOS E. The S.R.29/South Kelly Road intersection would be operating at LOS C during the AM peak hour and LOS D during the PM peak hour. (This result includes the planned third travel lanes in each direction on S.R.29 through the intersection by 2030.)

There would be a significant impact at the S.R.29/Green Island Road/Newell Road intersection.

It should be noted, however, that the S.R.29/South Kelly Road intersection may experience LOS E or F PM peak hour operation sometime after 2010 before S.R.29 has been widened to six lanes through the intersection. The proposed project would increase year 2030 PM peak hour volumes by 0.6 percent at this location, which ***would be considered a less than significant impact.***

2. 95th Percentile Queuing in the S.R.29 Turn Lanes Approaching South Kelly Road

Table 6 shows that the addition of project traffic would further increase 95th percentile AM peak hour vehicle queuing beyond available storage in the left turn lane on the northbound S.R.29 approach to South Kelly Road (from 265 up to a 95th percentile queue of 275 feet with only 250

feet of storage). Project traffic would increase volumes in the northbound left turn lane from 199 up to 206 vehicles, or by more than one percent (3.5%).

This would be a significant impact.

3. Jameson Canyon Road Operation

AM Peak Hour

Base Case + Project operation along a four-lane Jameson Canyon Road would be LOS B eastbound and LOS D westbound.

This would be a less than significant impact.

PM Peak Hour

Base Case + Project operation along a four-lane Jameson Canyon Road would be LOS D eastbound and LOS B westbound.

This would be a less than significant impact.

C. PROJECT ACCESS

Napa County staff has not requested evaluation of project access along the future southerly extension of Devlin Road as part of this study. All near term horizon inbound access would be right turns, while all exiting movements would be left turns.

XI. RECOMMENDED PROJECT MITIGATIONS

A. YEAR 2010

1. S.R.29/South Kelly Road

a. The Headwaters project should provide a fair share contribution towards improvements recommended for South Kelly Road as part of the Panattoni Phases 1 & 2 developments. This includes construction of a fourth lane on the eastbound approach to S.R.29 when needed between 2010 and 2030. In addition, the Headwaters project should provide a second left turn lane on the westbound South Kelly Road intersection approach.

Resultant Operation:
AM Peak Hour: LOS C-30.5 seconds control delay
PM Peak Hour: LOS D-48.7 seconds control delay

b. The Headwaters project should provide a fair share contribution to lengthening of the left turn lane on the northbound S.R.29 approach to South Kelly Road (from 250 feet up to at least 450 feet).

B. YEAR 2030

1. S.R.29/Green Island Road/Newell Road

a. The Headwaters project should provide a right turn lane on the northbound S.R.29 approach to the Green Island Road/Newell Road intersection. Although project traffic would not use this particular lane, this would be the lowest cost alternative to improve operating conditions back to LOS D operation.

Resultant Base Case + Project 2030 Operation:
PM Peak Hour: LOS D – 53.7 seconds control delay

2. S.R.29/South Kelly Road

b. The Headwaters project should provide a fair share contribution to lengthening of the left turn lane on the northbound S.R.29 approach to South Kelly Road (from 250 feet up to at least 450 feet). In addition, the project should lengthen the right turn on the southbound S.R.29 approach to South Kelly Road from 50 up to at least 100 feet.

XII. COMPARISON OF HEADWATERS IMPACTS & MITIGATIONS TO THOSE OF THE BERINGER WINE ESTATES DEVLIN ROAD PROJECT IN 1999

A 1,424,400-square-foot warehousing, bottling, fermenting, shipping and receiving facility for Beringer Wine Estates (BWE) was approved for the project site in the year 1999. Weekday AM and PM peak hour circulation impacts were determined for the years 2005 and 2015. The following impacts were determined to be significant.

A. YEAR 2005

IMPACT 1: The length of the left turn lane on the northbound S.R.29 approach to South Kelly Road will not be long enough to accommodate the expected vehicle queuing.

MITIGATION 1: Lengthen the turn lane from 250 up to 375 feet.

IMPACT 2: Project traffic on the westbound South Kelly Road approach to Devlin Road will negatively impact backups being caused by traffic waiting to enter the waste transfer facility on the west side of Devlin Road.

MITIGATION 2: The waste transfer station should improve internal operations to eliminate backups on South Kelly Road. If not provided, BWE should provide a left turn lane on the westbound South Kelly Road approach to Devlin Road extending back to S.R.29.

*Note: **The waste transfer station has eliminated backups and this is no longer an issue.***

B. YEAR 2015

IMPACT 3: The length of the left turn lane on the northbound S.R.29 approach to South Kelly Road will not be long enough to accommodate the expected vehicle queuing.

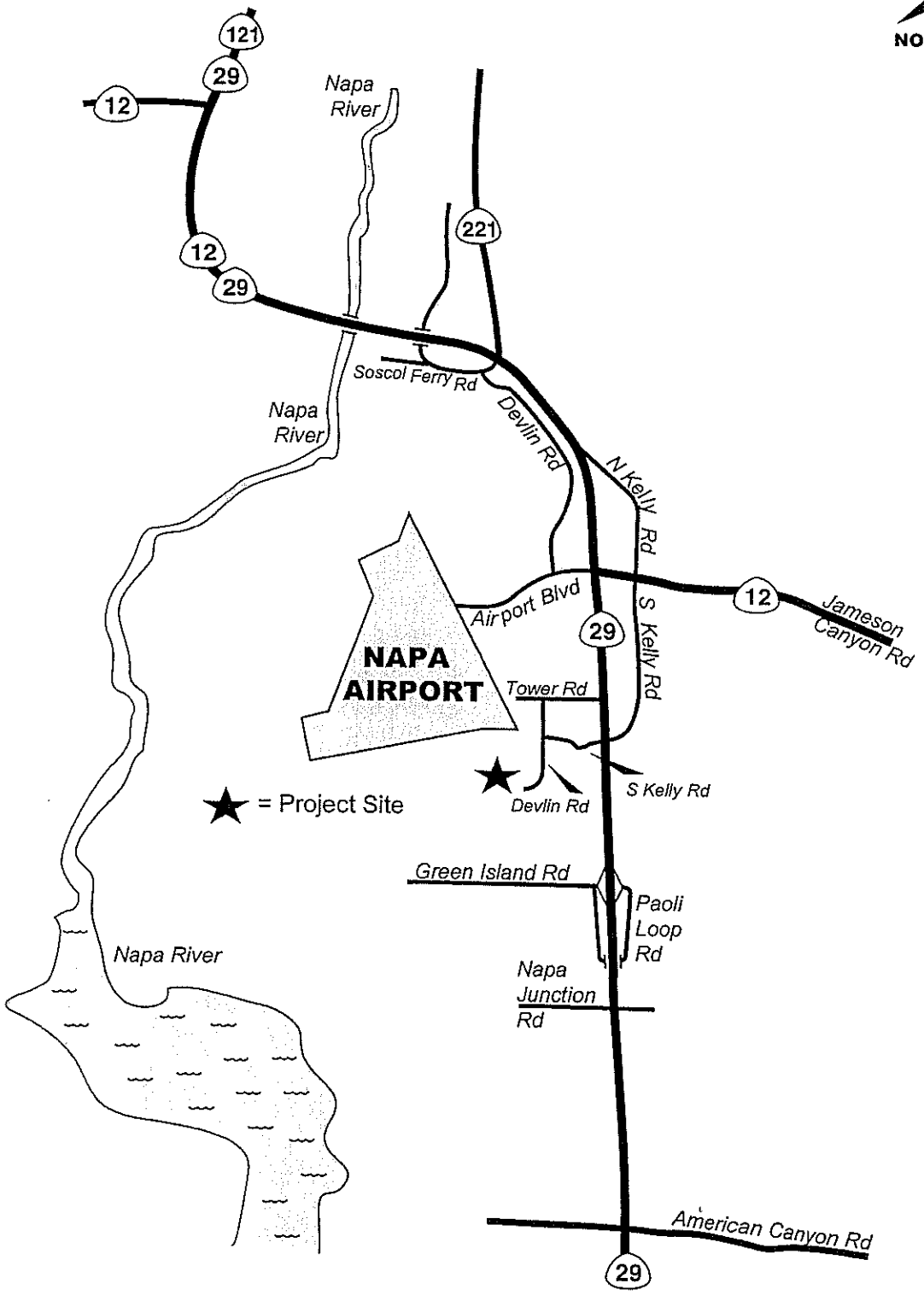
MITIGATION 3: Lengthen the turn lane from 250 up to 375 feet.

IMPACT 4: Project traffic on the westbound South Kelly Road approach to Devlin Road will negatively impact backups being caused by traffic waiting to enter the waste transfer facility on the west side of Devlin Road.

MITIGATION 4: The waste transfer station should improve internal operations to eliminate backups on South Kelly Road. If not provided, BWE should provide a left turn lane on the westbound South Kelly Road approach to Devlin Road extending back to S.R.29.

Impacts 1 and 3 for BWE in 2005 and 2015 are the same as those expected for the proposed Headwaters development in 2010 and 2030. Impacts 2 and 4 for BWE are no longer an issue for Headwaters as the waste transfer station has eliminated backups on the westbound South Kelly Road approach to Devlin Road.

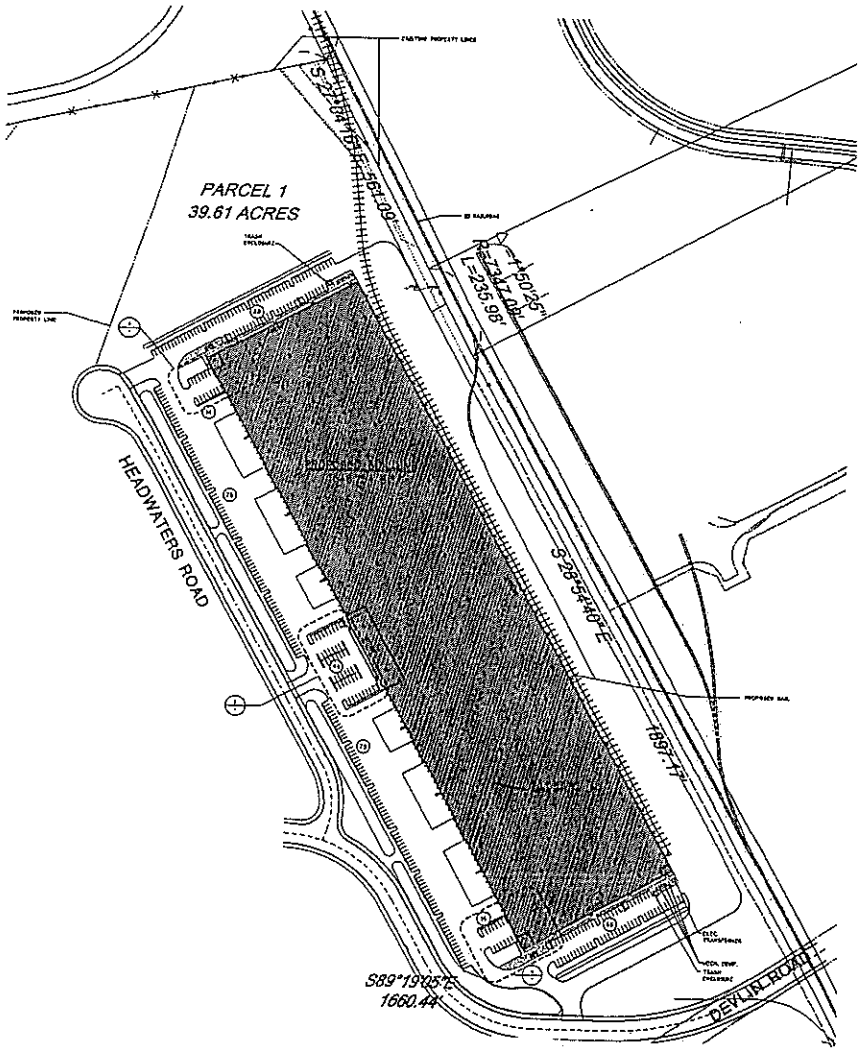
Figures



Napa Headwaters Traffic Study

CRANE TRANSPORTATION GROUP

Figure 1
Area Map



Napa Headwaters Traffic Study

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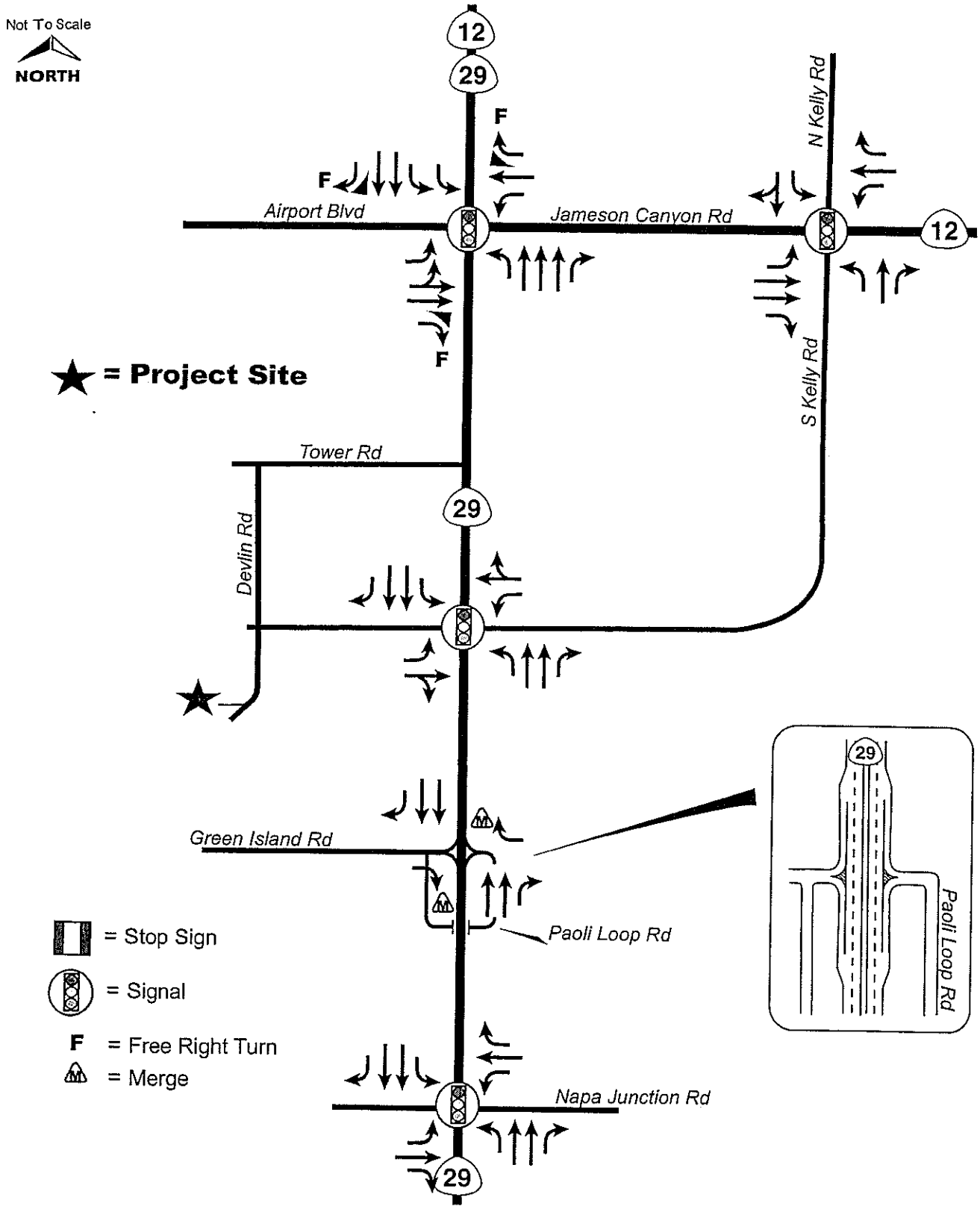
Figure 2
Site Plan



Napa Headwaters Traffic Study

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Figure 3

Existing and Year 2010
Intersection Lane Geometrics and Control

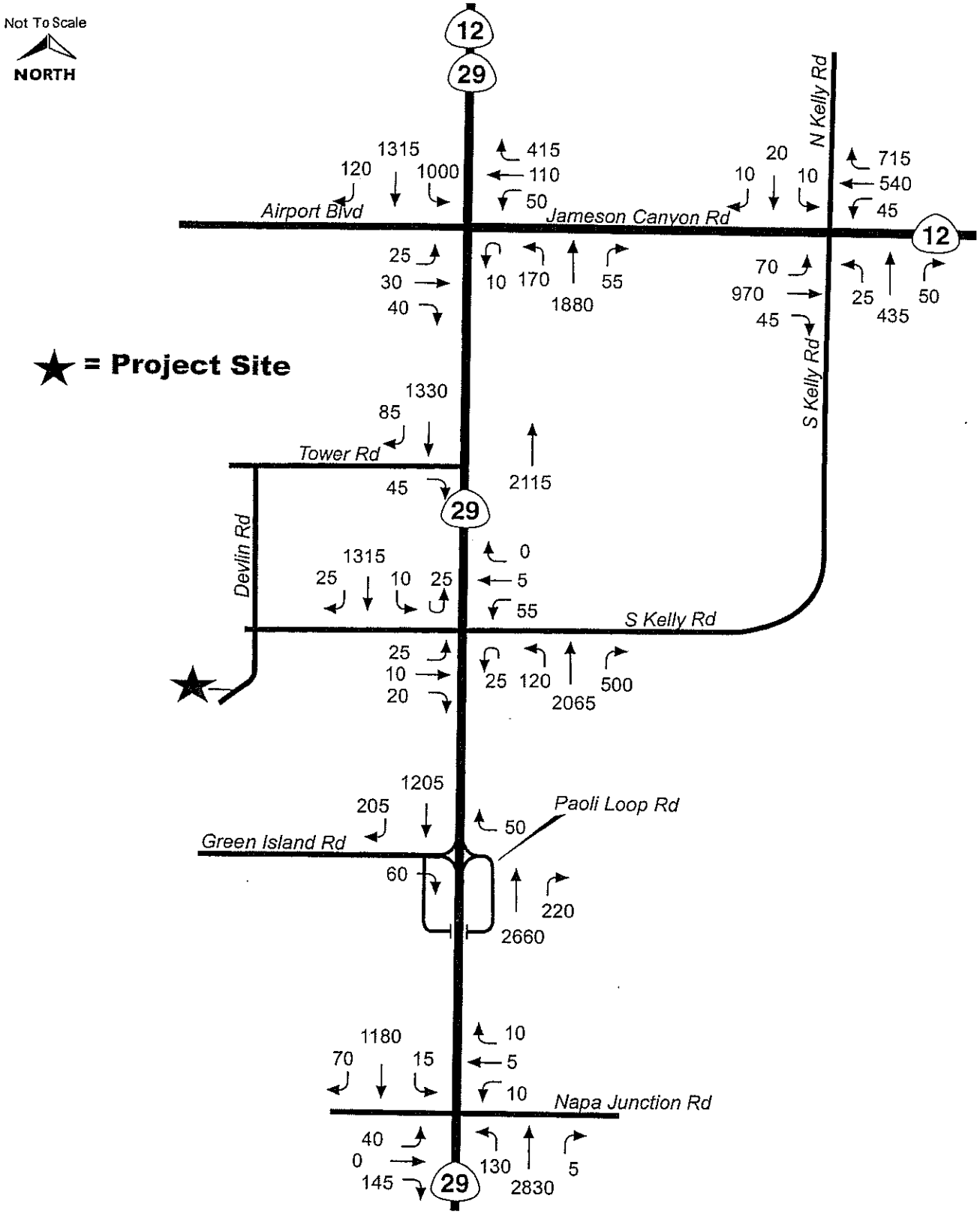

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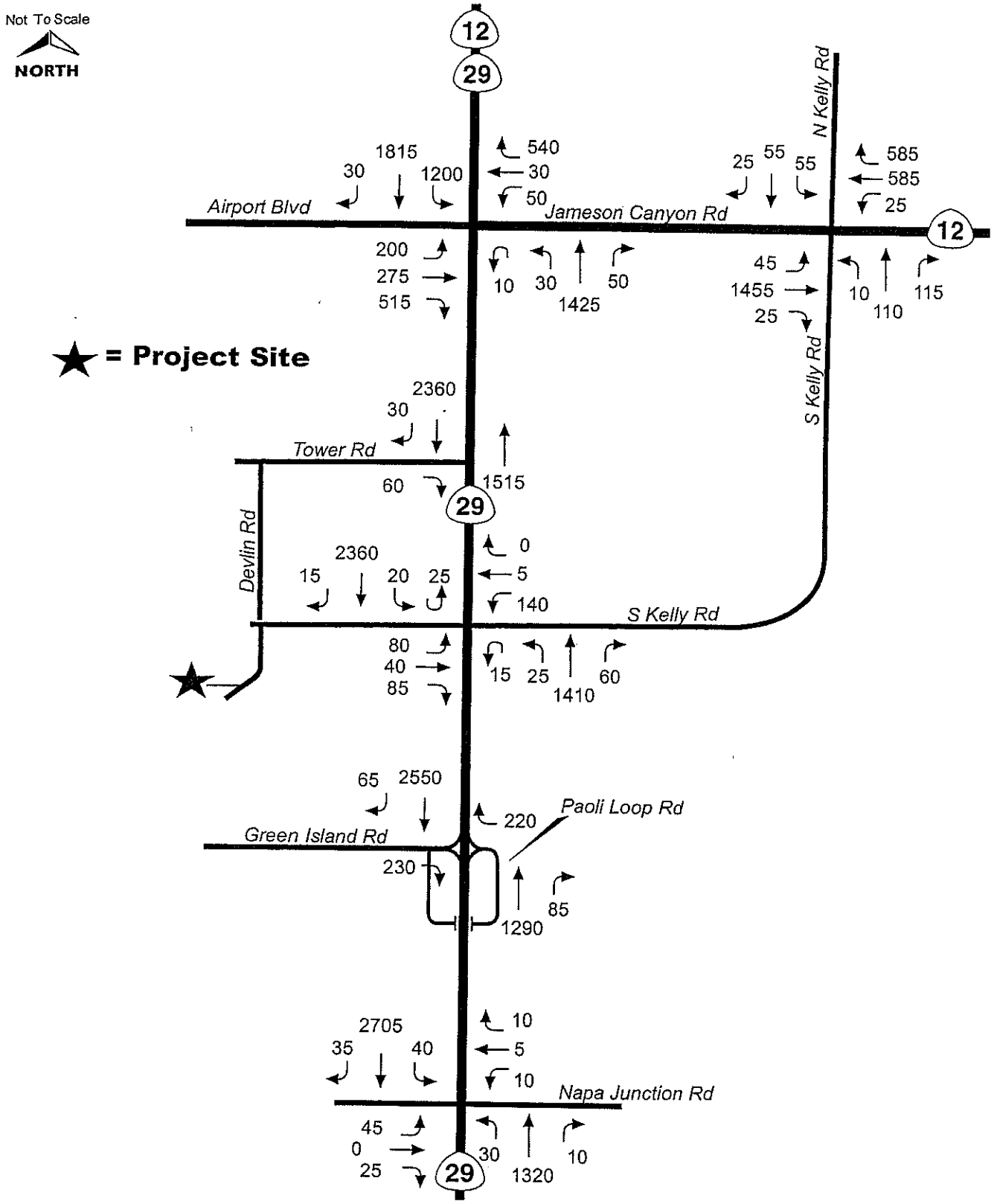
Figure 4
Existing (Year 2007)
AM Peak Hour Volumes



Napa Headwaters Traffic Study

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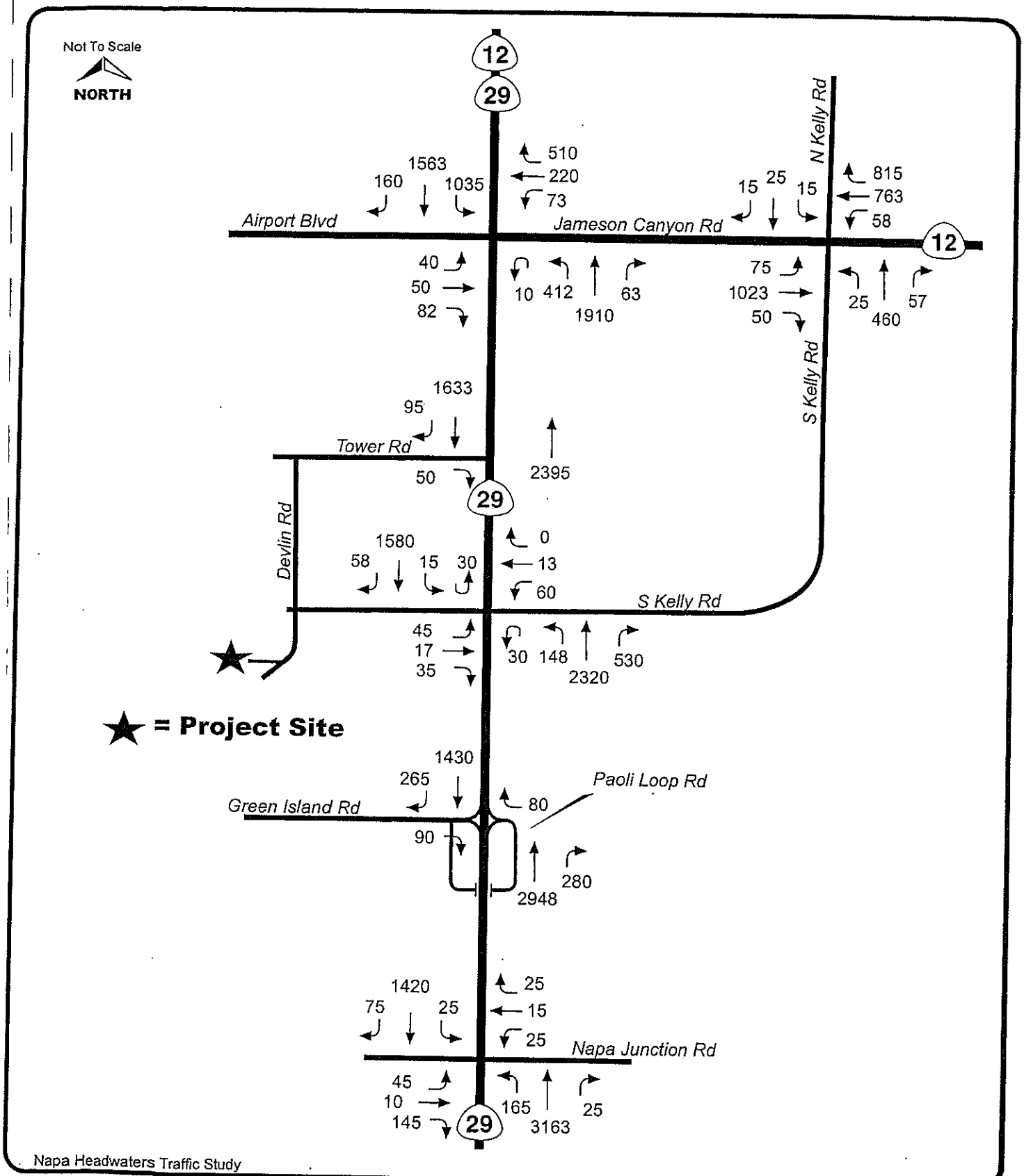
Figure 5
Existing (Year 2007)
PM Peak Hour Volumes



Napa Headwaters Traffic Study

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Figure 6
Near Term (Year 2010) Base Case
AM Peak Hour Volumes

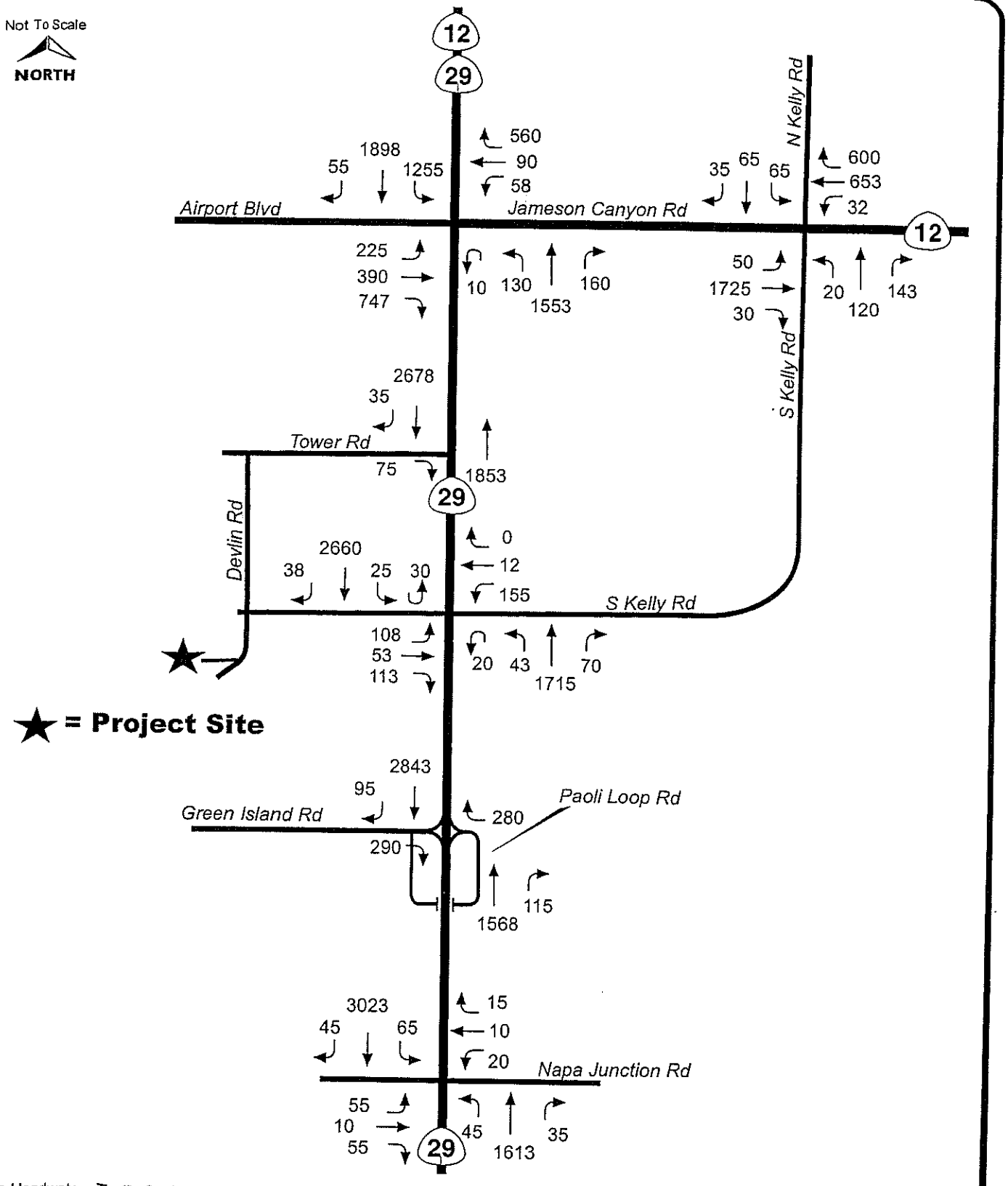

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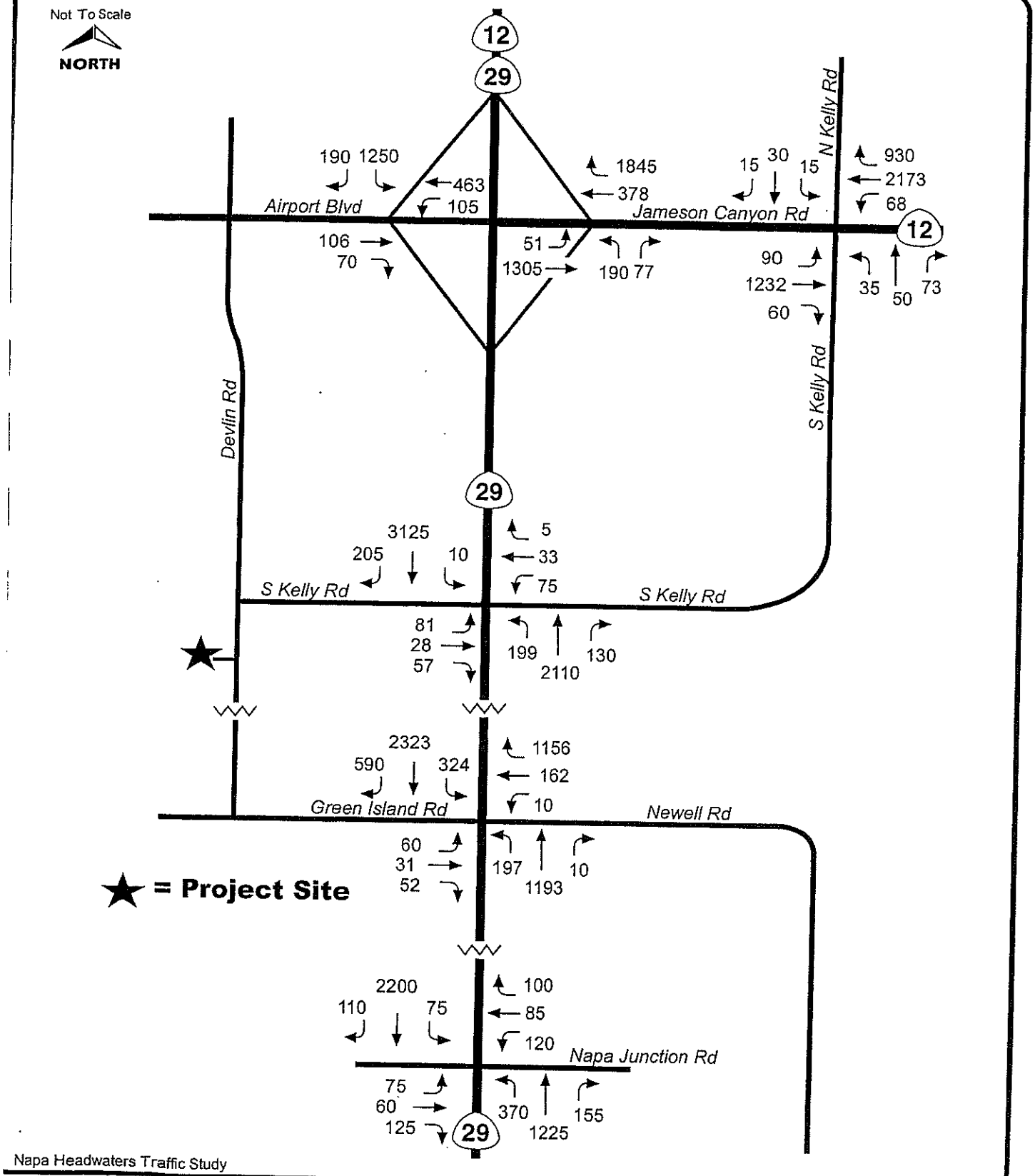
Figure 7
Near Term (Year 2010) Base Case
PM Peak Hour Volumes



Napa Headwaters Traffic Study

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Figure 8
Year 2030 Base Case
AM Peak Hour Volumes

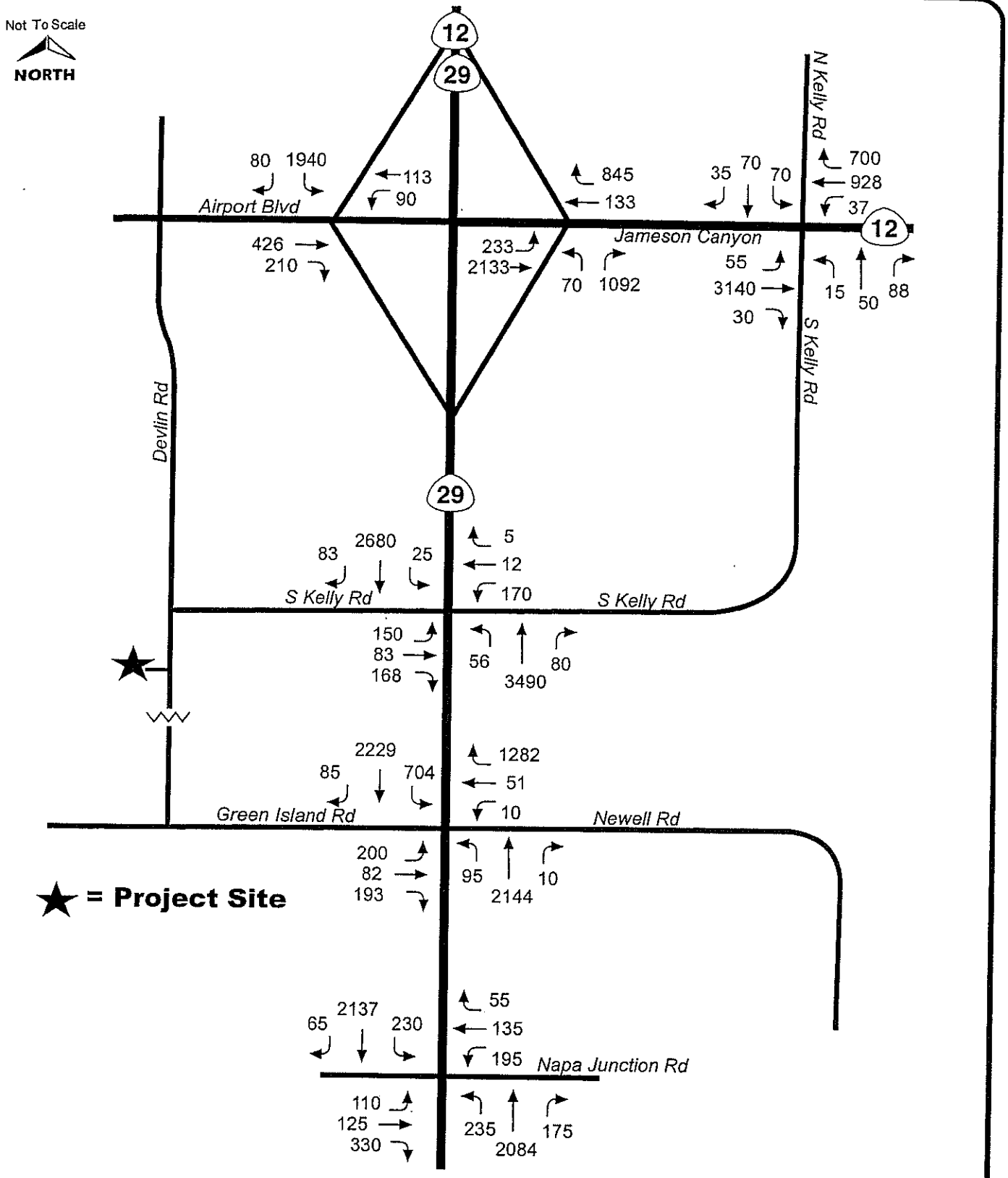

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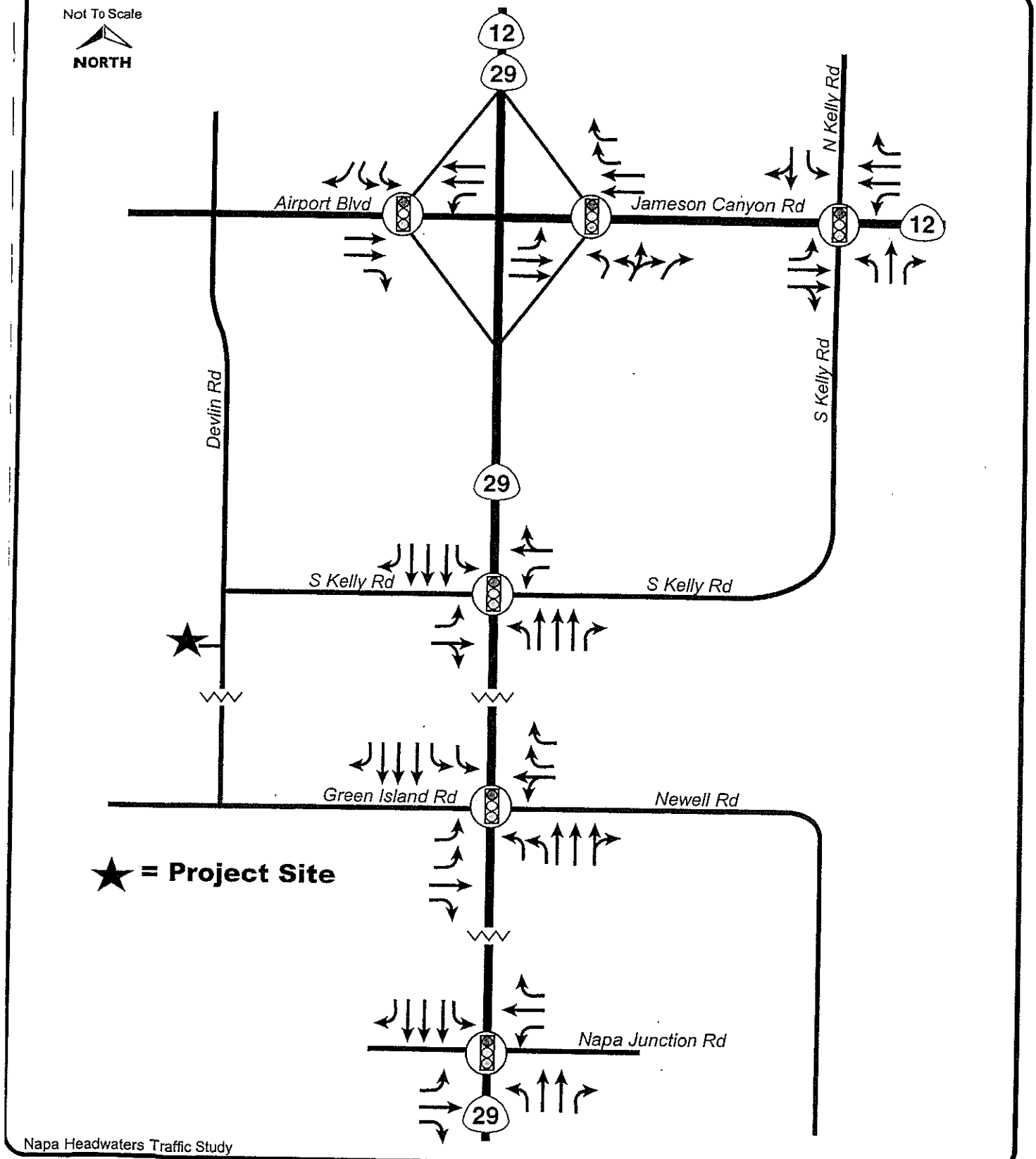
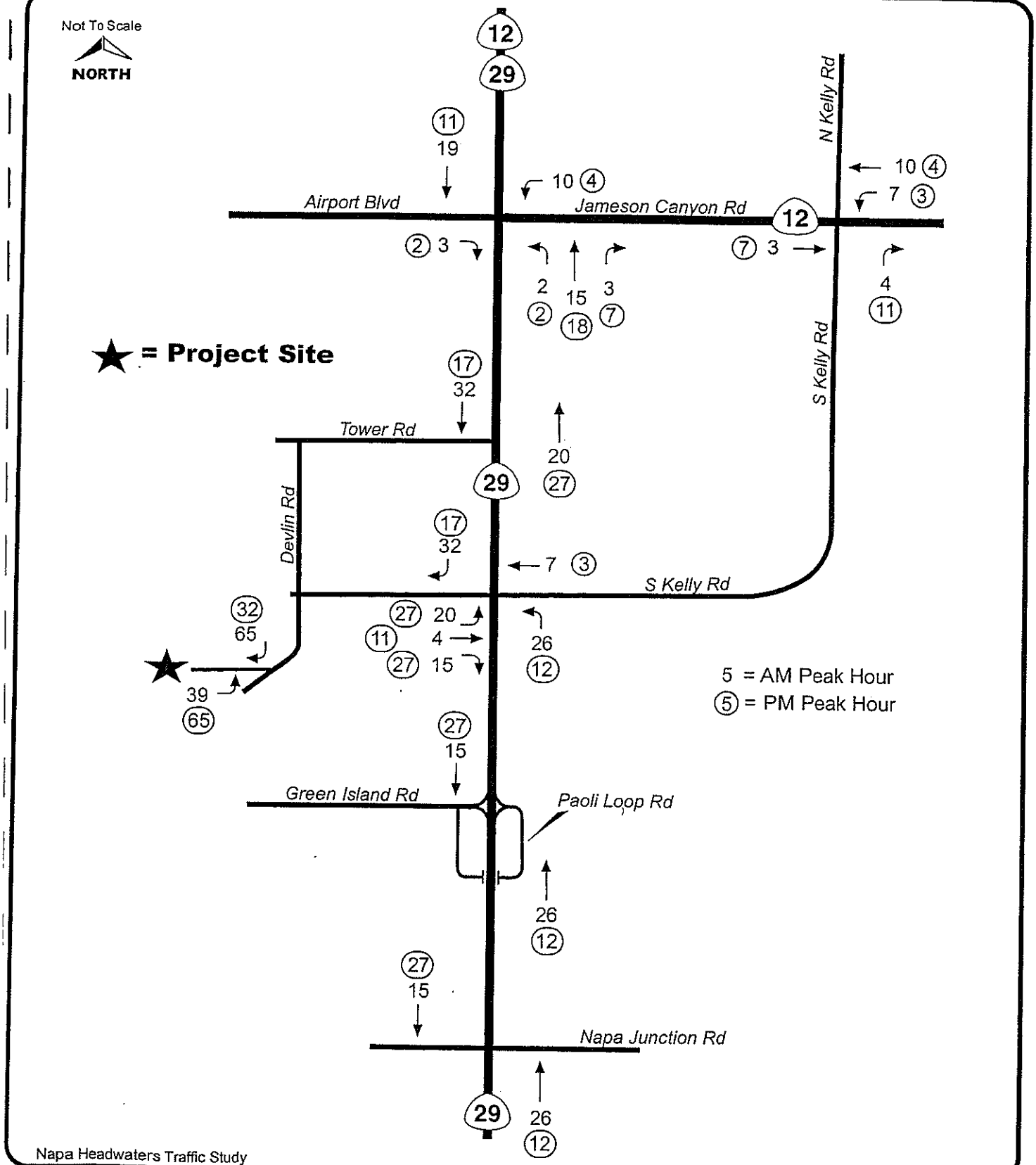
Figure 9
Year 2030 Base Case
PM Peak Hour Volumes



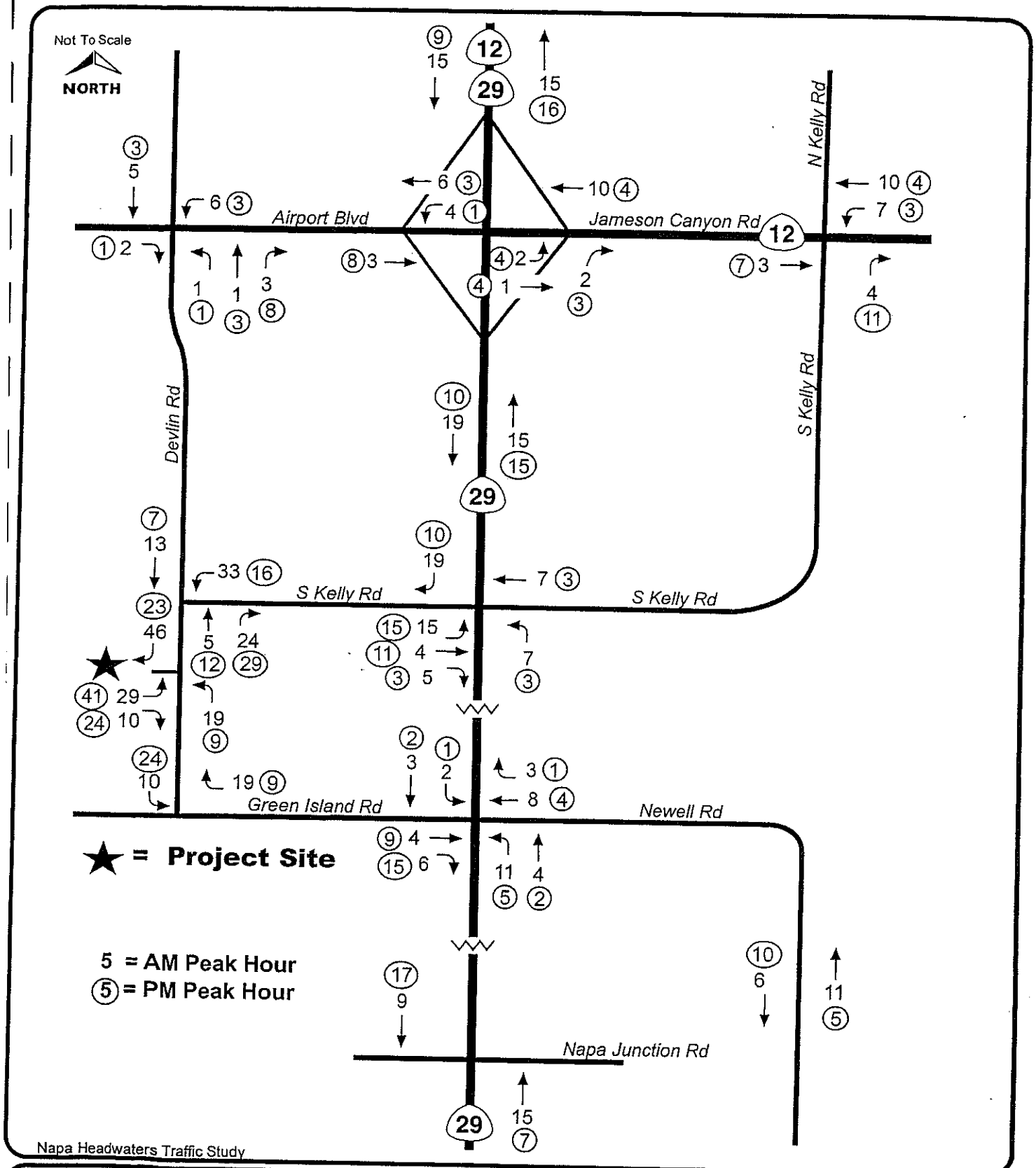
CRANE TRANSPORTATION GROUP

Figure 10
Year 2030 Intersection
Lane Geometrics and Control



CRANE TRANSPORTATION GROUP

Figure 11
Year 2010 AM and PM Peak Hour
Project Traffic Increment



Napa Headwaters Traffic Study

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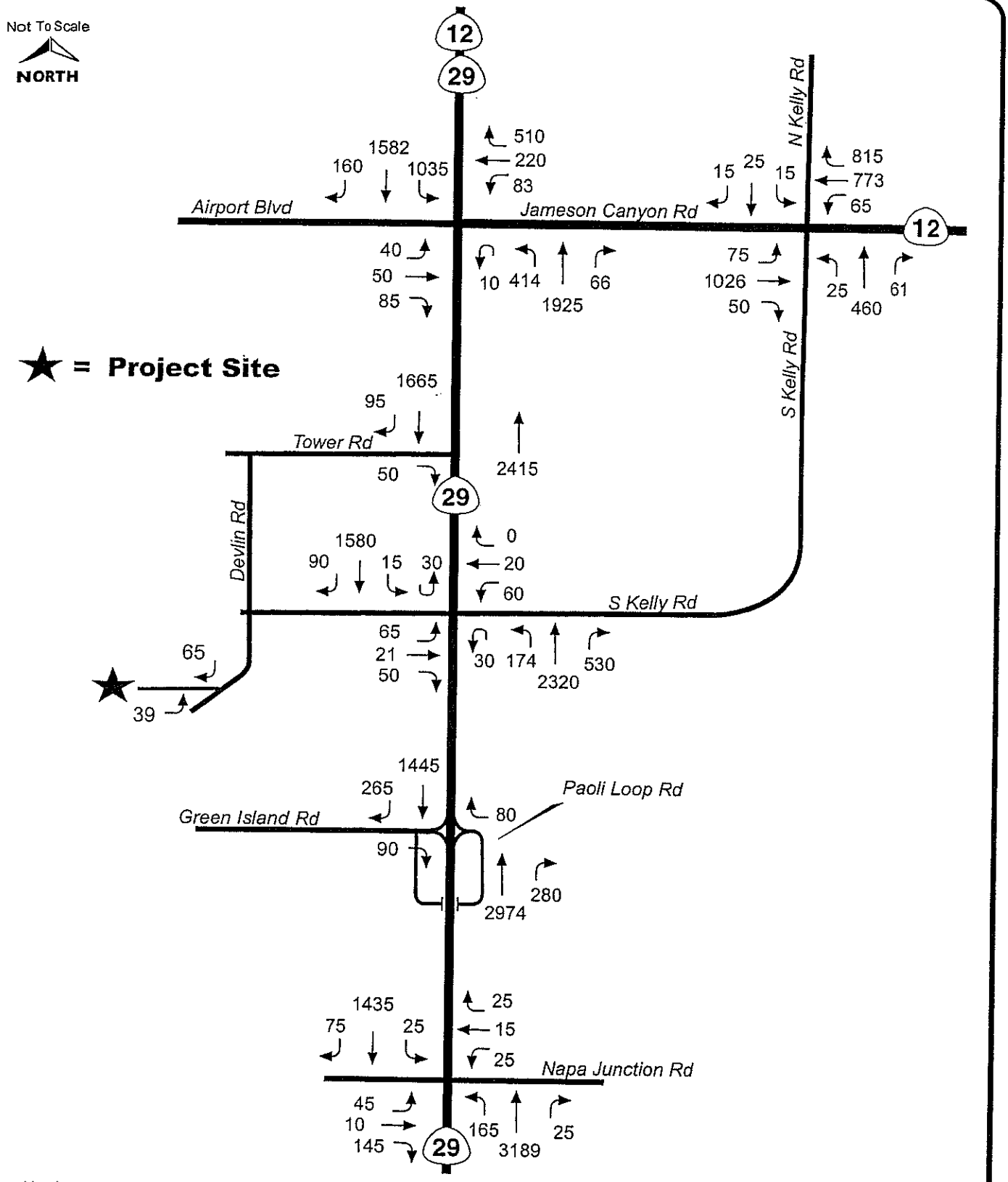
Figure 12

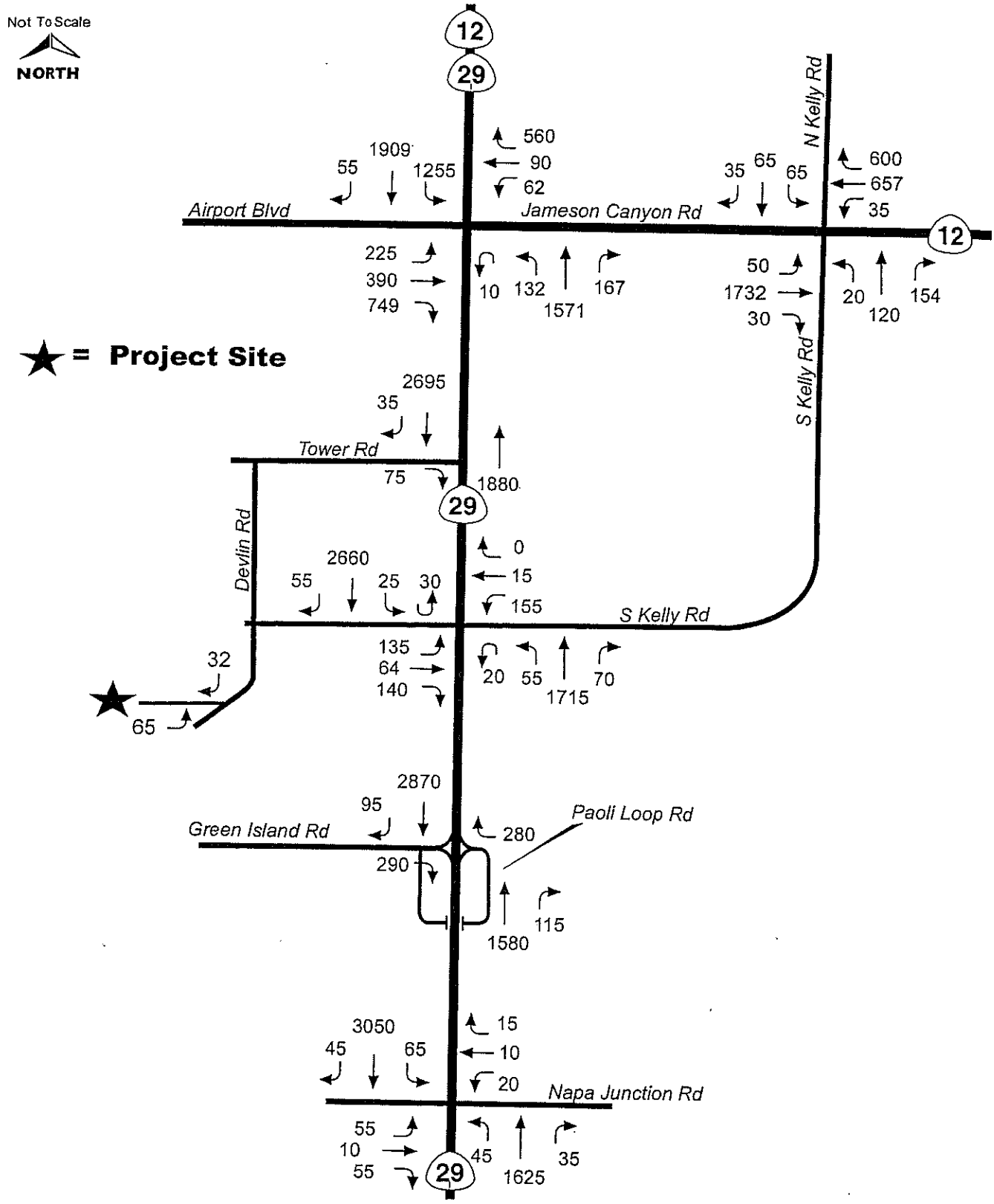
Year 2030 AM and PM Peak Hour Project Traffic Increment



Napa Headwaters Traffic Study

CRANE TRANSPORTATION GROUP

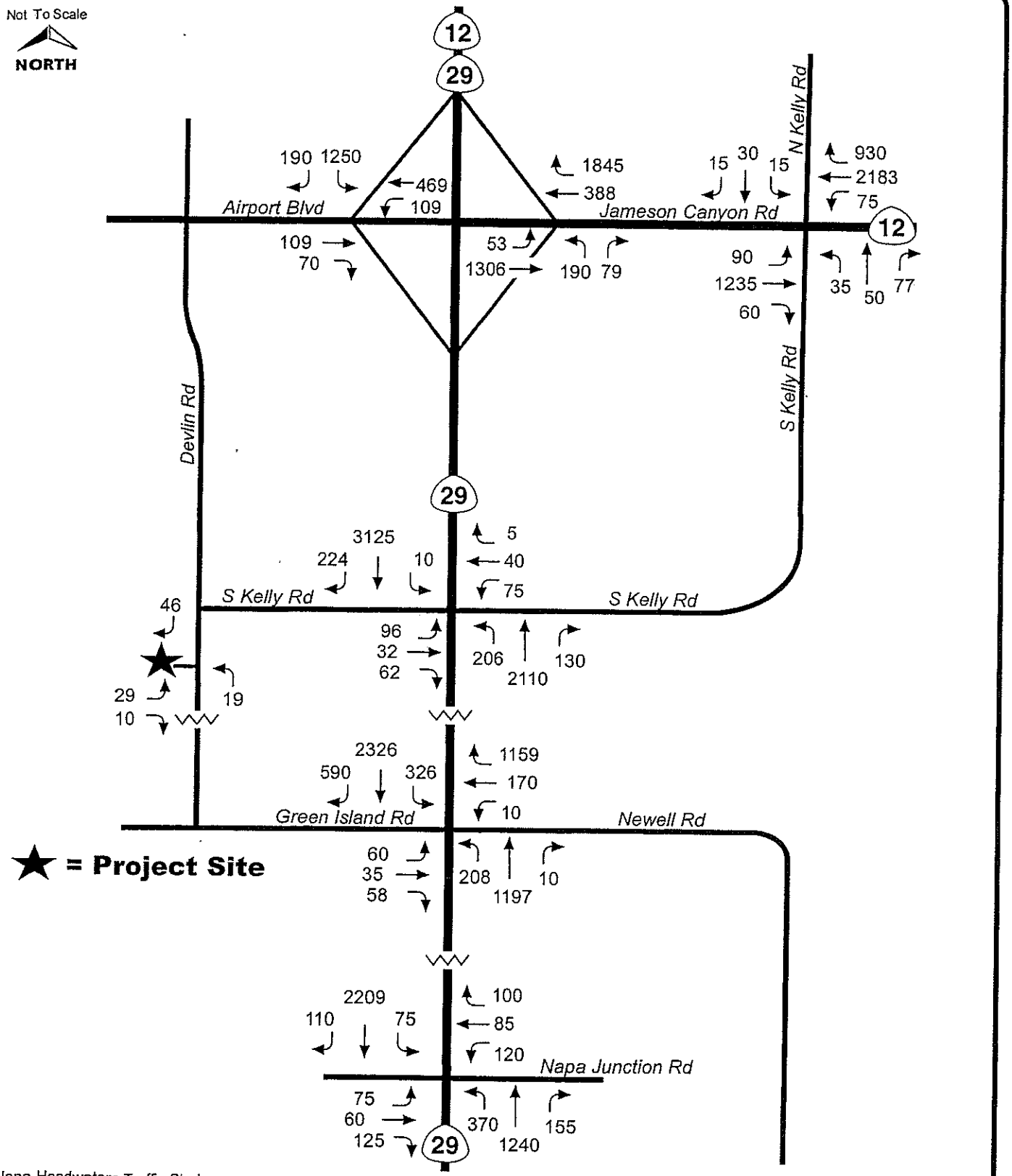
Figure 13
Near Term (Year 2010) Base Case + Project
AM Peak Hour Volumes



Napa Headwaters Traffic Study

CRANE TRANSPORTATION GROUP

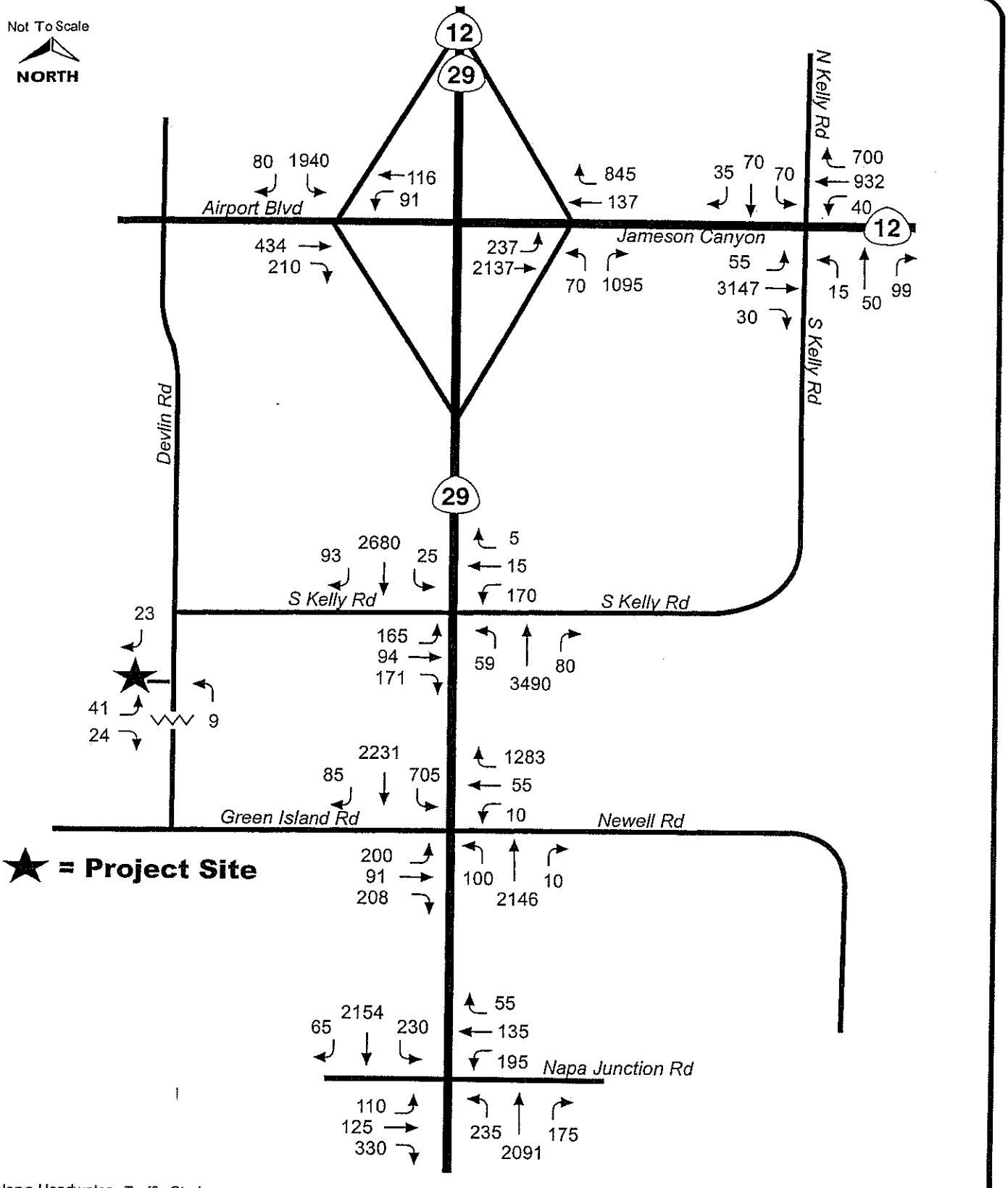
Figure 14
Near Term (Year 2010) Base Case + Project
PM Peak Hour Volumes



Napa Headwaters Traffic Study

CRANE TRANSPORTATION GROUP

Figure 15
Year 2030 Base Case + Project
AM Peak Hour Volumes



Napa Headwaters Traffic Study

CRANE TRANSPORTATION GROUP

Figure 16
Year 2030 Base Case + Project
PM Peak Hour 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: 2000 Highway Capacity Manual (Transportation Research Board, 2000).

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: 2000 Highway Capacity Manual (Transportation Research Board, 2000).

Table 3

INTERSECTION LEVEL OF SERVICE
AM PEAK HOUR

LOCATION	EXISTING	YEAR 2010		YEAR 2030	
		BASE CASE	BASE CASE + PROJECT	BASE CASE	BASE CASE + PROJECT
S.R.29/Jameson Canyon Rd.(S.R.12)/Airport Blvd. (Signal)	C-33.3[1]	E-62.3	E-63.9		
Jameson Canyon Rd. (S.R.12)/North Kelly Rd./South Kelly Rd. (Signal)	C-30.2[1]	D-43.3	D-43.3	C-27.6	C-28.9
S.R.29/South Kelly Rd. (Signal)	B-17.4[1]	C-30.2	C-31.1	C-27.6	C-33.0
S.R.29/Napa Junction Rd. (Signal)	C-30.7[1]	E-68.2[1]	E-70.8	C-30.1	C-30.1
YEAR 2030					
Diamond Interchange at S.R.12-29/Jameson Canyon Rd.					
Airport Blvd./S.R.12-29 Southbound On-Off Ramps (Signal)				B-13.6[1]	B-14.2
Jameson Canyon Rd (S.R.12)/S.R.12-29 Northbound On-Off Ramps (Signal)				D-47.4[1]	D-47.4
S.R.29/Green Island Rd./Newell Rd. (Signal)				C-23.3[1]	C-24.0

(1) Signalized level of service – average control delay in seconds.
(2) Side Street Stop Sign controlled level of service – average delay in seconds – eastbound approach/westbound approach.

Year 2000 Highway Capacity Manual Analysis Methodology.
Source: Crane Transportation Group

Table 4

INTERSECTION LEVEL OF SERVICE
PM PEAK HOUR

LOCATION	EXISTING	YEAR 2010		YEAR 2030	
		BASE CASE	BASE CASE + PROJECT	BASE CASE	BASE CASE + PROJECT
S.R.29/Jameson Canyon Rd.(S.R.12)/Airport Blvd. (Signal)	D-31.8[1]	D-47.4	D-50.6		
Jameson Canyon Rd. (S.R.12)/North Kelly Rd./South Kelly Rd. (Signal)	B-16.6[1]	B-19.3	B-19.3	B-18.9	B-19.5
S.R.29/South Kelly Rd. (Signal)	D-38.3[1]	E-69.7	E-71.4	D-41.7	D-45.2
S.R.29/Napa Junction Rd. (Signal)	C-25.5[1]	D-47.2[1]	D-48.4	D-50.7	D-51.0
YEAR 2030					
Diamond Interchange at S.R.12-29/Jameson Canyon Rd.					
Airport Blvd./S.R.12-29 Southbound On-Off Ramps (Signal)				C-22.6[1]	C-22.9
Jameson Canyon Rd (S.R.12)/S.R.12-29 Northbound On-Off Ramps (Signal)				D-35.8[1]	D-35.8
S.R.29/Green Island Rd./Newell Rd. (Signal)				D-54.9[1]	E-55.2

(1) Signalized level of service – average control delay in seconds.
(2) Side Street Stop Sign controlled level of service – average delay in seconds – eastbound approach/westbound approach.

Year 2000 Highway Capacity Manual Analysis Methodology
Source: Crane Transportation Group

Table 5

MERGE ANALYSIS
S.R.29/GREEN ISLAND ROAD & S.R.29/PAOLI LOOP ROAD HOOK RAMPS

AM PEAK HOUR

LOCATION	EXISTING			YEAR 2010					
				BASE CASE			BASE CASE + PROJECT		
	LOS[1]	DENSITY[2]	SPEED	LOS	DENSITY	SPEED	LOS	DENSITY	SPEED
Paoli Loop Road to NB S.R.29	C	24.1	57	C	26.8	56	C	27.0	56
Green Island Rd. to SB S.R.29	B	12.0	58	B	14.1	58	B	14.2	58

PM PEAK HOUR

LOCATION	EXISTING			YEAR 2010					
				BASE CASE			BASE CASE + PROJECT		
	LOS	DENSITY	SPEED	LOS	DENSITY	SPEED	LOS	DENSITY	SPEED
Paoli Loop Road to NB S.R.29	B	14.0	58	B	15.2	58	B	15.9	58
Green Island Rd. to SB S.R.29	C	24.7	57	C	27.6	56	C	27.8	56

(1) LOS = Level of Service
(2) Density in passenger cars/lane/mile

Year 2000 Highway Capacity Manual Analysis Methodology.
Compiled by: Crane Transportation Group

Table 6

TURN LANE 95TH PERCENTILE QUEUE LENGTHS ON THE S.R.29 APPROACHES TO SOUTH KELLY ROAD

AM PEAK HOUR

	EXISTING	YEAR 2010		YEAR 2030	
		BASE CASE	BASE CASE + PROJECT	BASE CASE	BASE CASE + PROJECT
Northbound S.R.29 Left Turn Lane					
Storage	250'	250'	250'	250'	250'
Demand	136	200	256	265	275
Southbound S.R. Right Turn Lane					
Storage	50'	50'	50'	50'	50'
Demand	13	24	37	51	54

PM PEAK HOUR

	EXISTING	YEAR 2010		YEAR 2030	
		BASE CASE	BASE CASE + PROJECT	BASE CASE	BASE CASE + PROJECT
Northbound S.R.29 Left Turn Lane					
Storage	250'	250'	250'	250'	250'
Demand	82	183	217	93	131
Southbound S.R. Right Turn Lane					
Storage	50'	50'	50'	50'	50'
Demand	8	18	24	33	38

Source: Crane Transportation Group

Table 7

JAMESON CANYON ROAD (S.R.12) LEVEL OF SERVICE (AT THE NAPA/SOLANO COUNTY LINE)

CONDITION	LEVEL OF SERVICE	
	AM PEAK HOUR	PM PEAK HOUR
Existing (2-Lane, 2-Way Operation)	E	F
Year 2010 (2-Lane, 2-Way Operation)		
Base Case	F	F
Base Case + Project	F	F
Year 2030 (4-Lane Directional Operation)		
Base Case (Eastbound)	B	D
Base Case (Westbound)	D	B
Base Case + Project (Eastbound)	B	D
Base Case + Project (Westbound)	D	B

Year 2000 Highway Capacity Manual Analysis Methodology
Compiled by: Crane Transportation Group

Table 8

HEADWATERS PROJECT TRIP GENERATION

USE	SIZE (SQ.FT.)	DAILY 2-WAY TRIPS (INBD + OUTBD)		AM PEAK HOUR				PM PEAK HOUR			
				INBOUND		OUTBOUND		INBOUND		OUTBOUND	
		RATE	VOL	RATE	VOL	RATE	VOL	RATE	VOL	RATE	VOL
Winery Warehouse	645,000	1.70	1098	.10	65	.06	39	.05	32	.10	65

Trip Rate Source: Crane Transportation Group, surveys at four winery warehouses in the Napa Airport Industrial Park, July 2007, factored to reflect peak season of warehouse trucking activity.
Compiled by: Crane Transportation Group

Table 9

PROJECT TRAFFIC DISTRIBUTION

	AM PEAK HOUR		PM PEAK HOUR	
	IN	OUT	IN	OUT
S.R.29 South of South Kelly Road	40%	35%	35%	40%
S.R.29 North of Jameson Canyon Road	35%	45%	45%	30%
Jameson Canyon Road East of North Kelly Road/South Kelly Road	25%	20%	20%	30%
TOTAL	100%	100%	100%	100%

Source: Crane Transportation Group

Appendix

Appendix A

February 11, 2008

Mr. Douglas Pope
Napa Industrial, LLC
c/o Headwaters Development Co., LLC
50 Fullerton Court, Suite 203
Sacramento, CA 95825

RE: DETERMINATION OF AM & PM PEAK HOUR TRIP RATES FOR WINERY WAREHOUSES IN THE NAPA INDUSTRIAL PARK – HEADWATERS

Dear Doug:

At your request, Crane Transportation Group has conducted a study to determine the AM and PM peak hour trip generation rates that would be reflective of expected peak traffic activity at new high-cube winery warehouse buildings in the Napa Airport Industrial Park. This data may be incorporated into the traffic study for your proposed Napa Airport Industrial Park Headwaters Development, which will be located along the west side of Devlin Road when it is extended to the south of South Kelly Road. Work tasks have included weekday AM and PM peak period surveys at four existing winery warehouses and determination of average trip rates for the proposed warehouses reflective of maximum AM and PM peak hour traffic activity. A projection has then been made of the expected traffic activity resulting from 650,000 square feet of winery warehouse activity at your Headwaters project in Napa.

I. RESULTS OF SURVEYS OF EXISTING WEEKDAY AM AND PM PEAK HOUR TRAFFIC AT FOUR COMPARABLE WINERY WAREHOUSE FACILITIES

Weekday AM peak period (7:00-900) and PM peak period (4:00-6:00) traffic counts were conducted by Crane Transportation Group in June or July 2007 at four winery warehouse facilities acceptable to the County: Cal Wine Transport, 660 Airpark Boulevard (Napa County); Biagi Brothers, 787 Airpark Boulevard (Napa County); Biagi Brothers, 770 Skyway (Napa County); and Biagi Brotheres., 50/80 Technology Court (Napa County). Traffic count resutls, by hour, are presented in **Table 1. Table 2** presents the resultant mid summer AM and PM peak hour raw trip rates for each of the surveyed winery warehouses, while **Table 3** presents the resultant seasonally adjusted trip rates reflecting peak (pre-Christmas) trip activity at the winery warehouses with 100 percent building occupancy.

Table 3 shows that the pre-Christmas AM peak hour (inbound + outbound) winery warehouse trip rate would be .16 trips/1,000 square feet, while the pre-Christmas PM peak hour (inbound + outbound) trip rate would be .15 trips/1,000 square feet.

Table 4 presents the expected daily, AM peak hour and PM peak hour trip generation of your proposed 650,000-square-foot development should all activities be winery warehouse uses. As shown, your project would generate 65 inbound and 39 outbound trips during the AM commute peak hour, with 33 inbound and 65 outbound trips generated during the PM commute peak hour. Trip generation may be somewhat less during this period with any significant replacement of truck activity by rail service.

We thank you for the opportunity to conduct this study and stand ready to assist in responding to any questions from County staff regarding our survey findings.

Sincerely,

Mark D. Crane, P.E.
Principal

Appendix A Table 1

SURVEY RESULTS OF EXISTING AM & PM PEAK PERIOD TRAFFIC ACTIVITY AT 4 WINERY WAREHOUSES IN THE NAPA INDUSTRIAL PARK JUNE/JULY 2007

WAREHOUSE FACILITY	AM PEAK HOUR						PM PEAK HOUR					
	INBOUND TRIPS			OUTBOUND TRIPS			INBOUND TRIPS			OUTBOUND TRIPS		
	AUTO	TRUCK*	TOTAL	AUTO	TRUCK*	TOTAL	AUTO	TRUCK*	TOTAL	AUTO	TRUCK*	TOTAL
Cal Wine Transport, 660 Airpark (119,430 sq.ft.)												
7:00-8:00 AM	11	3	14	1	1	2						
8:00-9:00 AM	4	2	6	8	2	10						
4:00-5:00 PM							3	1	4	15	2	17
5:00-6:00 PM							1	0	1	2	0	2
Biagi Bros., 770 Skyway (101,200 sq.ft.)												
7:00-8:00 AM	0	1	1	0	0	0						
8:00-9:00 AM	3	1	4	1	3	4						
4:00-5:00 PM							0	5	5	3	1	4
5:00-6:00 PM							1	1	2	1	2	3
Biagi Bros., 787 Airpark (377,000 sq.ft.)												
7:00-8:00 AM	14	7	21	3	5	8						
8:00-9:00 AM	12	12	24	4	7	11						
4:00-5:00 PM							3	9	12	13	4	17
5:00-6:00 PM							0	3	4	9	8	17
Biagi Bros., 50/80 Technology Court (400,000 sq.ft.)												
7:00-8:00 AM	4	2	6	0	4	4						
8:00-9:00 AM	1	5	6	3	1	4						
4:00-5:00 PM							1	0	1	2	1	3
5:00-6:00 PM							1	0	1	2	0	2

* Also includes truck cab only.

Source: Crane Transportation Group

Appendix A Table 2

TRIP GENERATION RATES

WINERY WAREHOUSES IN THE NAPA INDUSTRIAL PARK
RAW MID SUMMER 2007 COUNT DATA – NOT ADJUSTED FOR BUILDING OCCUPANCY OR PEAK SEASONAL ACTIVITY

LOCATION	SIZE	AM PEAK HOUR				PM PEAK HOUR			
		INBOUND		OUTBOUND		INBOUND		OUTBOUND	
		TRIPS	RATE/ 1000 SQ.FT.	TRIPS	RATE/ 1000 SQ.FT.	TRIPS	RATE/ 1000 SQ.FT.	TRIPS	RATE/ 1000 SQ. FT.
Cal Wine Transport 660 Airpark	119,430 sq.ft.	14	.12	6	.05	4	.03	17	.14
Biagi Bros. 770 Skyway	101,200 sq.ft.	4	.04	4	.04	5	.05	4	.04
Biagi Bros. 787 Airpark	377,000 sq.ft.	24	.06	11	.03	10	.03	21	.06
Biagi Bros. 50/80 Technology Court	400,000 sq.ft.	6	.02	6	.02	1	.01	3	.01

Source: Crane Transportation Group

Appendix A Table 3

TRIP GENERATION RATES

WINERY WAREHOUSES IN THE NAPA INDUSTRIAL PARK
YEAR 2007 COUNT DATA ADJUSTED TO REFLECT 100% BUILDING OCCUPANCY AND PEAK SEASON ACTIVITY

LOCATION	SIZE	AM PEAK HOUR				PM PEAK HOUR			
		INBOUND		OUTBOUND		INBOUND		OUTBOUND	
		TRIPS	RATE/ 1000 SQ.FT.	TRIPS	RATE/ 1000 SQ.FT.	TRIPS	RATE/ 1000 SQ.FT.	TRIPS	RATE/ 1000 SQ. FT.
Cal Wine Transport 660 Airpark	119,430 sq.ft.	21	.18	9	.08	6	.05	26	.22
Biagi Bros. 770 Skyway	101,200 sq.ft.	5	.05	5	.05	6	.06	5	.05
Biagi Bros. 787 Airpark	377,000 sq.ft.	47	.13	22	.06	20	.06	41	.11
Biagi Bros. 50/80 Technology Court	400,000 sq.ft.	11	.03	11	.03	2	.01	6	.02
Average			.10		.06		.05		.10

Source: Crane Transportation Group

Appendix A Table 4

TRIP GENERATION
NAPA INDUSTRIAL – HEADWATERS
WINERY WAREHOUSE USES

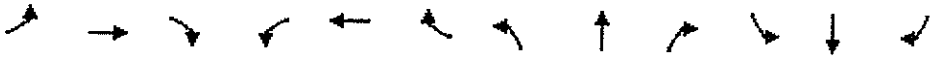
USE	SIZE	DAILY 2-WAY TRIPS		AM PEAK HOUR				PM PEAK HOUR			
				INBOUND		OUTBOUND		INBOUND		OUTBOUND	
		RATE	VOL	RATE	VOL	RATE	VOL	RATE	VOL	RATE	VOL
Winery Warehouse	650,000 SQ.FT.	1.70	1106	.10	65	.06	39	.05	33	.10	65

Trip Rate Source: Crane Transportation Group, surveys at four winery warehouses in the Napa Airport Industrial Park, June/July 2007; factored to reflect peak season of warehouse activity.
Compiled by: Crane Transportation Group

TECHNICAL APPENDIX

Capacity Worksheets

Existing
Level of Service
AM & PM Peak Hours



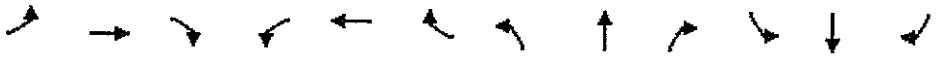
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	275	515	50	30	540	40	1425	50	1200	1815	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.91	0.91	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1610	3366	1583	1770	1863	1583	1770	5085	1583	3433	3539	1583
Flt Permitted	0.95	0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1610	3366	1583	1770	1863	1583	1770	5085	1583	3433	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	211	289	542	53	32	568	42	1500	53	1263	1911	32
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	36	0	0	0
Lane Group Flow (vph)	162	338	542	53	32	568	42	1500	17	1263	1911	32
Turn Type	Split		Free	Split		Free	Prot		Perm	Prot		Free
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free			Free			2			Free
Actuated Green, G (s)	11.0	11.0	100.0	3.2	3.2	100.0	3.2	31.6	31.6	38.2	66.6	100.0
Effective Green, g (s)	11.0	11.0	100.0	3.2	3.2	100.0	3.2	31.6	31.6	38.2	66.6	100.0
Actuated g/C Ratio	0.11	0.11	1.00	0.03	0.03	1.00	0.03	0.32	0.32	0.38	0.67	1.00
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	177	370	1583	57	60	1583	57	1607	500	1311	2357	1583
v/s Ratio Prot	c0.10	0.10		c0.03	0.02		0.02	c0.29		c0.37	0.54	
v/s Ratio Perm			0.34			0.36			0.01			0.02
v/c Ratio	0.92	0.91	0.34	0.93	0.53	0.36	0.74	0.93	0.03	0.96	0.81	0.02
Uniform Delay, d1	44.0	44.0	0.0	48.3	47.7	0.0	48.0	33.2	23.6	30.2	12.1	0.0
Progression Factor	1.00	1.00	1.00	0.81	0.83	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	43.8	26.3	0.6	79.2	6.8	0.5	38.8	11.4	0.1	16.8	3.2	0.0
Delay (s)	87.8	70.3	0.6	118.4	46.3	0.5	86.8	44.6	23.8	47.0	15.3	0.0
Level of Service	F	E	A	F	D	A	F	D	C	D	B	A
Approach Delay (s)		36.8			12.3			45.0			27.6	
Approach LOS		D			B			D			C	

Intersection Summary				
HCM Average Control Delay	31.8	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.94			
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	87.4%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	10	25	55	5	0	145	2065	500	35	1315	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.89		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1327	1339		1612	1900		1612	3505	1599	1805	3505	1417
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1327	1339		1612	1900		1612	3505	1599	1805	3505	1417
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	27	11	27	59	5	0	156	2220	538	38	1414	27
RTOR Reduction (vph)	0	26	0	0	0	0	0	0	129	0	0	8
Lane Group Flow (vph)	27	12	0	59	5	0	156	2220	409	38	1414	19
Heavy Vehicles (%)	36%	63%	12%	12%	0%	0%	12%	3%	1%	0%	3%	14%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	2.4	2.4		4.0	4.0		11.5	55.2	55.2	2.4	46.1	46.1
Effective Green, g (s)	2.4	2.4		4.0	4.0		11.5	55.2	55.2	2.4	46.1	46.1
Actuated g/C Ratio	0.03	0.03		0.05	0.05		0.14	0.69	0.69	0.03	0.58	0.58
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	40	40		81	95		232	2418	1103	54	2020	817
v/s Ratio Prot	c0.02	0.01		c0.04	0.00		0.10	c0.63		0.02	c0.40	
v/s Ratio Perm									0.26			0.01
v/c Ratio	0.68	0.30		0.73	0.05		0.67	0.92	0.37	0.70	0.70	0.02
Uniform Delay, d1	38.4	38.0		37.5	36.2		32.5	10.5	5.2	38.4	12.0	7.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	36.7	4.1		27.6	0.2		7.5	7.0	1.0	34.1	2.0	0.1
Delay (s)	75.2	42.1		65.1	36.4		39.9	17.5	6.1	72.5	14.1	7.3
Level of Service	E	D		E	D		D	B	A	E	B	A
Approach Delay (s)		55.8			62.8			16.6			15.5	
Approach LOS		E			E			B			B	

Intersection Summary				
HCM Average Control Delay	17.4	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.86			
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	80.1%	ICU Level of Service	D	
Analysis Period (min)	15			

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	40	85	140	5	0	40	1410	60	45	2360	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.90		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	1664		1770	1900		1671	3574	1583	1805	3574	1615
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1805	1664		1770	1900		1671	3574	1583	1805	3574	1615
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	84	42	89	147	5	0	42	1484	63	47	2484	16
RTOR Reduction (vph)	0	70	0	0	0	0	0	0	19	0	0	2
Lane Group Flow (vph)	84	61	0	147	5	0	42	1484	44	47	2484	14
Heavy Vehicles (%)	0%	8%	0%	2%	0%	0%	8%	1%	2%	0%	1%	0%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	5.0	5.0		8.0	8.0		3.9	67.5	67.5	3.5	67.1	67.1
Effective Green, g (s)	5.0	5.0		8.0	8.0		3.9	67.5	67.5	3.5	67.1	67.1
Actuated g/C Ratio	0.05	0.05		0.08	0.08		0.04	0.68	0.68	0.04	0.67	0.67
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	90	83		142	152		65	2412	1069	63	2398	1084
v/s Ratio Prot	c0.05	0.04		c0.08	0.00		0.03	c0.42		0.03	c0.69	
v/s Ratio Perm									0.03			0.01
v/c Ratio	0.93	0.73		1.04	0.03		0.65	0.62	0.04	0.75	1.04	0.01
Uniform Delay, d1	47.3	46.8		46.0	42.4		47.4	9.0	5.4	47.8	16.5	5.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	72.7	27.9		85.2	0.1		20.0	0.5	0.0	37.6	28.4	0.0
Delay (s)	120.0	74.7		131.2	42.5		67.3	9.5	5.4	85.4	44.9	5.5
Level of Service	F	E		F	D		E	A	A	F	D	A
Approach Delay (s)		92.4			128.3			10.9			45.4	
Approach LOS		F			F			B			D	

Intersection Summary					
HCM Average Control Delay	38.3	HCM Level of Service		D	
HCM Volume to Capacity ratio	0.98				
Actuated Cycle Length (s)	100.0	Sum of lost time (s)		12.0	
Intersection Capacity Utilization	90.3%	ICU Level of Service		E	
Analysis Period (min)	15				

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	0	145	10	5	10	130	2830	5	15	1180	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00		0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770		1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770		1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	43	0	156	11	5	11	140	3043	5	16	1269	75
RTOR Reduction (vph)	0	0	152	0	0	11	0	0	1	0	0	17
Lane Group Flow (vph)	43	0	4	11	5	0	140	3043	4	16	1269	58
Turn Type	Prot		Perm	Prot		Perm	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4		3	8		5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0		4.0	1.5	1.5	1.5	15.7	122.4	123.9	1.5	108.2	112.2
Effective Green, g (s)	4.0		4.0	1.5	1.5	1.5	15.7	122.4	123.9	1.5	108.2	112.2
Actuated g/C Ratio	0.03		0.03	0.01	0.01	0.01	0.11	0.84	0.85	0.01	0.74	0.77
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	49		44	18	19	16	191	2979	1349	18	2634	1222
v/s Ratio Prot	c0.02			0.01	c0.00		c0.08	c0.86	0.00	0.01	0.36	0.00
v/s Ratio Perm			0.00			0.00			0.00			0.04
v/c Ratio	0.88		0.10	0.61	0.26	0.01	0.73	1.02	0.00	0.89	0.48	0.05
Uniform Delay, d1	70.5		68.9	71.7	71.4	71.2	62.8	11.5	1.6	71.9	7.4	3.9
Progression Factor	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	83.1		1.0	48.7	7.3	0.2	13.5	22.2	0.0	156.5	0.1	0.0
Delay (s)	153.6		69.9	120.3	78.7	71.4	76.4	33.7	1.6	228.4	7.6	4.0
Level of Service	F		E	F	E	E	E	C	A	F	A	A
Approach Delay (s)		88.0			92.7			35.5			10.0	
Approach LOS		F			F			D			A	

Intersection Summary			
HCM Average Control Delay	30.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	145.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	100.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	0	25	10	5	10	30	1320	10	40	2705	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00		0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770		1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770		1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	0	26	11	5	11	32	1389	11	42	2847	37
RTOR Reduction (vph)	0	0	25	0	0	11	0	0	2	0	0	6
Lane Group Flow (vph)	47	0	1	11	5	0	32	1389	9	42	2847	31
Turn Type	Prot		Perm	Prot		Perm	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4		3	8		5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.5		4.7	2.3	1.5	1.5	3.1	97.8	100.1	7.7	102.4	107.9
Effective Green, g (s)	5.5		4.7	2.3	1.5	1.5	3.1	97.8	100.1	7.7	102.4	107.9
Actuated g/C Ratio	0.04		0.04	0.02	0.01	0.01	0.02	0.76	0.78	0.06	0.80	0.84
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	76		58	32	22	18	43	2693	1233	106	2820	1329
v/s Ratio Prot	c0.03			0.01	c0.00		c0.02	0.39	0.00	0.02	c0.80	0.00
v/s Ratio Perm			c0.00			0.00			0.01			0.02
v/c Ratio	0.62		0.02	0.34	0.23	0.01	0.74	0.52	0.01	0.40	1.01	0.02
Uniform Delay, d1	60.5		59.7	62.4	62.9	62.8	62.3	6.0	3.2	58.2	13.0	1.7
Progression Factor	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.1		0.1	6.3	5.2	0.2	50.5	0.2	0.0	2.4	19.3	0.0
Delay (s)	74.5		59.8	68.7	68.1	62.9	112.8	6.2	3.2	60.6	32.4	1.7
Level of Service	E		E	E	E	E	F	A	A	E	C	A
Approach Delay (s)		69.3			66.2			8.6			32.4	
Approach LOS		E			E			A			C	

Intersection Summary			
HCM Average Control Delay	25.5	HCM Level of Service	C
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	128.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	91.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	30	40	50	110	415	180	1880	55	1000	1315	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.91	0.91	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1610	3357	1583	1770	1863	1583	1770	5085	1583	3433	3539	1583
Flt Permitted	0.95	0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1610	3357	1583	1770	1863	1583	1770	5085	1583	3433	3539	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	27	32	43	54	118	446	194	2022	59	1075	1414	129
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	34	0	0	0
Lane Group Flow (vph)	19	40	43	54	118	446	194	2022	25	1075	1414	129
Turn Type	Split		Free	Split		Free	Prot		Perm	Prot		Free
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free			Free			2			Free
Actuated Green, G (s)	3.2	3.2	110.0	8.3	8.3	110.0	16.5	47.0	47.0	35.5	66.0	110.0
Effective Green, g (s)	3.2	3.2	110.0	8.3	8.3	110.0	16.5	47.0	47.0	35.5	66.0	110.0
Actuated g/C Ratio	0.03	0.03	1.00	0.08	0.08	1.00	0.15	0.43	0.43	0.32	0.60	1.00
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	47	98	1583	134	141	1583	266	2173	676	1108	2123	1583
v/s Ratio Prot	0.01	0.01		0.03	c0.06		0.11	c0.40		c0.31	0.40	
v/s Ratio Perm			0.03			c0.28			0.02			0.08
v/c Ratio	0.40	0.41	0.03	0.40	0.84	0.28	0.73	0.93	0.04	0.97	0.67	0.08
Uniform Delay, d1	52.5	52.5	0.0	48.5	50.2	0.0	44.6	29.9	18.3	36.7	14.7	0.0
Progression Factor	1.00	1.00	1.00	0.84	0.85	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.6	2.8	0.0	1.0	19.5	0.2	9.6	8.7	0.1	20.1	1.7	0.1
Delay (s)	58.1	55.2	0.0	41.7	62.1	0.2	54.2	38.6	18.4	56.9	16.3	0.1
Level of Service	E	E	A	D	E	A	D	D	B	E	B	A
Approach Delay (s)		32.5			15.7			39.4			32.2	
Approach LOS		C			B			D			C	

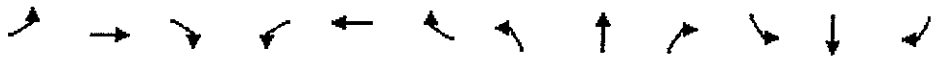
Intersection Summary				
HCM Average Control Delay	33.3	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.89			
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	84.3%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	970	45	45	540	715	25	435	50	10	20	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	1863	1583	1770	1863	1583	1770	1770	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	1863	1583	1770	1863	1583	1770	1770	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	75	1043	48	48	581	769	27	468	54	11	22	11
RTOR Reduction (vph)	0	0	0	0	0	291	0	0	27	0	7	0
Lane Group Flow (vph)	75	1043	48	48	581	478	27	468	27	11	26	0
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.6	39.6	39.6	4.6	37.6	37.6	5.2	48.3	48.3	1.5	44.6	
Effective Green, g (s)	6.6	39.6	39.6	4.6	37.6	37.6	5.2	48.3	48.3	1.5	44.6	
Actuated g/C Ratio	0.06	0.36	0.36	0.04	0.34	0.34	0.05	0.44	0.44	0.01	0.41	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	106	1274	570	74	637	541	84	818	695	24	718	
v/s Ratio Prot	c0.04	0.29		0.03	c0.31		0.02	c0.25		c0.01	0.01	
v/s Ratio Perm			0.03			0.30			0.02			
v/c Ratio	0.71	0.82	0.08	0.65	0.91	0.88	0.32	0.57	0.04	0.46	0.04	
Uniform Delay, d1	50.8	31.9	23.2	51.9	34.6	34.1	50.7	23.1	17.6	53.8	19.7	
Progression Factor	0.53	0.09	0.09	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	8.4	1.7	0.0	17.9	17.4	15.7	2.2	2.9	0.1	13.2	0.1	
Delay (s)	35.5	4.6	2.1	69.8	52.0	49.8	52.9	26.0	17.7	67.1	19.8	
Level of Service	D	A	A	E	D	D	D	C	B	E	B	
Approach Delay (s)		6.5			51.4			26.5			31.6	
Approach LOS		A			D			C			C	

Intersection Summary			
HCM Average Control Delay	30.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
5: Jameson Canyon & Kelly St

16/09/2007



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1455	25	25	585	585	10	110	115	55	55	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	1863	1583	1770	1863	1583	1770	1776	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	1863	1583	1770	1863	1583	1770	1776	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	47	1532	26	26	616	616	11	116	121	58	58	26
RTOR Reduction (vph)	0	0	0	0	0	333	0	0	91	0	14	0
Lane Group Flow (vph)	47	1532	26	26	616	283	11	116	30	58	70	0
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	5.6	49.7	49.7	1.8	45.9	45.9	1.2	24.9	24.9	7.6	31.3	
Effective Green, g (s)	5.6	49.7	49.7	1.8	45.9	45.9	1.2	24.9	24.9	7.6	31.3	
Actuated g/C Ratio	0.06	0.50	0.50	0.02	0.46	0.46	0.01	0.25	0.25	0.08	0.31	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	99	1759	787	32	855	727	21	464	394	135	556	
v/s Ratio Prot	0.03	c0.43		0.01	c0.33		0.01	c0.06		c0.03	0.04	
v/s Ratio Perm			0.02			0.18			0.02			
v/c Ratio	0.47	0.87	0.03	0.81	0.72	0.39	0.52	0.25	0.08	0.43	0.13	
Uniform Delay, d1	45.8	22.3	12.9	48.9	21.9	17.8	49.1	30.1	28.7	44.1	24.6	
Progression Factor	0.55	0.21	0.12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.2	1.8	0.0	84.7	3.0	0.3	21.6	1.3	0.4	2.2	0.5	
Delay (s)	26.2	6.5	1.5	133.6	24.9	18.2	70.7	31.4	29.1	46.3	25.0	
Level of Service	C	A	A	F	C	B	E	C	C	D	C	
Approach Delay (s)		7.0			23.8			32.0			33.7	
Approach LOS		A			C			C			C	

Intersection Summary				
HCM Average Control Delay	16.6	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.66			
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	60.7%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

2010 Base Case
Level of Service
AM & PM Peak Hours

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	50	82	73	220	510	422	1910	63	1035	1563	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.91	0.91	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1610	3360	1583	1770	1863	1583	1770	5085	1583	3433	3539	1583
Flt Permitted	0.95	0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1610	3360	1583	1770	1863	1583	1770	5085	1583	3433	3539	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	43	54	88	78	237	548	454	2054	68	1113	1681	172
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	39	0	0	0
Lane Group Flow (vph)	31	66	88	78	237	548	454	2054	29	1113	1681	172
Turn Type	Split		Free	Split		Free	Prot		Perm	Prot		Free
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free			Free			2			Free
Actuated Green, G (s)	3.2	3.2	110.0	14.6	14.6	110.0	26.0	42.2	42.2	34.0	50.2	110.0
Effective Green, g (s)	3.2	3.2	110.0	14.6	14.6	110.0	26.0	42.2	42.2	34.0	50.2	110.0
Actuated g/C Ratio	0.03	0.03	1.00	0.13	0.13	1.00	0.24	0.38	0.38	0.31	0.46	1.00
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	47	98	1583	235	247	1583	418	1951	607	1061	1615	1583
v/s Ratio Prot	0.02	0.02		0.04	c0.13		0.26	0.40		c0.32	c0.47	
v/s Ratio Perm			0.06			c0.35			0.02			0.11
v/c Ratio	0.66	0.67	0.06	0.33	0.96	0.35	1.09	1.05	0.05	1.05	1.04	0.11
Uniform Delay, d1	52.9	52.9	0.0	43.3	47.4	0.0	42.0	33.9	21.3	38.0	29.9	0.0
Progression Factor	1.00	1.00	1.00	0.71	0.73	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	28.7	16.7	0.1	0.1	9.4	0.1	69.2	35.9	0.1	41.4	33.8	0.1
Delay (s)	81.6	69.6	0.1	30.7	44.1	0.1	111.2	69.8	21.4	79.4	63.7	0.1
Level of Service	F	E	A	C	D	A	F	E	C	E	E	A
Approach Delay (s)		38.5			14.9			75.8			65.9	
Approach LOS		D			B			E			E	

Intersection Summary			
HCM Average Control Delay	62.3	HCM Level of Service	E
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	94.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	46	17	35	60	13	0	178	2320	530	45	1580	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.90		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1327	1329		1612	1900		1612	3505	1599	1805	3505	1417
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1327	1329		1612	1900		1612	3505	1599	1805	3505	1417
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	49	18	38	65	14	0	191	2495	570	48	1699	62
RTOR Reduction (vph)	0	36	0	0	0	0	0	0	119	0	0	14
Lane Group Flow (vph)	49	20	0	65	14	0	191	2495	451	48	1699	48
Heavy Vehicles (%)	36%	63%	12%	12%	0%	0%	12%	3%	1%	0%	3%	14%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	4.0	4.0		4.0	4.0		13.7	62.1	62.1	3.1	51.5	51.5
Effective Green, g (s)	4.0	4.0		4.0	4.0		13.7	62.1	62.1	3.1	51.5	51.5
Actuated g/C Ratio	0.04	0.04		0.04	0.04		0.15	0.70	0.70	0.03	0.58	0.58
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	60	60		72	85		248	2440	1113	63	2024	818
v/s Ratio Prot	c0.04	0.01		c0.04	0.01		0.12	c0.71		0.03	c0.48	
v/s Ratio Perm									0.28			0.03
v/c Ratio	0.82	0.33		0.90	0.16		0.77	1.02	0.41	0.76	0.84	0.06
Uniform Delay, d1	42.2	41.3		42.4	41.0		36.2	13.6	5.7	42.7	15.5	8.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	55.6	3.2		73.0	0.9		13.7	24.2	0.2	41.2	3.2	0.0
Delay (s)	97.8	44.5		115.5	41.9		49.9	37.7	6.0	83.9	18.7	8.3
Level of Service	F	D		F	D		D	D	A	F	B	A
Approach Delay (s)		69.4			102.4			32.9			20.1	
Approach LOS		E			F			C			C	

Intersection Summary				
HCM Average Control Delay	30.2	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.97			
Actuated Cycle Length (s)	89.2	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	87.5%	ICU Level of Service	E	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	108	53	113	155	12	0	63	1715	70	55	2660	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.90		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	1664		1770	1900		1671	3574	1583	1805	3574	1615
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1805	1664		1770	1900		1671	3574	1583	1805	3574	1615
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	114	56	119	163	13	0	66	1805	74	58	2800	40
RTOR Reduction (vph)	0	55	0	0	0	0	0	0	14	0	0	3
Lane Group Flow (vph)	114	120	0	163	13	0	66	1805	60	58	2800	37
Heavy Vehicles (%)	0%	8%	0%	2%	0%	0%	8%	1%	2%	0%	1%	0%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	11.6	11.6		8.0	8.0		7.1	96.0	96.0	6.3	95.2	95.2
Effective Green, g (s)	11.6	11.6		8.0	8.0		7.1	96.0	96.0	6.3	95.2	95.2
Actuated g/C Ratio	0.08	0.08		0.06	0.06		0.05	0.70	0.70	0.05	0.69	0.69
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	152	140		103	110		86	2488	1102	82	2467	1115
v/s Ratio Prot	0.06	c0.07		c0.09	0.01		0.04	c0.51		0.03	c0.78	
v/s Ratio Perm									0.04			0.02
v/c Ratio	0.75	0.86		1.58	0.12		0.77	0.73	0.05	0.71	1.13	0.03
Uniform Delay, d1	61.7	62.3		65.0	61.6		64.6	12.9	6.6	64.9	21.4	6.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	18.6	37.2		303.2	0.5		32.8	1.1	0.0	24.2	66.4	0.0
Delay (s)	80.3	99.5		368.1	62.1		97.4	13.9	6.6	89.1	87.7	6.8
Level of Service	F	F		F	E		F	B	A	F	F	A
Approach Delay (s)		92.0			345.5			16.5			86.6	
Approach LOS		F			F			B			F	

Intersection Summary			
HCM Average Control Delay	69.8	HCM Level of Service	E
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	137.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	101.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	10	145	25	15	25	165	3163	25	25	1420	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	48	11	156	27	16	27	177	3401	27	27	1527	81
RTOR Reduction (vph)	0	0	152	0	0	26	0	0	5	0	0	23
Lane Group Flow (vph)	48	11	4	27	16	1	177	3401	22	27	1527	58
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	4.0	4.0	3.1	3.1	3.1	19.3	122.2	122.2	3.1	106.0	106.0
Effective Green, g (s)	4.0	4.0	4.0	3.1	3.1	3.1	19.3	122.2	122.2	3.1	106.0	106.0
Actuated g/C Ratio	0.03	0.03	0.03	0.02	0.02	0.02	0.13	0.82	0.82	0.02	0.71	0.71
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	48	50	43	37	39	33	230	2914	1304	37	2528	1131
v/s Ratio Prot	c0.03	0.01		0.02	c0.01		c0.10	c0.96		0.02	0.43	
v/s Ratio Perm			0.00			0.00			0.01			0.04
v/c Ratio	1.00	0.22	0.10	0.73	0.41	0.02	0.77	1.17	0.02	0.73	0.60	0.05
Uniform Delay, d1	72.2	70.7	70.4	72.2	71.7	71.2	62.4	13.1	2.3	72.2	10.7	6.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	129.9	2.2	1.0	52.2	6.9	0.2	14.3	79.3	0.0	52.2	0.4	0.0
Delay (s)	202.1	72.9	71.4	124.4	78.6	71.4	76.7	92.4	2.4	124.4	11.1	6.3
Level of Service	F	E	E	F	E	E	E	F	A	F	B	A
Approach Delay (s)		100.7			93.5			91.0			12.7	
Approach LOS		F			F			F			B	

Intersection Summary				
HCM Average Control Delay	68.2	HCM Level of Service	E	
HCM Volume to Capacity ratio	1.14			
Actuated Cycle Length (s)	148.4	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	109.9%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	10	55	20	10	15	45	1613	35	65	3023	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	58	11	58	21	11	16	47	1698	37	68	3182	47
RTOR Reduction (vph)	0	0	56	0	0	16	0	0	8	0	0	8
Lane Group Flow (vph)	58	11	2	21	11	0	47	1698	29	68	3182	39
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	4.0	4.0	2.3	2.3	2.3	3.9	115.7	115.7	9.5	121.3	121.3
Effective Green, g (s)	4.0	4.0	4.0	2.3	2.3	2.3	3.9	115.7	115.7	9.5	121.3	121.3
Actuated g/C Ratio	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.78	0.78	0.06	0.82	0.82
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	48	51	43	28	29	25	47	2776	1242	114	2910	1302
v/s Ratio Prot	c0.03	c0.01		0.01	0.01		c0.03	0.48		0.04	c0.90	
v/s Ratio Perm			0.00			0.00			0.02			0.02
v/c Ratio	1.21	0.22	0.04	0.75	0.38	0.01	1.00	0.61	0.02	0.60	1.09	0.03
Uniform Delay, d1	71.8	70.2	69.9	72.3	71.9	71.5	71.8	6.6	3.5	67.1	13.1	2.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	197.2	2.1	0.3	71.8	8.1	0.2	131.3	0.4	0.0	8.1	48.4	0.0
Delay (s)	268.9	72.3	70.2	144.1	80.0	71.6	203.1	7.0	3.5	75.3	61.5	2.4
Level of Service	F	E	E	F	F	E	F	A	A	E	E	A
Approach Delay (s)		161.1			105.3			12.1			60.9	
Approach LOS		F			F			B			E	

Intersection Summary				
HCM Average Control Delay	47.2	HCM Level of Service	D	
HCM Volume to Capacity ratio	1.05			
Actuated Cycle Length (s)	147.5	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	100.3%	ICU Level of Service	G	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	1023	50	56	763	815	25	460	57	15	25	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	1863	1583	1770	1863	1583	1770	1759	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	1863	1583	1770	1863	1583	1770	1759	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	81	1100	54	60	820	876	27	495	61	16	27	16
RTOR Reduction (vph)	0	0	0	0	0	262	0	0	33	0	10	0
Lane Group Flow (vph)	81	1100	54	60	820	614	27	495	28	16	33	0
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	5.8	44.2	44.2	6.6	45.0	45.0	3.6	36.8	36.8	6.4	39.6	
Effective Green, g (s)	5.8	44.2	44.2	6.6	45.0	45.0	3.6	36.8	36.8	6.4	39.6	
Actuated g/C Ratio	0.05	0.40	0.40	0.06	0.41	0.41	0.03	0.33	0.33	0.06	0.36	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	93	1422	636	106	762	648	58	623	530	103	633	
v/s Ratio Prot	c0.05	0.31		0.03	c0.44		0.02	c0.27		c0.01	0.02	
v/s Ratio Perm			0.03			0.39			0.02			
v/c Ratio	0.87	0.77	0.08	0.57	1.08	0.95	0.47	0.79	0.05	0.16	0.05	
Uniform Delay, d1	51.7	28.6	20.4	50.3	32.5	31.4	52.3	33.2	24.8	49.2	23.0	
Progression Factor	0.66	0.09	0.09	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	20.9	0.8	0.0	6.8	55.0	23.0	5.8	10.1	0.2	0.7	0.2	
Delay (s)	55.1	3.4	1.9	57.1	87.5	54.4	58.1	43.2	25.0	49.9	23.1	
Level of Service	E	A	A	E	F	D	E	D	C	D	C	
Approach Delay (s)		6.7			70.0			42.0			30.4	
Approach LOS		A			E			D			C	

Intersection Summary			
HCM Average Control Delay	43.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	88.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
5: Jameson Canyon & Kelly St

23/05/2008

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1725	30	32	653	600	20	120	143	65	65	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	1863	1583	1770	1863	1583	1770	1764	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	1863	1583	1770	1863	1583	1770	1764	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	1816	32	34	687	632	21	126	151	68	68	37
RTOR Reduction (vph)	0	0	0	0	0	318	0	0	121	0	14	0
Lane Group Flow (vph)	53	1816	32	34	687	314	21	126	30	68	91	0
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	14.3	75.7	75.7	3.2	64.6	64.6	3.6	26.0	26.0	9.1	31.5	
Effective Green, g (s)	14.3	75.7	75.7	3.2	64.6	64.6	3.6	26.0	26.0	9.1	31.5	
Actuated g/C Ratio	0.11	0.58	0.58	0.02	0.50	0.50	0.03	0.20	0.20	0.07	0.24	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	195	2061	922	44	926	787	49	373	317	124	427	
v/s Ratio Prot	0.03	c0.51		0.02	c0.37		0.01	c0.07		c0.04	0.05	
v/s Ratio Perm			0.02			0.20			0.02			
v/c Ratio	0.27	0.88	0.03	0.77	0.74	0.40	0.43	0.34	0.10	0.55	0.21	
Uniform Delay, d1	53.1	23.3	11.6	63.0	26.1	20.5	62.2	44.6	42.4	58.5	39.3	
Progression Factor	0.58	0.17	0.18	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.3	1.8	0.0	57.0	3.2	0.3	5.9	2.4	0.6	4.9	1.1	
Delay (s)	30.9	5.7	2.0	120.0	29.3	20.9	68.1	47.1	43.0	63.4	40.5	
Level of Service	C	A	A	F	C	C	E	D	D	E	D	
Approach Delay (s)		6.3			27.6			46.5			49.5	
Approach LOS		A			C			D			D	

Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	225	390	746	58	65	560	140	1553	160	1255	1898	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.91	0.91	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1610	3379	1583	1770	1863	1583	1770	5085	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1610	3379	1583	1770	1863	1583	1770	5085	1583	3433	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	237	411	785	61	68	589	147	1635	168	1321	1998	58
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	58	0	0	0
Lane Group Flow (vph)	209	439	785	61	68	589	147	1635	110	1321	1998	58
Turn Type	Split		Free	Split		Free	Prot		Perm	Prot		Free
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free			Free			2			Free
Actuated Green, G (s)	17.0	17.0	130.0	5.0	5.0	130.0	12.7	42.0	42.0	50.0	79.3	130.0
Effective Green, g (s)	17.0	17.0	130.0	5.0	5.0	130.0	12.7	42.0	42.0	50.0	79.3	130.0
Actuated g/C Ratio	0.13	0.13	1.00	0.04	0.04	1.00	0.10	0.32	0.32	0.38	0.61	1.00
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	211	442	1583	68	72	1583	173	1643	511	1320	2159	1583
v/s Ratio Prot	0.13	c0.13		0.03	c0.04		0.08	c0.32		c0.38	0.56	
v/s Ratio Perm			0.50			0.37			0.07			0.04
v/c Ratio	0.99	0.99	0.50	0.90	0.94	0.37	0.85	1.00	0.21	1.00	0.93	0.04
Uniform Delay, d1	56.4	56.4	0.0	62.2	62.4	0.0	57.7	43.9	32.0	40.0	22.7	0.0
Progression Factor	1.00	1.00	1.00	0.61	0.61	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	59.1	40.8	1.1	62.5	74.6	0.5	30.2	21.1	1.0	25.0	8.3	0.0
Delay (s)	115.5	97.3	1.1	100.5	112.6	0.5	88.0	65.0	33.0	65.0	31.0	0.0
Level of Service	F	F	A	F	F	A	F	E	C	E	C	A
Approach Delay (s)		47.3			19.6			64.0			43.7	
Approach LOS		D			B			E			D	

Intersection Summary				
HCM Average Control Delay	47.4	HCM Level of Service	D	
HCM Volume to Capacity ratio	1.00			
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	94.1%	ICU Level of Service	F	
Analysis Period (min)	15			
c Critical Lane Group				

2010 Base Case + Project
Level of Service
AM & PM Peak Hours

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	21	50	60	20	0	204	2320	530	45	1580	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.89		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1327	1336		1612	1900		1612	3505	1599	1805	3505	1417
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1327	1336		1612	1900		1612	3505	1599	1805	3505	1417
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	70	23	54	65	22	0	219	2495	570	48	1699	97
RTOR Reduction (vph)	0	51	0	0	0	0	0	0	107	0	0	19
Lane Group Flow (vph)	70	26	0	65	22	0	219	2495	463	48	1699	78
Heavy Vehicles (%)	36%	63%	12%	12%	0%	0%	12%	3%	1%	0%	3%	14%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	6.0	6.0		4.0	4.0		16.0	70.1	70.1	3.1	57.2	57.2
Effective Green, g (s)	6.0	6.0		4.0	4.0		16.0	70.1	70.1	3.1	57.2	57.2
Actuated g/C Ratio	0.06	0.06		0.04	0.04		0.16	0.71	0.71	0.03	0.58	0.58
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	80	81		65	77		260	2477	1130	56	2021	817
v/s Ratio Prot	c0.05	0.02		c0.04	0.01		0.14	c0.71		0.03	c0.48	
v/s Ratio Perm									0.29			0.06
v/c Ratio	0.88	0.32		1.00	0.29		0.84	1.01	0.41	0.86	0.84	0.10
Uniform Delay, d1	46.2	44.7		47.6	46.2		40.4	14.6	6.0	47.8	17.3	9.4
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	60.2	2.3		111.6	2.0		21.2	19.9	0.2	70.1	3.3	0.1
Delay (s)	106.5	47.0		159.2	48.3		61.6	34.4	6.3	117.9	20.6	9.5
Level of Service	F	D		F	D		E	C	A	F	C	A
Approach Delay (s)		75.3			131.2			31.3			22.5	
Approach LOS		E			F			C			C	

Intersection Summary			
HCM Average Control Delay	31.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	99.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	10	145	25	15	25	165	3189	25	25	1435	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	48	11	156	27	16	27	177	3429	27	27	1543	81
RTOR Reduction (vph)	0	0	152	0	0	26	0	0	5	0	0	23
Lane Group Flow (vph)	48	11	4	27	16	1	177	3429	22	27	1543	58
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	4.0	4.0	3.1	3.1	3.1	19.3	122.2	122.2	3.1	106.0	106.0
Effective Green, g (s)	4.0	4.0	4.0	3.1	3.1	3.1	19.3	122.2	122.2	3.1	106.0	106.0
Actuated g/C Ratio	0.03	0.03	0.03	0.02	0.02	0.02	0.13	0.82	0.82	0.02	0.71	0.71
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	48	50	43	37	39	33	230	2914	1304	37	2528	1131
v/s Ratio Prot	c0.03	0.01		0.02	c0.01		c0.10	c0.97		0.02	0.44	
v/s Ratio Perm			0.00			0.00			0.01			0.04
v/c Ratio	1.00	0.22	0.10	0.73	0.41	0.02	0.77	1.18	0.02	0.73	0.61	0.05
Uniform Delay, d1	72.2	70.7	70.4	72.2	71.7	71.2	62.4	13.1	2.3	72.2	10.7	6.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	129.9	2.2	1.0	52.2	6.9	0.2	14.3	83.4	0.0	52.2	0.4	0.0
Delay (s)	202.1	72.9	71.4	124.4	78.6	71.4	76.7	96.5	2.4	124.4	11.2	6.3
Level of Service	F	E	E	F	E	E	E	F	A	F	B	A
Approach Delay (s)		100.7			93.5			94.9			12.8	
Approach LOS		F			F			F			B	

Intersection Summary				
HCM Average Control Delay	70.8	HCM Level of Service	E	
HCM Volume to Capacity ratio	1.15			
Actuated Cycle Length (s)	148.4	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	110.6%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	1026	50	65	773	815	25	460	61	15	25	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	1863	1583	1770	1863	1583	1770	1759	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	1863	1583	1770	1863	1583	1770	1759	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	81	1103	54	70	831	876	27	495	66	16	27	16
RTOR Reduction (vph)	0	0	0	0	0	241	0	0	33	0	10	0
Lane Group Flow (vph)	81	1103	54	70	831	635	27	495	33	16	33	0
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	6.8	50.7	50.7	7.1	51.0	51.0	3.6	39.8	39.8	6.4	42.6	
Effective Green, g (s)	6.8	50.7	50.7	7.1	51.0	51.0	3.6	39.8	39.8	6.4	42.6	
Actuated g/C Ratio	0.06	0.42	0.42	0.06	0.42	0.42	0.03	0.33	0.33	0.05	0.36	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	100	1495	669	105	792	673	53	618	525	94	624	
v/s Ratio Prot	0.05	c0.31		0.04	c0.45		0.02	c0.27		c0.01	0.02	
v/s Ratio Perm			0.03			0.40			0.02			
v/c Ratio	0.81	0.74	0.08	0.67	1.05	0.94	0.51	0.80	0.06	0.17	0.05	
Uniform Delay, d1	56.0	29.1	20.7	55.3	34.5	33.1	57.3	36.5	27.4	54.3	25.4	
Progression Factor	0.43	0.07	0.10	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	14.5	0.6	0.0	14.8	45.7	21.8	7.5	10.5	0.2	0.9	0.2	
Delay (s)	38.8	2.8	2.0	70.1	80.2	54.9	64.8	47.0	27.6	55.1	25.6	
Level of Service	D	A	A	E	F	D	E	D	C	E	C	
Approach Delay (s)		5.1			67.3			45.6			33.6	
Approach LOS		A			E			D			C	

Intersection Summary			
HCM Average Control Delay	42.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	50	85	83	220	510	424	1925	66	1035	1582	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.91	0.91	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1610	3360	1583	1770	1863	1583	1770	5085	1583	3433	3539	1583
Flt Permitted	0.95	0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1610	3360	1583	1770	1863	1583	1770	5085	1583	3433	3539	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	43	54	91	89	237	548	456	2070	71	1113	1701	172
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	37	0	0	0
Lane Group Flow (vph)	31	66	91	89	237	548	456	2070	34	1113	1701	172
Turn Type	Split		Free	Split		Free	Prot		Perm	Prot		Free
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free			Free			2			Free
Actuated Green, G (s)	3.2	3.2	120.0	16.3	16.3	120.0	30.3	46.5	46.5	38.0	54.2	120.0
Effective Green, g (s)	3.2	3.2	120.0	16.3	16.3	120.0	30.3	46.5	46.5	38.0	54.2	120.0
Actuated g/C Ratio	0.03	0.03	1.00	0.14	0.14	1.00	0.25	0.39	0.39	0.32	0.45	1.00
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	43	90	1583	240	253	1583	447	1970	613	1087	1598	1583
v/s Ratio Prot	0.02	0.02		0.05	c0.13		0.26	c0.41		0.32	c0.48	
v/s Ratio Perm			0.06			c0.35			0.02			0.11
v/c Ratio	0.72	0.73	0.06	0.37	0.94	0.35	1.02	1.05	0.06	1.02	1.06	0.11
Uniform Delay, d1	58.0	58.0	0.0	47.2	51.3	0.0	44.9	36.8	23.0	41.0	32.9	0.0
Progression Factor	1.00	1.00	1.00	0.69	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	45.2	26.3	0.1	0.1	6.8	0.1	47.8	35.1	0.2	33.5	41.9	0.1
Delay (s)	103.1	84.2	0.1	32.7	41.4	0.1	92.6	71.9	23.2	74.5	74.8	0.1
Level of Service	F	F	A	C	D	A	F	E	C	E	E	A
Approach Delay (s)		46.6			14.6			74.2			70.4	
Approach LOS		D			B			E			E	

Intersection Summary			
HCM Average Control Delay	63.9	HCM Level of Service	E
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	95.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	225	390	749	62	90	560	142	1571	167	1255	1909	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.91	0.91	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1610	3379	1583	1770	1863	1583	1770	5085	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1610	3379	1583	1770	1863	1583	1770	5085	1583	3433	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	237	411	788	65	95	589	149	1654	176	1321	2009	58
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	78	0	0	0
Lane Group Flow (vph)	209	439	788	65	95	589	149	1654	98	1321	2009	58
Turn Type	Split		Free	Split		Free	Prot		Perm	Prot		Free
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free			Free			2			Free
Actuated Green, G (s)	15.0	15.0	120.0	6.0	6.0	120.0	11.1	39.0	39.0	44.0	71.9	120.0
Effective Green, g (s)	15.0	15.0	120.0	6.0	6.0	120.0	11.1	39.0	39.0	44.0	71.9	120.0
Actuated g/C Ratio	0.12	0.12	1.00	0.05	0.05	1.00	0.09	0.32	0.32	0.37	0.60	1.00
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	201	422	1583	89	93	1583	164	1653	514	1259	2120	1583
v/s Ratio Prot	0.13	c0.13		0.04	c0.05		0.08	c0.33		c0.38	0.57	
v/s Ratio Perm			0.50			0.37			0.06			0.04
v/c Ratio	1.04	1.04	0.50	0.73	1.02	0.37	0.91	1.00	0.19	1.05	0.95	0.04
Uniform Delay, d1	52.5	52.5	0.0	56.2	57.0	0.0	53.9	40.5	29.2	38.0	22.3	0.0
Progression Factor	1.00	1.00	1.00	0.62	0.62	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	74.3	54.7	1.1	20.6	87.0	0.5	44.2	22.3	0.8	39.3	10.6	0.0
Delay (s)	126.8	107.2	1.1	55.6	122.2	0.5	98.1	62.8	30.0	77.3	32.9	0.0
Level of Service	F	F	A	E	F	A	F	E	C	E	C	A
Approach Delay (s)		51.8			20.7			62.5			49.7	
Approach LOS		D			C			E			D	

Intersection Summary			
HCM Average Control Delay	50.6	HCM Level of Service	D
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	95.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1732	30	35	657	600	20	120	154	65	65	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	1863	1583	1770	1863	1583	1770	1764	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	1863	1583	1770	1863	1583	1770	1764	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	1823	32	37	692	632	21	126	162	68	68	37
RTOR Reduction (vph)	0	0	0	0	0	320	0	0	131	0	15	0
Lane Group Flow (vph)	53	1823	32	37	692	312	21	126	31	68	90	0
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	12.9	68.9	68.9	3.2	59.2	59.2	2.4	23.2	23.2	8.7	29.5	
Effective Green, g (s)	12.9	68.9	68.9	3.2	59.2	59.2	2.4	23.2	23.2	8.7	29.5	
Actuated g/C Ratio	0.11	0.57	0.57	0.03	0.49	0.49	0.02	0.19	0.19	0.07	0.25	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	190	2032	909	47	919	781	35	360	306	128	434	
v/s Ratio Prot	0.03	c0.52		0.02	c0.37		0.01	c0.07		c0.04	0.05	
v/s Ratio Perm			0.02			0.20			0.02			
v/c Ratio	0.28	0.90	0.04	0.79	0.75	0.40	0.60	0.35	0.10	0.53	0.21	
Uniform Delay, d1	49.3	22.4	11.1	58.1	24.5	19.2	58.3	41.9	39.8	53.7	36.0	
Progression Factor	0.57	0.18	0.16	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.2	1.7	0.0	57.7	3.5	0.3	24.7	2.7	0.7	4.2	1.1	
Delay (s)	28.2	5.6	1.8	115.7	28.0	19.5	83.0	44.5	40.5	57.9	37.0	
Level of Service	C	A	A	F	C	B	F	D	D	E	D	
Approach Delay (s)		6.2			26.5			45.0			45.2	
Approach LOS		A			C			D			D	

Intersection Summary				
HCM Average Control Delay	18.5	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.75			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	71.0%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	135	64	140	155	15	0	75	1715	70	55	2660	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.90		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	1663		1770	1900		1671	3574	1583	1805	3574	1615
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1805	1663		1770	1900		1671	3574	1583	1805	3574	1615
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	142	67	147	163	16	0	79	1805	74	58	2800	58
RTOR Reduction (vph)	0	51	0	0	0	0	0	0	13	0	0	5
Lane Group Flow (vph)	142	163	0	163	16	0	79	1805	61	58	2800	53
Heavy Vehicles (%)	0%	8%	0%	2%	0%	0%	8%	1%	2%	0%	1%	0%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	10.0	10.0		11.0	11.0		5.8	105.0	105.0	8.0	107.2	107.2
Effective Green, g (s)	10.0	10.0		11.0	11.0		5.8	105.0	105.0	8.0	107.2	107.2
Actuated g/C Ratio	0.07	0.07		0.07	0.07		0.04	0.70	0.70	0.05	0.71	0.71
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	120	111		130	139		65	2502	1108	96	2554	1154
v/s Ratio Prot	0.08	c0.10		c0.09	0.01		c0.05	0.51		0.03	c0.78	
v/s Ratio Perm									0.04			0.03
v/c Ratio	1.18	1.47		1.25	0.12		1.22	0.72	0.06	0.60	1.10	0.05
Uniform Delay, d1	70.0	70.0		69.5	65.0		72.1	13.6	7.0	69.5	21.4	6.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	0.80	0.46	1.00	1.00	1.00
Incremental Delay, d2	139.7	251.9		162.4	0.4		179.3	1.8	0.1	10.3	50.3	0.1
Delay (s)	209.7	321.9		231.9	65.3		251.3	12.7	3.3	79.7	71.7	6.4
Level of Service	F	F		F	E		F	B	A	E	E	A
Approach Delay (s)		277.1			217.0			22.0			70.5	
Approach LOS		F			F			C			E	

Intersection Summary				
HCM Average Control Delay	71.4	HCM Level of Service	E	
HCM Volume to Capacity ratio	1.14			
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	104.1%	ICU Level of Service	G	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	10	55	20	10	15	45	1625	35	65	3050	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	58	11	58	21	11	16	47	1711	37	68	3211	47
RTOR Reduction (vph)	0	0	49	0	0	16	0	0	9	0	0	9
Lane Group Flow (vph)	58	11	9	21	11	0	47	1711	28	68	3211	38
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	7.2	7.2	7.2	2.4	2.4	2.4	4.0	114.8	114.8	9.6	120.4	120.4
Effective Green, g (s)	7.2	7.2	7.2	2.4	2.4	2.4	4.0	114.8	114.8	9.6	120.4	120.4
Actuated g/C Ratio	0.05	0.05	0.05	0.02	0.02	0.02	0.03	0.77	0.77	0.06	0.80	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	85	89	76	28	30	25	47	2709	1212	113	2841	1271
v/s Ratio Prot	c0.03	0.01		c0.01	0.01		c0.03	0.48		0.04	c0.91	
v/s Ratio Perm			0.01			0.00			0.02			0.02
v/c Ratio	0.68	0.12	0.12	0.75	0.37	0.01	1.00	0.63	0.02	0.60	1.13	0.03
Uniform Delay, d1	70.3	68.4	68.4	73.5	73.0	72.6	73.0	8.0	4.2	68.3	14.8	3.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.28	0.04
Incremental Delay, d2	20.2	0.6	0.7	71.8	7.4	0.2	131.3	1.1	0.0	5.5	61.8	0.0
Delay (s)	90.5	69.0	69.1	145.3	80.5	72.8	204.3	9.1	4.2	64.2	65.9	0.1
Level of Service	F	E	E	F	F	E	F	A	A	E	E	A
Approach Delay (s)		78.9			106.3			14.1			65.0	
Approach LOS		E			F			B			E	

Intersection Summary			
HCM Average Control Delay	48.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	101.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

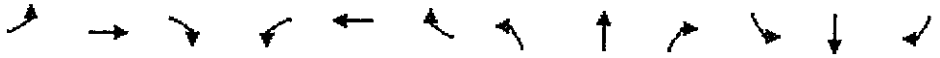
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	135	64	140	155	15	0	75	1715	70	55	2660	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.90		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	1663		1770	1900		1671	3574	1583	1805	3574	1615
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1805	1663		1770	1900		1671	3574	1583	1805	3574	1615
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	142	67	147	163	16	0	79	1805	74	58	2800	58
RTOR Reduction (vph)	0	51	0	0	0	0	0	0	13	0	0	5
Lane Group Flow (vph)	142	163	0	163	16	0	79	1805	61	58	2800	53
Heavy Vehicles (%)	0%	8%	0%	2%	0%	0%	8%	1%	2%	0%	1%	0%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	10.0	10.0		11.0	11.0		5.8	105.0	105.0	8.0	107.2	107.2
Effective Green, g (s)	10.0	10.0		11.0	11.0		5.8	105.0	105.0	8.0	107.2	107.2
Actuated g/C Ratio	0.07	0.07		0.07	0.07		0.04	0.70	0.70	0.05	0.71	0.71
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	120	111		130	139		65	2502	1108	96	2554	1154
v/s Ratio Prot	0.08	c0.10		c0.09	0.01		c0.05	0.51		0.03	c0.78	
v/s Ratio Perm									0.04			0.03
v/c Ratio	1.18	1.47		1.25	0.12		1.22	0.72	0.06	0.60	1.10	0.05
Uniform Delay, d1	70.0	70.0		69.5	65.0		72.1	13.6	7.0	69.5	21.4	6.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	0.80	0.46	1.00	1.00	1.00
Incremental Delay, d2	139.7	251.9		162.4	0.4		179.3	1.8	0.1	10.3	50.3	0.1
Delay (s)	209.7	321.9		231.9	65.3		251.3	12.7	3.3	79.7	71.7	6.4
Level of Service	F	F		F	E		F	B	A	E	E	A
Approach Delay (s)		277.1			217.0			22.0			70.5	
Approach LOS		F			F			C			E	

Intersection Summary				
HCM Average Control Delay	71.4	HCM Level of Service	E	
HCM Volume to Capacity ratio	1.14			
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	104.1%	ICU Level of Service	G	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	10	55	20	10	15	45	1625	35	65	3050	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	58	11	58	21	11	16	47	1711	37	68	3211	47
RTOR Reduction (vph)	0	0	49	0	0	16	0	0	9	0	0	9
Lane Group Flow (vph)	58	11	9	21	11	0	47	1711	28	68	3211	38
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	7.2	7.2	7.2	2.4	2.4	2.4	4.0	114.8	114.8	9.6	120.4	120.4
Effective Green, g (s)	7.2	7.2	7.2	2.4	2.4	2.4	4.0	114.8	114.8	9.6	120.4	120.4
Actuated g/C Ratio	0.05	0.05	0.05	0.02	0.02	0.02	0.03	0.77	0.77	0.06	0.80	0.80
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	85	89	76	28	30	25	47	2709	1212	113	2841	1271
v/s Ratio Prot	c0.03	0.01		c0.01	0.01		c0.03	0.48		0.04	c0.91	
v/s Ratio Perm			0.01			0.00			0.02			0.02
v/c Ratio	0.68	0.12	0.12	0.75	0.37	0.01	1.00	0.63	0.02	0.60	1.13	0.03
Uniform Delay, d1	70.3	68.4	68.4	73.5	73.0	72.6	73.0	8.0	4.2	68.3	14.8	3.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.28	0.04
Incremental Delay, d2	20.2	0.6	0.7	71.8	7.4	0.2	131.3	1.1	0.0	5.5	61.8	0.0
Delay (s)	90.5	69.0	69.1	145.3	80.5	72.8	204.3	9.1	4.2	64.2	65.9	0.1
Level of Service	F	E	E	F	F	E	F	A	A	E	E	A
Approach Delay (s)		78.9			106.3			14.1			65.0	
Approach LOS		E			F			B			E	

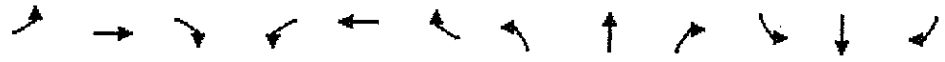
Intersection Summary			
HCM Average Control Delay	48.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	101.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1732	30	35	657	600	20	120	154	65	65	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	1863	1583	1770	1863	1583	1770	1764	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	1863	1583	1770	1863	1583	1770	1764	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	1823	32	37	692	632	21	126	162	68	68	37
RTOR Reduction (vph)	0	0	0	0	0	320	0	0	131	0	15	0
Lane Group Flow (vph)	53	1823	32	37	692	312	21	126	31	68	90	0
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			
Actuated Green, G (s)	12.9	68.9	68.9	3.2	59.2	59.2	2.4	23.2	23.2	8.7	29.5	
Effective Green, g (s)	12.9	68.9	68.9	3.2	59.2	59.2	2.4	23.2	23.2	8.7	29.5	
Actuated g/C Ratio	0.11	0.57	0.57	0.03	0.49	0.49	0.02	0.19	0.19	0.07	0.25	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	190	2032	909	47	919	781	35	360	306	128	434	
v/s Ratio Prot	0.03	c0.52		0.02	c0.37		0.01	c0.07		c0.04	0.05	
v/s Ratio Perm			0.02			0.20			0.02			
v/c Ratio	0.28	0.90	0.04	0.79	0.75	0.40	0.60	0.35	0.10	0.53	0.21	
Uniform Delay, d1	49.3	22.4	11.1	58.1	24.5	19.2	58.3	41.9	39.8	53.7	36.0	
Progression Factor	0.57	0.18	0.16	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.2	1.7	0.0	57.7	3.5	0.3	24.7	2.7	0.7	4.2	1.1	
Delay (s)	28.2	5.6	1.8	115.7	28.0	19.5	83.0	44.5	40.5	57.9	37.0	
Level of Service	C	A	A	F	C	B	F	D	D	E	D	
Approach Delay (s)		6.2			26.5			45.0			45.2	
Approach LOS		A			C			D			D	

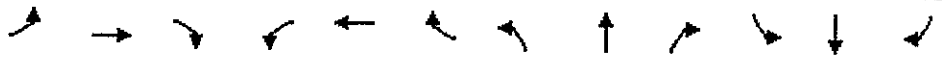
Intersection Summary			
HCM Average Control Delay	18.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

2030 Base Case
Level of Service
AM & PM Peak Hours



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	31	52	10	162	1156	197	1193	10	324	2323	590
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	0.88	0.97	0.91		0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3367	1827	1553	1736	1827	2733	3367	4981		3367	4988	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3367	1827	1553	1736	1827	2733	3367	4981		3367	4988	1553
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	60	31	52	10	162	1156	197	1193	10	324	2323	590
RTOR Reduction (vph)	0	0	50	0	0	58	0	1	0	0	0	167
Lane Group Flow (vph)	60	31	2	10	162	1098	197	1202	0	324	2323	423
Turn Type	Split		Perm	Split		pm+ov	Prot			Prot		Perm
Protected Phases	4	4		8	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	3.2	3.2	3.2	8.0	8.0	30.5	5.2	20.3		22.5	37.6	37.6
Effective Green, g (s)	3.2	3.2	3.2	8.0	8.0	30.5	5.2	20.3		22.5	37.6	37.6
Actuated g/C Ratio	0.05	0.05	0.05	0.11	0.11	0.44	0.07	0.29		0.32	0.54	0.54
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	154	84	71	198	209	1191	250	1444		1082	2679	834
v/s Ratio Prot	c0.02	0.02		0.01	0.09	c0.30	0.06	c0.24		0.10	c0.47	
v/s Ratio Perm			0.00			0.11						0.27
v/c Ratio	0.39	0.37	0.03	0.05	0.78	0.92	0.79	0.83		0.30	0.87	0.51
Uniform Delay, d1	32.5	32.4	31.9	27.6	30.1	18.6	31.9	23.3		17.8	14.0	10.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		0.96	0.95	1.63
Incremental Delay, d2	1.6	2.7	0.2	0.1	16.3	11.7	15.1	5.7		0.1	1.4	0.7
Delay (s)	34.1	35.2	32.1	27.7	46.4	30.3	46.9	29.0		17.2	14.8	17.6
Level of Service	C	D	C	C	D	C	D	C		B	B	B
Approach Delay (s)		33.6			32.3			31.5			15.5	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM Average Control Delay	23.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	51	1305	0	0	378	1845	190	0	77	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	1.00	0.91			0.95	0.88	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.99	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.96	1.00			
Satd. Flow (prot)	1736	4988			3471	2733	1649	1571	1475			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.96	1.00			
Satd. Flow (perm)	1736	4988			3471	2733	1649	1571	1475			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	54	1374	0	0	398	1942	200	0	81	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	898	0	4	51	0	0	0
Lane Group Flow (vph)	54	1374	0	0	398	1044	104	100	22	0	0	0
Turn Type	Prot					Prot	Prot		Perm			
Protected Phases	7	4			8	8	5	2				
Permitted Phases									2			
Actuated Green, G (s)	5.1	37.8			28.7	28.7	19.2	19.2	19.2			
Effective Green, g (s)	5.1	37.8			28.7	28.7	19.2	19.2	19.2			
Actuated g/C Ratio	0.08	0.58			0.44	0.44	0.30	0.30	0.30			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	136	2901			1533	1207	487	464	436			
v/s Ratio Prot	0.03	c0.28			0.11	c0.38	0.06	c0.06				
v/s Ratio Perm									0.01			
v/c Ratio	0.40	0.47			0.26	0.86	0.21	0.22	0.05			
Uniform Delay, d1	28.5	7.9			11.4	16.4	17.2	17.2	16.4			
Progression Factor	0.85	0.70			0.88	5.35	1.00	1.00	1.00			
Incremental Delay, d2	1.7	0.1			0.0	1.9	0.2	0.2	0.2			
Delay (s)	25.8	5.6			10.1	89.6	17.4	17.5	16.6			
Level of Service	C	A			B	F	B	B	B			
Approach Delay (s)		6.4			76.1			17.2			0.0	
Approach LOS		A			E			B			A	

Intersection Summary			
HCM Average Control Delay	47.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱	↰	↑↑					↰↰		↱
Volume (vph)	0	109	70	109	469	0	0	0	0	1250	0	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.95	1.00	1.00	0.95					0.97		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		3471	1553	1736	3471					3367		1553
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		3471	1553	1736	3471					3367		1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	115	74	115	494	0	0	0	0	1316	0	200
RTOR Reduction (vph)	0	0	66	0	0	0	0	0	0	0	0	54
Lane Group Flow (vph)	0	115	8	115	494	0	0	0	0	1316	0	146
Turn Type			Perm	Prot						Prot		custom
Protected Phases		4		3	8					1		
Permitted Phases			4									6
Actuated Green, G (s)		7.1	7.1	7.9	19.0					38.0		38.0
Effective Green, g (s)		7.1	7.1	7.9	19.0					38.0		38.0
Actuated g/C Ratio		0.11	0.11	0.12	0.29					0.58		0.58
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0		3.0
Lane Grp Cap (vph)		379	170	211	1015					1968		908
v/s Ratio Prot		0.03		0.07	c0.14					c0.39		
v/s Ratio Perm			0.01									0.09
v/c Ratio		0.30	0.05	0.55	0.49					0.67		0.16
Uniform Delay, d1		26.7	25.9	26.9	19.0					9.2		6.2
Progression Factor		1.00	1.00	0.64	1.00					1.00		1.00
Incremental Delay, d2		0.5	0.1	2.8	0.4					0.9		0.4
Delay (s)		27.1	26.0	20.0	19.4					10.1		6.6
Level of Service		C	C	B	B					B		A
Approach Delay (s)		26.7			19.5			0.0			9.6	
Approach LOS		C			B			A			A	

Intersection Summary			
HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	96	32	62	75	40	5	206	2110	130	10	3125	224
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00		1.00	1.00		1.00	0.91	1.00	1.00	0.91	1.00
Frt	1.00	0.90		1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	2575	1323		1612	1868		1612	5036	1599	1612	5187	1615
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	2575	1323		1612	1868		1612	5036	1599	1612	5187	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	96	32	62	75	40	5	206	2110	130	10	3125	224
RTOR Reduction (vph)	0	59	0	0	5	0	0	0	36	0	0	53
Lane Group Flow (vph)	96	35	0	75	40	0	206	2110	94	10	3125	171
Heavy Vehicles (%)	36%	63%	12%	12%	0%	0%	12%	3%	1%	12%	0%	0%
Turn Type	Split			Split			Prot		Prot	Prot		Perm
Protected Phases	4	4		8	8		5	2	2	1	6	
Permitted Phases												6
Actuated Green, G (s)	4.0	4.0		5.0	5.0		12.0	67.4	67.4	0.8	56.2	56.2
Effective Green, g (s)	4.0	4.0		5.0	5.0		12.0	67.4	67.4	0.8	56.2	56.2
Actuated g/C Ratio	0.04	0.04		0.05	0.05		0.13	0.72	0.72	0.01	0.60	0.60
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	111	57		86	100		208	3642	1156	14	3128	974
v/s Ratio Prot	c0.04	0.03		c0.05	0.02		c0.13	0.42	0.06	0.01	c0.60	
v/s Ratio Perm												0.11
v/c Ratio	0.86	0.61		0.87	0.40		0.99	0.58	0.08	0.71	1.00	0.18
Uniform Delay, d1	44.3	43.8		43.8	42.7		40.5	6.1	3.8	46.1	18.5	8.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	45.9	17.0		56.9	2.6		59.5	0.2	0.0	100.1	15.7	0.1
Delay (s)	90.2	60.8		100.6	45.3		100.0	6.4	3.8	146.2	34.2	8.3
Level of Service	F	E		F	D		F	A	A	F	C	A
Approach Delay (s)		75.7			79.9			14.1			32.8	
Approach LOS		E			E			B			C	

Intersection Summary				
HCM Average Control Delay	27.6	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.98			
Actuated Cycle Length (s)	93.2	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	92.6%	ICU Level of Service	F	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	60	125	120	85	100	370	1225	155	75	2200	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1736	1827	1553	1736	1827	1553	1736	3471	1553	1736	4988	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1736	1827	1553	1736	1827	1553	1736	3471	1553	1736	4988	1553
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	75	60	125	120	85	100	370	1225	155	75	2200	110
RTOR Reduction (vph)	0	0	9	0	0	76	0	0	46	0	0	42
Lane Group Flow (vph)	75	60	116	120	85	24	370	1225	109	75	2200	68
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	6.8	4.0	24.8	7.8	5.0	12.0	20.8	56.8	64.6	7.0	43.0	49.8
Effective Green, g (s)	6.8	4.0	24.8	7.8	5.0	12.0	20.8	56.8	64.6	7.0	43.0	49.8
Actuated g/C Ratio	0.07	0.04	0.27	0.09	0.05	0.13	0.23	0.62	0.71	0.08	0.47	0.54
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	129	80	420	148	100	203	394	2152	1163	133	2342	912
v/s Ratio Prot	c0.04	0.03	0.06	c0.07	0.05	0.01	c0.21	0.35	0.01	0.04	c0.44	0.01
v/s Ratio Perm			0.01			0.01			0.06			0.04
v/c Ratio	0.58	0.75	0.28	0.81	0.85	0.12	0.94	0.57	0.09	0.56	0.94	0.07
Uniform Delay, d1	41.0	43.3	26.3	41.2	42.9	35.1	34.8	10.2	4.3	40.8	23.1	9.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.5	32.0	0.4	27.4	45.4	0.3	29.9	0.3	0.0	5.4	8.1	0.0
Delay (s)	47.5	75.4	26.7	68.6	88.3	35.4	64.7	10.6	4.3	46.2	31.2	10.0
Level of Service	D	E	C	E	F	D	E	B	A	D	C	A
Approach Delay (s)		43.9			63.2			21.5			30.7	
Approach LOS		D			E			C			C	

Intersection Summary			
HCM Average Control Delay	30.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	91.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
5: Jameson Canyon & Kelly St

02/06/2008

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	1232	60	68	2173	930	35	50	73	15	30	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1736	4953		1736	3471	1553	1736	1827	1553	1736	1736	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1736	4953		1736	3471	1553	1736	1827	1553	1736	1736	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	95	1297	63	72	2287	979	37	53	77	16	32	16
RTOR Reduction (vph)	0	0	0	0	0	186	0	0	71	0	14	0
Lane Group Flow (vph)	95	1360	0	72	2287	793	37	53	6	16	34	0
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			
Actuated Green, G (s)	9.9	88.6		8.1	86.8	86.8	8.5	10.6	10.6	6.7	8.8	
Effective Green, g (s)	9.9	88.6		8.1	86.8	86.8	8.5	10.6	10.6	6.7	8.8	
Actuated g/C Ratio	0.08	0.68		0.06	0.67	0.67	0.07	0.08	0.08	0.05	0.07	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	132	3376		108	2318	1037	114	149	127	89	118	
v/s Ratio Prot	c0.05	0.27		0.04	c0.66		c0.02	c0.03		0.01	0.02	
v/s Ratio Perm						0.51			0.00			
v/c Ratio	0.72	0.40		0.67	0.99	0.76	0.32	0.36	0.05	0.18	0.29	
Uniform Delay, d1	58.7	9.1		59.6	21.0	14.7	58.0	56.5	55.1	59.0	57.6	
Progression Factor	0.98	0.90		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	16.2	0.1		14.5	15.5	3.4	1.7	6.5	0.7	1.0	6.1	
Delay (s)	73.9	8.2		74.1	36.5	18.1	59.7	63.0	55.8	60.0	63.7	
Level of Service	E	A		E	D	B	E	E	E	E	E	
Approach Delay (s)		12.5			31.9			58.9			62.8	
Approach LOS		B			C			E			E	

Intersection Summary			
HCM Average Control Delay	27.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	80	193	10	51	1282	95	2144	10	704	2229	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	0.88	0.97	0.91		0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	1863	1583	1770	1863	2787	3433	5082		3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	1863	1583	1770	1863	2787	3433	5082		3433	5085	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	200	80	193	10	51	1282	95	2144	10	704	2229	85
RTOR Reduction (vph)	0	0	36	0	0	1	0	1	0	0	0	26
Lane Group Flow (vph)	200	80	157	10	51	1281	95	2153	0	704	2229	59
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot			Prot		Perm
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	7.0	13.4	23.2	0.8	7.2	57.2	9.8	53.0		50.0	93.2	93.2
Effective Green, g (s)	7.0	13.4	23.2	0.8	7.2	57.2	9.8	53.0		50.0	93.2	93.2
Actuated g/C Ratio	0.05	0.10	0.17	0.01	0.05	0.43	0.07	0.40		0.38	0.70	0.70
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	180	187	276	11	101	1197	253	2022		1289	3558	1108
v/s Ratio Prot	c0.06	0.04	0.04	0.01	0.03	c0.40	0.03	c0.42		0.21	0.44	
v/s Ratio Perm			0.06			0.06						0.04
v/c Ratio	1.11	0.43	0.57	0.91	0.50	1.07	0.38	1.06		0.55	0.63	0.05
Uniform Delay, d1	63.1	56.3	50.4	66.2	61.3	38.0	58.8	40.1		32.7	10.7	6.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	100.0	1.6	2.7	217.6	3.9	46.9	0.9	39.9		0.5	0.3	0.0
Delay (s)	163.1	57.9	53.1	283.7	65.2	84.9	59.7	80.0		33.2	11.0	6.3
Level of Service	F	E	D	F	E	F	E	F		C	B	A
Approach Delay (s)		100.4			85.7			79.2			16.1	
Approach LOS		F			F			E			B	

Intersection Summary				
HCM Average Control Delay	54.9	HCM Level of Service	D	
HCM Volume to Capacity ratio	1.07			
Actuated Cycle Length (s)	133.2	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	102.2%	ICU Level of Service	G	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	233	2133	0	0	133	845	70	0	1092	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	1.00	0.91			0.95	0.88	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	1770	5085			3539	2787	1681	1443	1504			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	1770	5085			3539	2787	1681	1443	1504			
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	233	2133	0	0	133	845	70	0	1092	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	632	0	1	1	0	0	0
Lane Group Flow (vph)	233	2133	0	0	133	213	63	552	545	0	0	0
Turn Type	Prot					Perm	Prot		Perm			
Protected Phases	7	4			8		5	2				
Permitted Phases						8			2			
Actuated Green, G (s)	14.3	41.0			22.7	22.7	41.0	41.0	41.0			
Effective Green, g (s)	14.3	41.0			22.7	22.7	41.0	41.0	41.0			
Actuated g/C Ratio	0.16	0.46			0.25	0.25	0.46	0.46	0.46			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	281	2317			893	703	766	657	685			
v/s Ratio Prot	0.13	c0.42			0.04		0.04	c0.38				
v/s Ratio Perm						0.08			0.36			
v/c Ratio	0.83	0.92			0.15	0.30	0.08	0.84	0.80			
Uniform Delay, d1	36.7	23.0			26.1	27.2	13.9	21.6	20.9			
Progression Factor	0.75	0.69			1.06	3.16	1.00	1.00	1.00			
Incremental Delay, d2	10.5	3.6			0.1	0.2	0.0	9.5	9.3			
Delay (s)	37.8	19.4			27.8	86.3	13.9	31.1	30.3			
Level of Service	D	B			C	F	B	C	C			
Approach Delay (s)		21.2			78.3			29.8			0.0	
Approach LOS		C			E			C			A	

Intersection Summary			
HCM Average Control Delay	35.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	136.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱	↰	↑↑					↰↰		↱
Volume (vph)	0	426	210	90	113	0	0	0	0	1940	0	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.95	1.00	1.00	0.95					0.97		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		3539	1583	1770	3539					3433		1583
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		3539	1583	1770	3539					3433		1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	426	210	90	113	0	0	0	0	1940	0	80
RTOR Reduction (vph)	0	0	180	0	0	0	0	0	0	0	0	27
Lane Group Flow (vph)	0	426	30	90	113	0	0	0	0	1940	0	53
Turn Type			Perm	Prot						Prot		custom
Protected Phases		4		3	8					1		
Permitted Phases			4									6
Actuated Green, G (s)		12.9	12.9	5.9	22.8					59.2		59.2
Effective Green, g (s)		12.9	12.9	5.9	22.8					59.2		59.2
Actuated g/C Ratio		0.14	0.14	0.07	0.25					0.66		0.66
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0		3.0
Lane Grp Cap (vph)		507	227	116	897					2258		1041
v/s Ratio Prot		c0.12		c0.05	0.03					c0.57		
v/s Ratio Perm			0.02									0.03
v/c Ratio		0.84	0.13	0.78	0.13					0.86		0.05
Uniform Delay, d1		37.5	33.7	41.4	25.9					12.1		5.5
Progression Factor		1.00	1.00	0.37	0.60					1.00		1.00
Incremental Delay, d2		11.9	0.3	26.9	0.1					3.5		0.1
Delay (s)		49.5	33.9	42.3	15.5					15.6		5.5
Level of Service		D	C	D	B					B		A
Approach Delay (s)		44.3			27.4			0.0			15.2	
Approach LOS		D			C			A			B	

Intersection Summary			
HCM Average Control Delay	22.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	136.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	150	83	168	170	12	5	56	3490	80	25	2680	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.91	1.00	1.00	0.91	1.00
Frt	1.00	0.90		1.00	0.96		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	1665		1770	1816		1671	5136	1583	1805	5136	1615
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1805	1665		1770	1816		1671	5136	1583	1805	5136	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	150	83	168	170	12	5	56	3490	80	25	2680	83
RTOR Reduction (vph)	0	56	0	0	5	0	0	0	12	0	0	16
Lane Group Flow (vph)	150	195	0	170	12	0	56	3490	68	25	2680	67
Heavy Vehicles (%)	0%	8%	0%	2%	0%	0%	8%	1%	2%	0%	1%	0%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	12.0	12.0		12.0	12.0		6.9	87.0	87.0	2.4	82.5	82.5
Effective Green, g (s)	12.0	12.0		12.0	12.0		6.9	87.0	87.0	2.4	82.5	82.5
Actuated g/C Ratio	0.09	0.09		0.09	0.09		0.05	0.67	0.67	0.02	0.64	0.64
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	167	154		164	168		89	3453	1064	33	3274	1030
v/s Ratio Prot	0.08	c0.12		c0.10	0.01		0.03	c0.68		0.01	c0.52	
v/s Ratio Perm									0.04			0.04
v/c Ratio	0.90	1.26		1.04	0.07		0.63	1.01	0.06	0.76	0.82	0.07
Uniform Delay, d1	58.1	58.7		58.7	53.6		60.0	21.2	7.3	63.2	17.8	8.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	41.2	160.5		80.3	0.2		13.1	18.0	0.0	65.1	1.7	0.0
Delay (s)	99.3	219.2		139.0	53.8		73.1	39.2	7.3	128.3	19.5	8.9
Level of Service	F	F		F	D		E	D	A	F	B	A
Approach Delay (s)		174.4			131.2			39.0			20.1	
Approach LOS		F			F			D			C	

Intersection Summary				
HCM Average Control Delay	41.7	HCM Level of Service	D	
HCM Volume to Capacity ratio	1.02			
Actuated Cycle Length (s)	129.4	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	101.5%	ICU Level of Service	G	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	125	330	195	135	55	235	2084	175	230	2137	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	3539	1583	1770	5085	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	110	125	330	195	135	55	235	2084	175	230	2137	65
RTOR Reduction (vph)	0	0	9	0	0	14	0	0	27	0	0	20
Lane Group Flow (vph)	110	125	321	195	135	41	235	2084	148	230	2137	45
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	7.0	7.0	28.2	11.0	11.0	24.0	21.2	63.0	74.0	13.0	54.8	61.8
Effective Green, g (s)	7.0	7.0	28.2	11.0	11.0	24.0	21.2	63.0	74.0	13.0	54.8	61.8
Actuated g/C Ratio	0.06	0.06	0.26	0.10	0.10	0.22	0.19	0.57	0.67	0.12	0.50	0.56
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	113	119	406	177	186	345	341	2027	1065	209	2533	889
v/s Ratio Prot	0.06	c0.07	0.15	c0.11	c0.07	0.01	0.13	c0.59	0.01	c0.13	0.42	0.00
v/s Ratio Perm			0.05			0.01			0.08			0.03
v/c Ratio	0.97	1.05	0.79	1.10	0.73	0.12	0.69	1.03	0.14	1.10	0.84	0.05
Uniform Delay, d1	51.4	51.5	38.1	49.5	48.0	34.5	41.3	23.5	6.5	48.5	23.9	10.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	75.7	96.7	10.1	97.5	13.1	0.2	5.7	27.6	0.1	91.7	3.6	0.0
Delay (s)	127.2	148.2	48.2	147.0	61.2	34.7	47.0	51.1	6.6	140.2	27.5	10.9
Level of Service	F	F	D	F	E	C	D	D	A	F	C	B
Approach Delay (s)		85.7			100.9			47.6			37.7	
Approach LOS		F			F			D			D	

Intersection Summary			
HCM Average Control Delay	50.7	HCM Level of Service	D
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	101.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
5: Jameson Canyon & Kelly St

28/05/2008

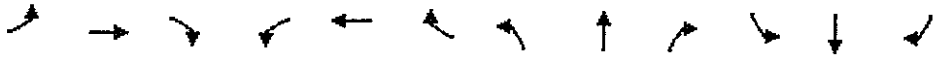
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	3140	30	36	928	700	15	50	88	70	70	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5078		1770	3539	1583	1770	1863	1583	1770	1770	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5078		1770	3539	1583	1770	1863	1583	1770	1770	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	55	3140	30	36	928	700	15	50	88	70	70	35
RTOR Reduction (vph)	0	0	0	0	0	289	0	0	84	0	20	0
Lane Group Flow (vph)	55	3170	0	36	928	411	15	50	4	70	85	0
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			
Actuated Green, G (s)	6.3	56.3		2.8	52.8	52.8	1.2	4.0	4.0	10.9	13.7	
Effective Green, g (s)	6.3	56.3		2.8	52.8	52.8	1.2	4.0	4.0	10.9	13.7	
Actuated g/C Ratio	0.07	0.63		0.03	0.59	0.59	0.01	0.04	0.04	0.12	0.15	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	124	3177		55	2076	929	24	83	70	214	269	
v/s Ratio Prot	0.03	c0.62		0.02	c0.26		0.01	c0.03		c0.04	c0.05	
v/s Ratio Perm						0.26			0.00			
v/c Ratio	0.44	1.00		0.65	0.45	0.44	0.62	0.60	0.06	0.33	0.31	
Uniform Delay, d1	40.2	16.8		43.1	10.4	10.4	44.2	42.2	41.2	36.2	34.0	
Progression Factor	1.07	0.56		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.1	10.0		24.6	0.2	0.3	41.4	28.4	1.5	0.9	3.0	
Delay (s)	44.2	19.4		67.7	10.6	10.7	85.5	70.6	42.7	37.1	37.0	
Level of Service	D	B		E	B	B	F	E	D	D	D	
Approach Delay (s)		19.8			11.9			56.0			37.0	
Approach LOS		B			B			E			D	

Intersection Summary			
HCM Average Control Delay	18.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	80.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

2030 Base Case + Project
Level of Service
AM & PM Peak Hours

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	35	58	10	170	1159	208	1197	10	326	2326	590
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	0.88	0.97	0.91		0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3367	1827	1553	1736	1827	2733	3367	4981		3367	4988	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3367	1827	1553	1736	1827	2733	3367	4981		3367	4988	1553
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	60	35	58	10	170	1159	208	1197	10	326	2326	590
RTOR Reduction (vph)	0	0	55	0	0	56	0	1	0	0	0	148
Lane Group Flow (vph)	60	35	3	10	170	1103	208	1206	0	326	2326	442
Turn Type	Split		Perm	Split		pm+ov	Prot			Prot		Perm
Protected Phases	4	4		8	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	3.1	3.1	3.1	7.0	7.0	29.8	5.0	20.3		22.8	38.1	38.1
Effective Green, g (s)	3.1	3.1	3.1	7.0	7.0	29.8	5.0	20.3		22.8	38.1	38.1
Actuated g/C Ratio	0.04	0.04	0.04	0.10	0.10	0.43	0.07	0.29		0.33	0.55	0.55
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	151	82	70	176	185	1177	243	1461		1109	2746	855
v/s Ratio Prot	0.02	c0.02		0.01	0.09	c0.31	0.06	c0.24		0.10	c0.47	
v/s Ratio Perm			0.00			0.09						0.28
v/c Ratio	0.40	0.43	0.04	0.06	0.92	0.94	0.86	0.83		0.29	0.85	0.52
Uniform Delay, d1	32.1	32.2	31.6	28.1	30.8	18.8	31.7	22.8		17.2	13.1	9.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.7	3.5	0.2	0.1	43.2	13.6	24.3	3.9		0.1	2.6	0.5
Delay (s)	33.9	35.7	31.8	28.3	74.0	32.4	56.1	26.7		17.4	15.7	10.3
Level of Service	C	D	C	C	E	C	E	C		B	B	B
Approach Delay (s)		33.5			37.7			31.1			14.9	
Approach LOS		C			D			C			B	

Intersection Summary				
HCM Average Control Delay	24.0	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.81			
Actuated Cycle Length (s)	69.2	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	77.2%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	53	1306	0	0	388	1845	190	0	79	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	1.00	0.91			0.95	0.88	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.99	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.96	1.00			
Satd. Flow (prot)	1736	4988			3471	2733	1649	1571	1475			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.96	1.00			
Satd. Flow (perm)	1736	4988			3471	2733	1649	1571	1475			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	56	1375	0	0	408	1942	200	0	83	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	890	0	4	52	0	0	0
Lane Group Flow (vph)	56	1375	0	0	408	1052	104	100	23	0	0	0
Turn Type	Prot					Prot	Prot		Perm			
Protected Phases	7	4			8	8	5	2				
Permitted Phases									2			
Actuated Green, G (s)	5.0	37.9			28.9	28.9	19.1	19.1	19.1			
Effective Green, g (s)	5.0	37.9			28.9	28.9	19.1	19.1	19.1			
Actuated g/C Ratio	0.08	0.58			0.44	0.44	0.29	0.29	0.29			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	134	2908			1543	1215	485	462	433			
v/s Ratio Prot	0.03	c0.28			0.12	c0.38	0.06	c0.06				
v/s Ratio Perm									0.02			
v/c Ratio	0.42	0.47			0.26	0.87	0.21	0.22	0.05			
Uniform Delay, d1	28.6	7.8			11.4	16.3	17.3	17.3	16.5			
Progression Factor	0.82	0.72			0.88	5.40	1.00	1.00	1.00			
Incremental Delay, d2	1.9	0.1			0.0	1.8	0.2	0.2	0.2			
Delay (s)	25.3	5.7			10.0	89.8	17.5	17.5	16.7			
Level of Service	C	A			B	F	B	B	B			
Approach Delay (s)		6.5			76.0			17.3			0.0	
Approach LOS		A			E			B			A	

Intersection Summary			
HCM Average Control Delay	47.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱	↰	↑↑					↰↰		↱
Volume (vph)	0	109	70	109	469	0	0	0	0	1250	0	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.95	1.00	1.00	0.95					0.97		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		3471	1553	1736	3471					3367		1553
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		3471	1553	1736	3471					3367		1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	115	74	115	494	0	0	0	0	1316	0	200
RTOR Reduction (vph)	0	0	66	0	0	0	0	0	0	0	0	48
Lane Group Flow (vph)	0	115	8	115	494	0	0	0	0	1316	0	152
Turn Type			Perm	Prot						Prot		custom
Protected Phases		4		3	8					1		
Permitted Phases			4									6
Actuated Green, G (s)		7.4	7.4	7.4	18.8					38.2		38.2
Effective Green, g (s)		7.4	7.4	7.4	18.8					38.2		38.2
Actuated g/C Ratio		0.11	0.11	0.11	0.29					0.59		0.59
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0		3.0
Lane Grp Cap (vph)		395	177	198	1004					1979		913
v/s Ratio Prot		0.03		0.07	c0.14					c0.39		
v/s Ratio Perm			0.01									0.10
v/c Ratio		0.29	0.05	0.58	0.49					0.66		0.17
Uniform Delay, d1		26.4	25.7	27.3	19.1					9.1		6.1
Progression Factor		1.00	1.00	1.10	0.99					1.00		1.00
Incremental Delay, d2		0.4	0.1	4.2	0.4					0.9		0.4
Delay (s)		26.8	25.8	34.2	19.2					9.9		6.5
Level of Service		C	C	C	B					A		A
Approach Delay (s)		26.4			22.1			0.0			9.5	
Approach LOS		C			C			A			A	

Intersection Summary				
HCM Average Control Delay	14.2	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.61			
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0	
Intersection Capacity Utilization	83.9%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	96	32	62	75	40	5	206	2110	130	10	3125	224
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.91	1.00	1.00	0.91	1.00
Frt	1.00	0.90		1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1327	1323		1612	1868		1612	5036	1599	1612	5187	1615
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1327	1323		1612	1868		1612	5036	1599	1612	5187	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	96	32	62	75	40	5	206	2110	130	10	3125	224
RTOR Reduction (vph)	0	58	0	0	5	0	0	0	39	0	0	53
Lane Group Flow (vph)	96	36	0	75	40	0	206	2110	91	10	3125	171
Heavy Vehicles (%)	36%	63%	12%	12%	0%	0%	12%	3%	1%	12%	0%	0%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	6.0	6.0		5.0	5.0		11.0	65.4	65.4	0.8	55.2	55.2
Effective Green, g (s)	6.0	6.0		5.0	5.0		11.0	65.4	65.4	0.8	55.2	55.2
Actuated g/C Ratio	0.06	0.06		0.05	0.05		0.12	0.70	0.70	0.01	0.59	0.59
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	85	85		86	100		190	3534	1122	14	3072	957
v/s Ratio Prot	c0.07	0.03		c0.05	0.02		c0.13	0.42		0.01	c0.60	
v/s Ratio Perm									0.06			0.11
v/c Ratio	1.13	0.42		0.87	0.40		1.08	0.60	0.08	0.71	1.02	0.18
Uniform Delay, d1	43.6	41.9		43.8	42.7		41.1	7.1	4.4	46.1	19.0	8.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	136.9	3.4		56.9	2.6		89.5	0.3	0.0	100.1	20.7	0.1
Delay (s)	180.5	45.3		100.6	45.3		130.6	7.4	4.4	146.2	39.7	8.8
Level of Service	F	D		F	D		F	A	A	F	D	A
Approach Delay (s)		113.6			79.9			17.6			38.0	
Approach LOS		F			E			B			D	

Intersection Summary				
HCM Average Control Delay	33.0	HCM Level of Service	C	
HCM Volume to Capacity ratio	1.03			
Actuated Cycle Length (s)	93.2	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	93.8%	ICU Level of Service	F	
Analysis Period (min)	15			

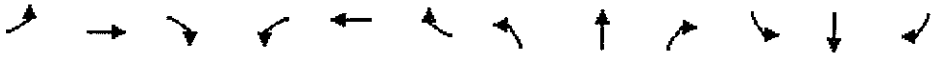
c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	60	125	120	85	100	370	1225	155	75	2200	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1736	1827	1553	1736	1827	1553	1736	3471	1553	1736	4988	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1736	1827	1553	1736	1827	1553	1736	3471	1553	1736	4988	1553
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	75	60	125	120	85	100	370	1225	155	75	2200	110
RTOR Reduction (vph)	0	0	17	0	0	65	0	0	45	0	0	42
Lane Group Flow (vph)	75	60	108	120	85	35	370	1225	110	75	2200	68
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov	Prot		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.7	3.2	24.2	7.0	5.5	12.3	21.0	56.6	63.6	6.8	42.4	47.1
Effective Green, g (s)	4.7	3.2	24.2	7.0	5.5	12.3	21.0	56.6	63.6	6.8	42.4	47.1
Actuated g/C Ratio	0.05	0.04	0.27	0.08	0.06	0.14	0.23	0.63	0.71	0.08	0.47	0.53
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	91	65	419	136	112	213	407	2193	1172	132	2360	886
v/s Ratio Prot	c0.04	0.03	0.06	c0.07	0.05	0.01	c0.21	0.35	0.01	0.04	c0.44	0.00
v/s Ratio Perm			0.01			0.01			0.06			0.04
v/c Ratio	0.82	0.92	0.26	0.88	0.76	0.17	0.91	0.56	0.09	0.57	0.93	0.08
Uniform Delay, d1	42.0	43.1	25.7	40.9	41.4	34.1	33.4	9.4	4.0	40.0	22.2	10.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	42.8	84.3	0.3	43.9	25.1	0.4	23.6	0.3	0.0	5.5	7.5	0.0
Delay (s)	84.9	127.4	26.0	84.8	66.5	34.5	56.9	9.7	4.1	45.5	29.7	10.5
Level of Service	F	F	C	F	E	C	E	A	A	D	C	B
Approach Delay (s)		66.4			63.2			19.2			29.3	
Approach LOS		E			E			B			C	

Intersection Summary				
HCM Average Control Delay	29.8	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.89			
Actuated Cycle Length (s)	89.6	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	86.3%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

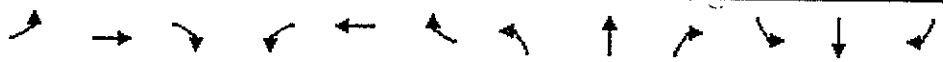
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱	↰	↑↑					↑↑		↱
Volume (vph)	0	109	70	109	469	0	0	0	0	1250	0	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.95	1.00	1.00	0.95					0.97		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		3471	1553	1736	3471					3367		1553
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		3471	1553	1736	3471					3367		1553
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	115	74	115	494	0	0	0	0	1316	0	200
RTOR Reduction (vph)	0	0	66	0	0	0	0	0	0	0	0	48
Lane Group Flow (vph)	0	115	8	115	494	0	0	0	0	1316	0	152
Turn Type			Perm	Prot						Prot		custom
Protected Phases		4		3	8					1		
Permitted Phases			4									6
Actuated Green, G (s)		7.4	7.4	7.4	18.8					38.2		38.2
Effective Green, g (s)		7.4	7.4	7.4	18.8					38.2		38.2
Actuated g/C Ratio		0.11	0.11	0.11	0.29					0.59		0.59
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0		3.0
Lane Grp Cap (vph)		395	177	198	1004					1979		913
v/s Ratio Prot		0.03		0.07	c0.14					c0.39		
v/s Ratio Perm			0.01									0.10
v/c Ratio		0.29	0.05	0.58	0.49					0.66		0.17
Uniform Delay, d1		26.4	25.7	27.3	19.1					9.1		6.1
Progression Factor		1.00	1.00	1.10	0.99					1.00		1.00
Incremental Delay, d2		0.4	0.1	4.2	0.4					0.9		0.4
Delay (s)		26.8	25.8	34.2	19.2					9.9		6.5
Level of Service		C	C	C	B					A		A
Approach Delay (s)		26.4			22.1			0.0			9.5	
Approach LOS		C			C			A			A	

Intersection Summary				
HCM Average Control Delay	14.2	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.61			
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0	
Intersection Capacity Utilization	83.9%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	53	1306	0	0	388	1845	190	0	79	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	1.00	0.91			0.95	0.88	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.99	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.96	1.00			
Satd. Flow (prot)	1736	4988			3471	2733	1649	1571	1475			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.96	1.00			
Satd. Flow (perm)	1736	4988			3471	2733	1649	1571	1475			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	56	1375	0	0	408	1942	200	0	83	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	737	0	4	56	0	0	0
Lane Group Flow (vph)	56	1375	0	0	408	1205	104	100	19	0	0	0
Turn Type	Prot					Prot	Prot		Perm			
Protected Phases	7	4			8	8	5	2				
Permitted Phases									2			
Actuated Green, G (s)	2.4	40.3			33.9	33.9	16.7	16.7	16.7			
Effective Green, g (s)	2.4	40.3			33.9	33.9	16.7	16.7	16.7			
Actuated g/C Ratio	0.04	0.62			0.52	0.52	0.26	0.26	0.26			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	64	3093			1810	1425	424	404	379			
v/s Ratio Prot	0.03	c0.28			0.12	c0.44	0.06	c0.06				
v/s Ratio Perm									0.01			
v/c Ratio	0.88	0.44			0.23	0.85	0.25	0.25	0.05			
Uniform Delay, d1	31.2	6.5			8.4	13.3	19.2	19.2	18.2			
Progression Factor	0.85	0.76			0.89	5.27	1.00	1.00	1.00			
Incremental Delay, d2	64.7	0.1			0.0	1.3	0.3	0.3	0.3			
Delay (s)	91.1	5.0			7.5	71.4	19.5	19.5	18.4			
Level of Service	F	A			A	E	B	B	B			
Approach Delay (s)		8.3			60.3			19.2			0.0	
Approach LOS		A			E			B			A	

Intersection Summary			
HCM Average Control Delay	39.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	1235	60	75	2183	930	35	50	77	15	30	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1736	4953		1736	3471	1553	1736	1827	1553	1736	1736	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1736	4953		1736	3471	1553	1736	1827	1553	1736	1736	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	95	1300	63	79	2298	979	37	53	81	16	32	16
RTOR Reduction (vph)	0	0	0	0	0	194	0	0	73	0	15	0
Lane Group Flow (vph)	95	1363	0	79	2298	785	37	53	8	16	33	0
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			
Actuated Green, G (s)	8.2	86.1		8.9	86.8	86.8	7.2	12.6	12.6	6.4	11.8	
Effective Green, g (s)	8.2	86.1		8.9	86.8	86.8	7.2	12.6	12.6	6.4	11.8	
Actuated g/C Ratio	0.06	0.66		0.07	0.67	0.67	0.06	0.10	0.10	0.05	0.09	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	110	3280		119	2318	1037	96	177	151	85	158	
v/s Ratio Prot	c0.05	0.28		0.05	c0.66		c0.02	c0.03		0.01	0.02	
v/s Ratio Perm						0.51			0.01			
v/c Ratio	0.86	0.42		0.66	0.99	0.76	0.39	0.30	0.05	0.19	0.21	
Uniform Delay, d1	60.3	10.2		59.1	21.2	14.5	59.3	54.6	53.3	59.3	54.8	
Progression Factor	1.02	0.86		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	44.2	0.1		13.1	16.6	3.2	2.6	4.3	0.7	1.1	3.0	
Delay (s)	105.8	8.9		72.2	37.9	17.7	61.8	58.9	53.9	60.4	57.8	
Level of Service	F	A		E	D	B	E	E	D	E	E	
Approach Delay (s)		15.2			32.8			57.2			58.5	
Approach LOS		B			C			E			E	

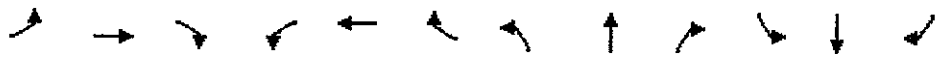
Intersection Summary			
HCM Average Control Delay	28.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	91	208	10	55	1283	100	2146	10	705	2231	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	0.88	0.97	0.91		0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	1863	1583	1770	1863	2787	3433	5082		3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	1863	1583	1770	1863	2787	3433	5082		3433	5085	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	200	91	208	10	55	1283	100	2146	10	705	2231	85
RTOR Reduction (vph)	0	0	36	0	0	1	0	1	0	0	0	26
Lane Group Flow (vph)	200	91	172	10	55	1282	100	2155	0	705	2231	59
Turn Type	Prot		pm+ov	Prot		pm+ov	Prot			Prot		Perm
Protected Phases	7	4	5	3	8	1	5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	7.0	13.4	23.4	0.8	7.2	57.2	10.0	53.0		50.0	93.0	93.0
Effective Green, g (s)	7.0	13.4	23.4	0.8	7.2	57.2	10.0	53.0		50.0	93.0	93.0
Actuated g/C Ratio	0.05	0.10	0.18	0.01	0.05	0.43	0.08	0.40		0.38	0.70	0.70
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	180	187	278	11	101	1197	258	2022		1289	3550	1105
v/s Ratio Prot	c0.06	0.05	0.05	0.01	0.03	c0.40	0.03	c0.42		0.21	0.44	
v/s Ratio Perm			0.06			0.06						0.04
v/c Ratio	1.11	0.49	0.62	0.91	0.54	1.07	0.39	1.07		0.55	0.63	0.05
Uniform Delay, d1	63.1	56.6	50.8	66.2	61.4	38.0	58.7	40.1		32.7	10.8	6.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	100.0	2.0	4.0	217.6	5.9	47.2	1.0	40.3		0.5	0.4	0.0
Delay (s)	163.1	58.6	54.8	283.7	67.3	85.2	59.7	80.4		33.2	11.2	6.3
Level of Service	F	E	D	F	E	F	E	F		C	B	A
Approach Delay (s)		98.9			86.0			79.5			16.2	
Approach LOS		F			F			E			B	

Intersection Summary			
HCM Average Control Delay	55.2	HCM Level of Service	E
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	133.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	102.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	237	2137	0	0	137	845	70	0	1095	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Lane Util. Factor	1.00	0.91			0.95	0.88	0.95	0.91	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	0.85	0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (prot)	1770	5085			3539	2787	1681	1443	1504			
Flt Permitted	0.95	1.00			1.00	1.00	0.95	1.00	1.00			
Satd. Flow (perm)	1770	5085			3539	2787	1681	1443	1504			
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	237	2137	0	0	137	845	70	0	1095	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	629	0	1	1	0	0	0
Lane Group Flow (vph)	237	2137	0	0	137	216	63	554	546	0	0	0
Turn Type	Prot					Perm	Prot		Perm			
Protected Phases	7	4			8		5	2				
Permitted Phases						8			2			
Actuated Green, G (s)	15.0	42.0			23.0	23.0	40.0	40.0	40.0			
Effective Green, g (s)	15.0	42.0			23.0	23.0	40.0	40.0	40.0			
Actuated g/C Ratio	0.17	0.47			0.26	0.26	0.44	0.44	0.44			
Clearance Time (s)	4.0	4.0			4.0	4.0	4.0	4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0			
Lane Grp Cap (vph)	295	2373			904	712	747	641	668			
v/s Ratio Prot	0.13	c0.42			0.04		0.04	c0.38				
v/s Ratio Perm						0.08			0.36			
v/c Ratio	0.80	0.90			0.15	0.30	0.08	0.86	0.82			
Uniform Delay, d1	36.1	22.1			25.9	27.0	14.4	22.5	21.8			
Progression Factor	0.81	0.66			1.02	2.84	1.00	1.00	1.00			
Incremental Delay, d2	9.3	2.7			0.1	0.2	0.0	11.6	10.7			
Delay (s)	38.4	17.3			26.4	76.9	14.5	34.2	32.5			
Level of Service	D	B			C	E	B	C	C			
Approach Delay (s)		19.4			69.9			32.3			0.0	
Approach LOS		B			E			C			A	

Intersection Summary			
HCM Average Control Delay	33.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	136.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↱	↰	↑↑					↰↰		↱
Volume (vph)	0	434	210	91	116	0	0	0	0	1940	0	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.95	1.00	1.00	0.95					0.97		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		3539	1583	1770	3539					3433		1583
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		3539	1583	1770	3539					3433		1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	434	210	91	116	0	0	0	0	1940	0	80
RTOR Reduction (vph)	0	0	178	0	0	0	0	0	0	0	0	28
Lane Group Flow (vph)	0	434	32	91	116	0	0	0	0	1940	0	52
Turn Type			Perm	Prot						Prot		custom
Protected Phases		4		3	8					1		
Permitted Phases			4									6
Actuated Green, G (s)		13.7	13.7	5.6	23.3					58.7		58.7
Effective Green, g (s)		13.7	13.7	5.6	23.3					58.7		58.7
Actuated g/C Ratio		0.15	0.15	0.06	0.26					0.65		0.65
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0		3.0
Lane Grp Cap (vph)		539	241	110	916					2239		1032
v/s Ratio Prot		c0.12		c0.05	0.03					c0.57		
v/s Ratio Perm			0.02									0.03
v/c Ratio		0.81	0.13	0.83	0.13					0.87		0.05
Uniform Delay, d1		36.9	33.0	41.7	25.6					12.5		5.6
Progression Factor		1.00	1.00	0.50	0.59					1.00		1.00
Incremental Delay, d2		8.6	0.3	37.5	0.1					3.8		0.1
Delay (s)		45.4	33.3	58.3	15.0					16.3		5.7
Level of Service		D	C	E	B					B		A
Approach Delay (s)		41.4			34.1			0.0			15.9	
Approach LOS		D			C			A			B	

Intersection Summary				
HCM Average Control Delay	22.9	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.85			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	136.6%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Signalized Intersection Capacity Analysis
17: South Kelly & SR29

29/05/2008

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	165	94	171	170	15	5	59	3490	80	25	2680	93
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.91	1.00	1.00	0.91	1.00
Frt	1.00	0.90		1.00	0.96		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	1669		1770	1829		1671	5136	1583	1805	5136	1615
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1805	1669		1770	1829		1671	5136	1583	1805	5136	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	165	94	171	170	15	5	59	3490	80	25	2680	93
RTOR Reduction (vph)	0	47	0	0	5	0	0	0	11	0	0	17
Lane Group Flow (vph)	165	218	0	170	15	0	59	3490	69	25	2680	76
Heavy Vehicles (%)	0%	8%	0%	2%	0%	0%	8%	1%	2%	0%	1%	0%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	16.0	16.0		13.0	13.0		5.5	91.8	91.8	2.4	88.7	88.7
Effective Green, g (s)	16.0	16.0		13.0	13.0		5.5	91.8	91.8	2.4	88.7	88.7
Actuated g/C Ratio	0.11	0.11		0.09	0.09		0.04	0.66	0.66	0.02	0.64	0.64
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	207	192		165	171		66	3387	1044	31	3273	1029
v/s Ratio Prot	0.09	c0.13		c0.10	0.01		0.04	c0.68		0.01	c0.52	
v/s Ratio Perm									0.04			0.05
v/c Ratio	0.80	1.14		1.03	0.09		0.89	1.03	0.07	0.81	0.82	0.07
Uniform Delay, d1	60.0	61.6		63.1	57.7		66.6	23.7	8.4	68.2	19.2	9.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	18.9	106.3		78.3	0.2		74.2	24.0	0.0	83.8	1.7	0.0
Delay (s)	78.9	167.9		141.4	57.9		140.7	47.7	8.5	152.0	20.8	9.6
Level of Service	E	F		F	E		F	D	A	F	C	A
Approach Delay (s)		133.7			132.6			48.3			21.6	
Approach LOS		F			F			D			C	

Intersection Summary				
HCM Average Control Delay	45.2	HCM Level of Service	D	
HCM Volume to Capacity ratio	1.02			
Actuated Cycle Length (s)	139.2	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	102.3%	ICU Level of Service	G	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	3147	30	40	932	700	15	50	99	70	70	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5078		1770	3539	1583	1770	1863	1583	1770	1770	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5078		1770	3539	1583	1770	1863	1583	1770	1770	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	55	3147	30	40	932	700	15	50	99	70	70	35
RTOR Reduction (vph)	0	0	0	0	0	289	0	0	95	0	20	0
Lane Group Flow (vph)	55	3177	0	40	932	411	15	50	4	70	85	0
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			
Actuated Green, G (s)	6.3	56.3		2.8	52.8	52.8	1.2	4.0	4.0	10.9	13.7	
Effective Green, g (s)	6.3	56.3		2.8	52.8	52.8	1.2	4.0	4.0	10.9	13.7	
Actuated g/C Ratio	0.07	0.63		0.03	0.59	0.59	0.01	0.04	0.04	0.12	0.15	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	124	3177		55	2076	929	24	83	70	214	269	
v/s Ratio Prot	0.03	c0.63		0.02	c0.26		0.01	c0.03		c0.04	c0.05	
v/s Ratio Perm						0.26			0.00			
v/c Ratio	0.44	1.00		0.73	0.45	0.44	0.62	0.60	0.06	0.33	0.31	
Uniform Delay, d1	40.2	16.9		43.2	10.4	10.4	44.2	42.2	41.2	36.2	34.0	
Progression Factor	1.06	0.56		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.1	10.7		37.9	0.2	0.3	41.4	28.4	1.7	0.9	3.0	
Delay (s)	43.9	20.1		81.1	10.6	10.7	85.5	70.6	42.9	37.1	37.0	
Level of Service	D	C		F	B	B	F	E	D	D	D	
Approach Delay (s)		20.5			12.3			55.3			37.0	
Approach LOS		C			B			E			D	

Intersection Summary			
HCM Average Control Delay	19.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	81.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Merge
Level of Service
AM & PM Peak Hours

HCS+: Ramps and Ramp Junctions Release 5.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DRR
Agency/Co.:	CTG
Date performed:	22/08/2007
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR29 NB
Junction:	Green Island Rd
Jurisdiction:	Napa Co
Analysis Year:	Existing
Description:	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2660	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	50	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2660	50		vph
Peak-hour factor, PHF	0.95	0.90		
Peak 15-min volume, v15	700	14		v
Trucks and buses	4	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2856	57	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2856 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2913	4700	No
v_{R12}	2913	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 24.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M_S = 0.347

Space mean speed in ramp influence area, S_R = 57.0 mph

Space mean speed in outer lanes, S_O = N/A mph

Space mean speed for all vehicles, S = 57.0 mph

HCS+: Ramps and Ramp Junctions Release 5.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DRR
Agency/Co.:	CTG
Date performed:	22/08/2007
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR29 SB
Junction:	Green Island Rd
Jurisdiction:	Napa Co
Analysis Year:	Existing
Description:	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1205	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	60	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1205	60		vph
Peak-hour factor, PHF	0.95	0.90		
Peak 15-min volume, v15	317	17		v
Trucks and buses	4	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1294	68	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1294 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1362	4700	No
v_{R12}	1362	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 12.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.291

Space mean speed in ramp influence area, S_R = 58.3 mph

Space mean speed in outer lanes, S_O = N/A mph

Space mean speed for all vehicles, S = 58.3 mph

HCS+: Ramps and Ramp Junctions Release 5.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DRR
Agency/Co.:	CTG
Date performed:	22/08/2007
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR29 NB
Junction:	Green Island Rd
Jurisdiction:	Napa Co
Analysis Year:	Existing
Description:	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1290	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	220	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1290	220		vph
Peak-hour factor, PHF	0.95	0.90		
Peak 15-min volume, v15	339	61		v
Trucks and buses	4	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1385	249	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1385 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1634	4700	No
v_{R12}	1634	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 14.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.295

Space mean speed in ramp influence area, S_R = 58.2 mph

Space mean speed in outer lanes, S_O = N/A mph

Space mean speed for all vehicles, S = 58.2 mph

HCS+: Ramps and Ramp Junctions Release 5.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DRR
Agency/Co.:	CTG
Date performed:	22/08/2007
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR29 SB
Junction:	Green Island Rd
Jurisdiction:	Napa Co
Analysis Year:	Existing
Description:	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2550	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	230	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2550	230		vph
Peak-hour factor, PHF	0.95	0.90		
Peak 15-min volume, v15	671	64		v
Trucks and buses	4	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2738	261	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 2738 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2999	4700	No
v_{R12}	2999	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 24.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.354	
Space mean speed in ramp influence area,	S_R = 56.9	mph
Space mean speed in outer lanes,	S_O = N/A	mph
Space mean speed for all vehicles,	S = 56.9	mph

HCS+: Ramps and Ramp Junctions Release 5.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DRR
Agency/Co.:	CTG
Date performed:	07/04/08
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR29 NB
Junction:	Green Island Rd
Jurisdiction:	Napa Co
Analysis Year:	Base Case
Description:	Headwater

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2948	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	80	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2948	80		vph
Peak-hour factor, PHF	0.95	0.90		
Peak 15-min volume, v15	776	22		v
Trucks and buses	4	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3165	91	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 3165 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3256	4700	No
v_{R12}	3256	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 26.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M_S = 0.377

Space mean speed in ramp influence area, S_R = 56.3 mph

Space mean speed in outer lanes, S_O = N/A mph

Space mean speed for all vehicles, S = 56.3 mph

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Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DRR
Agency/Co.:	CTG
Date performed:	07/04/08
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR29 NB
Junction:	Green Island Rd
Jurisdiction:	Napa Co
Analysis Year:	Base Case + Project
Description:	Headwater

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2974	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	80	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2974	80		vph
Peak-hour factor, PHF	0.95	0.90		
Peak 15-min volume, v15	783	22		v
Trucks and buses	4	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3193	91	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 3193 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3284	4700	No
v_{R12}	3284	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 27.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M_S = 0.380

Space mean speed in ramp influence area, S_R = 56.3 mph

Space mean speed in outer lanes, S_O = N/A mph

Space mean speed for all vehicles, S = 56.3 mph

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Phone:
E-mail:

Fax:

Merge Analysis

Analyst:	DRR
Agency/Co.:	CTG
Date performed:	07/04/08
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR29 NB
Junction:	Green Island Rd
Jurisdiction:	Napa Co
Analysis Year:	Base Case
Description:	Headwater

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1568	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	280	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1568	280		vph
Peak-hour factor, PHF	0.95	0.90		
Peak 15-min volume, v15	413	78		v
Trucks and buses	4	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1684	317	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1684 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2001	4700	No
v_{R12}	2001	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 16.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.304

Space mean speed in ramp influence area, S_R = 58.0 mph

Space mean speed in outer lanes, S_O = N/A mph

Space mean speed for all vehicles, S = 58.0 mph

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Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DRR
Agency/Co.:	CTG
Date performed:	07/04/08
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR29 NB
Junction:	Green Island Rd
Jurisdiction:	Napa Co
Analysis Year:	Base Case + Project
Description:	Headwater

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1580	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	280	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1580	280		vph
Peak-hour factor, PHF	0.95	0.90		
Peak 15-min volume, v15	416	78		v
Trucks and buses	4	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1696	317	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1696 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2013	4700	No
v_{R12}	2013	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 17.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.305

Space mean speed in ramp influence area, S_R = 58.0 mph

Space mean speed in outer lanes, S_O = N/A mph

Space mean speed for all vehicles, S = 58.0 mph

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Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DRR
Agency/Co.:	CTG
Date performed:	07/04/08
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR29 SB
Junction:	Green Island Rd
Jurisdiction:	Napa Co
Analysis Year:	2010 Base Case
Description:	Headwater

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1430	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	90	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1430	90		vph
Peak-hour factor, PHF	0.95	0.90		
Peak 15-min volume, v15	376	25		v
Trucks and buses	4	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1535	102	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1535 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1637	4700	No
v_{R12}	1637	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 14.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.296

Space mean speed in ramp influence area, S_R = 58.2 mph

Space mean speed in outer lanes, S_O = N/A mph

Space mean speed for all vehicles, S = 58.2 mph

HCS+: Ramps and Ramp Junctions Release 5.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DRR
Agency/Co.:	CTG
Date performed:	07/04/08
Analysis time period:	AM Peak Hour
Freeway/Dir of Travel:	SR29 SB
Junction:	Green Island Rd
Jurisdiction:	Napa Co
Analysis Year:	2010 Base Case + Project
Description:	Headwater

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	1445	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	90	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	1445	90		vph
Peak-hour factor, PHF	0.95	0.90		
Peak 15-min volume, v15	380	25		v
Trucks and buses	4	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	1551	102	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 1551 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	1653	4700	No
v_{R12}	1653	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 14.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.296

Space mean speed in ramp influence area, S_R = 58.2 mph

Space mean speed in outer lanes, S_O = N/A mph

Space mean speed for all vehicles, S = 58.2 mph

HCS+: Ramps and Ramp Junctions Release 5.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DRR
Agency/Co.:	CTG
Date performed:	07/04/08
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR29 SB
Junction:	Green Island Rd
Jurisdiction:	Napa Co
Analysis Year:	2010 Base Case
Description:	Headwater

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2843	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	290	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2843	290		vph
Peak-hour factor, PHF	0.95	0.90		
Peak 15-min volume, v15	748	81		v
Trucks and buses	4	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3052	329	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 3052 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3381	4700	No
v_{R12}	3381	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 27.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M_S = 0.390

Space mean speed in ramp influence area, S_R = 56.0 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 56.0 mph

HCS+: Ramps and Ramp Junctions Release 5.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	DRR
Agency/Co.:	CTG
Date performed:	07/04/08
Analysis time period:	PM Peak Hour
Freeway/Dir of Travel:	SR29 SB
Junction:	Green Island Rd
Jurisdiction:	Napa Co
Analysis Year:	2010 Base Case + Project
Description:	Headwater

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2870	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	290	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2870	290		vph
Peak-hour factor, PHF	0.95	0.90		
Peak 15-min volume, v15	755	81		v
Trucks and buses	4	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.980	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3081	329	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 3081 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3410	4700	No
v_{R12}	3410	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 27.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M_S = 0.394	
Space mean speed in ramp influence area,	S_R = 55.9	mph
Space mean speed in outer lanes,	S_O = N/A	mph
Space mean speed for all vehicles,	S = 55.9	mph

Midblock
Level of Service
AM & PM Peak Hours

HCS+: Two-Lane Highways Release 5.2

David Reed

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	DRR
Agency/Co.	CTG
Date Performed	09/11/07
Analysis Time Period	AM Peak Hour
Highway	SR 12
From/To	Napa County Line
Jurisdiction	Napa
Analysis Year	Existing
Description	Napa Panattoni

Input Data

Highway class	Class 1				
Shoulder width	4.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	2.0	mi	% Recreational vehicles	1	%
Terrain type	Level		% No-passing zones	100	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V 2330 veh/h
Directional split 56 / 44 %

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	2.0*	
PCE for RVs, ER	1.5*	
Heavy-vehicle adjustment factor,	0.948	
Two-way flow rate,(note-1) vp	2672	pc/h
Highest directional split proportion (note-2)	1496	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	55.0	mi/h
Adj. for lane and shoulder width, fLS	1.3	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	53.2	mi/h
Adjustment for no-passing zones, fnp	1.0	mi/h
Average travel speed, ATS	31.5	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	2.0*	
PCE for RVs, ER	1.5*	
Heavy-vehicle adjustment factor, fHV	0.948	
Two-way flow rate,(note-1) vp	2672	pc/h
Highest directional split proportion (note-2)	1496	
Base percent time-spent-following, BPTSF	90.5	%
Adj.for directional distribution and no-passing zones, fd/np	2.2	
Percent time-spent-following, PTSF	92.7	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.83	
Peak 15-min vehicle-miles of travel, VMT15	1266	veh-mi
Peak-hour vehicle-miles of travel, VMT60	4660	veh-mi
Peak 15-min total travel time, TT15	40.2	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

* These items have been entered or edited to override calculated value

HCS+: Two-Lane Highways Release 5.2

David Reed

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	DRR
Agency/Co.	CTG
Date Performed	09/11/2007
Analysis Time Period	PM Peak Hour
Highway	SR 12
From/To	Napa County Line
Jurisdiction	Napa
Analysis Year	Existing
Description	Napa Panattoni

Input Data

Highway class	Class 1				
Shoulder width	4.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	2.0	mi	% Recreational vehicles	1	%
Terrain type	Level		% No-passing zones	100	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	2820	veh/h	
Directional split	58 / 42	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	2.0*	
PCE for RVs, ER	1.5*	
Heavy-vehicle adjustment factor,	0.948	
Two-way flow rate,(note-1) vp	3234	pc/h
Highest directional split proportion (note-2)	1876	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	55.0	mi/h
Adj. for lane and shoulder width, fLS	1.3	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	53.2	mi/h
Adjustment for no-passing zones, fnp		mi/h
Average travel speed, ATS		mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	2.0*	
PCE for RVs, ER	1.5*	
Heavy-vehicle adjustment factor, fHV	0.948	
Two-way flow rate,(note-1) vp	3234	pc/h
Highest directional split proportion (note-2)	1876	
Base percent time-spent-following, BPTSF	94.2	%
Adj.for directional distribution and no-passing zones, fd/np	2.0	
Percent time-spent-following, PTSF	96.2	%

Level of Service and Other Performance Measures

Level of service, LOS		
Volume to capacity ratio, v/c	1.01	
Peak 15-min vehicle-miles of travel, VMT15	1533	veh-mi
Peak-hour vehicle-miles of travel, VMT60	5640	veh-mi
Peak 15-min total travel time, TT15		veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

* These items have been entered or edited to override calculated value

HCS+: Two-Lane Highways Release 5.2

David Reed

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	DRR
Agency/Co.	CTG
Date Performed	09/11/07
Analysis Time Period	AM Peak Hour
Highway	SR 12
From/To	Napa County Line
Jurisdiction	Napa
Analysis Year	Yr 2010 Base Case
Description	Headwater

Input Data

Highway class	Class 1				
Shoulder width	4.0	ft	Peak-hour factor, PHF	0.93	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	2.0	mi	% Recreational vehicles	1	%
Terrain type	Level		% No-passing zones	100	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V 2731 veh/h
Directional split 60 / 40 %

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	2.0*	
PCE for RVs, ER	1.5*	
Heavy-vehicle adjustment factor,	0.948	
Two-way flow rate,(note-1) vp	3098	pc/h
Highest directional split proportion (note-2)	1859	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	55.0	mi/h
Adj. for lane and shoulder width, fLS	1.3	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	53.2	mi/h
Adjustment for no-passing zones, fnp	0.8	mi/h
Average travel speed, ATS	28.4	mi/h

HCS+: Two-Lane Highways Release 5.2

David Reed

Phone: Fax:
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Two-Way Two-Lane Highway Segment Analysis

Analyst	DRR
Agency/Co.	CTG
Date Performed	09/11/07
Analysis Time Period	AM Peak Hour
Highway	SR 12
From/To	Napa County Line
Jurisdiction	Napa
Analysis Year	Yr 2010 Base Case + Project
Description	Headwater

Input Data

Highway class	Class 1				
Shoulder width	4.0	ft	Peak-hour factor, PHF	0.93	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	2.0	mi	% Recreational vehicles	1	%
Terrain type	Level		% No-passing zones	100	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V 2755 veh/h
Directional split 60 / 40 %

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	2.0*	
PCE for RVs, ER	1.5*	
Heavy-vehicle adjustment factor,	0.948	
Two-way flow rate,(note-1) vp	3125	pc/h
Highest directional split proportion (note-2)	1875	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	55.0	mi/h
Adj. for lane and shoulder width, fLS	1.3	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	53.2	mi/h
Adjustment for no-passing zones, fnp	0.7	mi/h
Average travel speed, ATS	28.2	mi/h

HCS+: Two-Lane Highways Release 5.2

David Reed

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	DRR
Agency/Co.	CTG
Date Performed	07/04/08
Analysis Time Period	PM Peak Hour
Highway	SR 12
From/To	Napa County Line
Jurisdiction	Napa
Analysis Year	2010 Base Case
Description	Headwater

Input Data

Highway class	Class 1				
Shoulder width	4.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	2.0	mi	% Recreational vehicles	1	%
Terrain type	Level		% No-passing zones	100	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V 3218 veh/h
Directional split 60 / 40 %

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	2.0*	
PCE for RVs, ER	1.5*	
Heavy-vehicle adjustment factor,	0.948	
Two-way flow rate,(note-1) vp	3690	pc/h
Highest directional split proportion (note-2)	2214	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	55.0	mi/h
Adj. for lane and shoulder width, fLS	1.3	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	53.2	mi/h
Adjustment for no-passing zones, fnp		mi/h
Average travel speed, ATS		mi/h

HCS+: Two-Lane Highways Release 5.2

David Reed

Phone:
E-Mail:
Fax:

Two-Way Two-Lane Highway Segment Analysis

Analyst	DRR
Agency/Co.	CTG
Date Performed	07/04/08
Analysis Time Period	PM Peak Hour
Highway	SR 12
From/To	Napa County Line
Jurisdiction	Napa
Analysis Year	2010 Base Case + Project
Description	Headwater

Input Data

Highway class	Class 1				
Shoulder width	4.0	ft	Peak-hour factor, PHF	0.92	
Lane width	12.0	ft	% Trucks and buses	5	%
Segment length	2.0	mi	% Recreational vehicles	1	%
Terrain type	Level		% No-passing zones	100	%
Grade: Length		mi	Access points/mi	2	/mi
Up/down		%			

Two-way hourly volume, V	3243	veh/h	
Directional split	60 / 40	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	2.0*	
PCE for RVs, ER	1.5*	
Heavy-vehicle adjustment factor,	0.948	
Two-way flow rate, (note-1) vp	3719	pc/h
Highest directional split proportion (note-2)	2231	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	55.0	mi/h
Adj. for lane and shoulder width, fLS	1.3	mi/h
Adj. for access points, fA	0.5	mi/h
Free-flow speed, FFS	53.2	mi/h
Adjustment for no-passing zones, fnp		mi/h
Average travel speed, ATS		mi/h

HCS+: Multilane Highways Release 5.2

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	DRR
Agency/Co:	CTG
Date:	07/04/08
Analysis Period:	AM Peak Hour
Highway:	SR12
From/To:	Napa/Solanio County line
Jurisdiction:	Napa
Analysis Year:	2030 Base Case
Project ID:	Headwater

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	3		3	
Median type	Undivided		Undivided	
Free-flow speed:	Base		Base	
FFS or BFFS	60.0	mph	60.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	1.6	mph	1.6	mph
Access points adjustment, FA	0.8	mph	0.8	mph
Free-flow speed	57.7	mph	57.7	mph

VOLUME

Direction	1		2	
Volume, V	3171	vph	1320	vph
Peak-hour factor, PHF	0.95		0.95	
Peak 15-minute volume, v15	834		347	
Trucks and buses	5	%	5	%
Recreational vehicles	1	%	1	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.974		0.974	
Flow rate, vp	1714	pcphpl	713	pcphpl

RESULTS

HCS+: Multilane Highways Release 5.2

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	DRR
Agency/Co:	CTG
Date:	07/04/08
Analysis Period:	AM Peak Hour
Highway:	SR12
From/To:	Napa/Solanio County line
Jurisdiction:	Napa
Analysis Year:	2030 Base Case + Project
Project ID:	Headwater

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	3		3	
Median type	Undivided		Undivided	
Free-flow speed:	Base		Base	
FFS or BFFS	60.0	mph	60.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	1.6	mph	1.6	mph
Access points adjustment, FA	0.8	mph	0.8	mph
Free-flow speed	57.7	mph	57.7	mph

VOLUME

Direction	1		2	
Volume, V	3188	vph	1327	vph
Peak-hour factor, PHF	0.95		0.95	
Peak 15-minute volume, v15	839		349	
Trucks and buses	5	%	5	%
Recreational vehicles	1	%	1	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.974		0.974	
Flow rate, vp	1723	pcphpl	717	pcphpl

RESULTS

HCS+: Multilane Highways Release 5.2

Phone: Fax:
E-mail:

OPERATIONAL ANALYSIS

Analyst:	DRR
Agency/Co:	CTG
Date:	07/04/2008
Analysis Period:	PM Peak Hour
Highway:	SR12
From/To:	Napa/Solanio County line
Jurisdiction:	Napa
Analysis Year:	2030 Base Case
Project ID:	Headwater

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	3		3	
Median type	Undivided		Undivided	
Free-flow speed:	Base		Base	
FFS or BFFS	60.0	mph	60.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	1.6	mph	1.6	mph
Access points adjustment, FA	0.8	mph	0.8	mph
Free-flow speed	57.7	mph	57.7	mph

VOLUME

Direction	1		2	
Volume, V	1665	vph	3298	vph
Peak-hour factor, PHF	0.95		0.95	
Peak 15-minute volume, v15	438		868	
Trucks and buses	5	%	5	%
Recreational vehicles	1	%	1	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.974		0.974	
Flow rate, vp	899	pcphpl	1782	pcphpl

RESULTS

HCS+: Multilane Highways Release 5.2

Phone:
E-mail:

Fax:

OPERATIONAL ANALYSIS

Analyst:	DRR
Agency/Co:	CTG
Date:	07/04/2008
Analysis Period:	PM Peak Hour
Highway:	SR12
From/To:	Napa/Solano County line
Jurisdiction:	Napa
Analysis Year:	2030 Base Case + Project
Project ID:	Headwater

FREE-FLOW SPEED

Direction	1		2	
Lane width	12.0	ft	12.0	ft
Lateral clearance:				
Right edge	6.0	ft	6.0	ft
Left edge	6.0	ft	6.0	ft
Total lateral clearance	12.0	ft	12.0	ft
Access points per mile	3		3	
Median type	Undivided		Undivided	
Free-flow speed:	Base		Base	
FFS or BFFS	60.0	mph	60.0	mph
Lane width adjustment, FLW	0.0	mph	0.0	mph
Lateral clearance adjustment, FLC	0.0	mph	0.0	mph
Median type adjustment, FM	1.6	mph	1.6	mph
Access points adjustment, FA	0.8	mph	0.8	mph
Free-flow speed	57.7	mph	57.7	mph

VOLUME

Direction	1		2	
Volume, V	1672	vph	3316	vph
Peak-hour factor, PHF	0.95		0.95	
Peak 15-minute volume, v15	440		873	
Trucks and buses	5	%	5	%
Recreational vehicles	1	%	1	%
Terrain type	Level		Level	
Grade	0.00	%	0.00	%
Segment length	0.00	mi	0.00	mi
Number of lanes	2		2	
Driver population adjustment, fP	1.00		1.00	
Trucks and buses PCE, ET	1.5		1.5	
Recreational vehicles PCE, ER	1.2		1.2	
Heavy vehicle adjustment, fHV	0.974		0.974	
Flow rate, vp	903	pcphpl	1792	pcphpl

RESULTS

Queues
AM & PM Peak Hours

Queues
17: South Kelly & SR29

27/06/2008

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	49	56	65	14	191	2495	570	48	1699	62
v/c Ratio	0.82	0.58	0.89	0.16	0.77	1.01	0.46	0.60	0.85	0.08
Control Delay	117.7	45.5	123.3	45.8	56.9	36.8	3.0	73.3	21.0	5.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	117.7	45.5	123.3	45.8	56.9	36.8	3.0	73.3	21.0	5.4
Queue Length 50th (ft)	28	10	38	8	104	~810	31	27	397	7
Queue Length 95th (ft)	#96	#66	#117	27	#200	#947	68	#81	510	24
Internal Link Dist (ft)		1208		195		5905			1642	
Turn Bay Length (ft)	150		100		250		150	250		100
Base Capacity (vph)	60	96	73	86	270	2462	1239	80	2020	830
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.82	0.58	0.89	0.16	0.71	1.01	0.46	0.60	0.84	0.07

Intersection Summary

~: Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

#: 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
17: South Kelly & SR29

29/05/2008

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	70	77	65	22	219	2495	570	48	1699	97
v/c Ratio	0.86	0.58	1.00	0.29	0.84	1.00	0.46	0.67	0.85	0.12
Control Delay	115.5	37.7	161.8	56.1	67.1	33.6	3.3	88.7	22.8	6.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	115.5	37.7	161.8	56.1	67.1	33.6	3.3	88.7	22.8	6.1
Queue Length 50th (ft)	45	14	~43	14	136	~807	39	31	446	14
Queue Length 95th (ft)	#131	#75	#132	39	#256	#1026	82	#91	558	37
Internal Link Dist (ft)		1208		195		5905			1642	
Turn Bay Length (ft)	150		100		250		150	250		100
Base Capacity (vph)	81	132	65	77	276	2497	1244	72	2018	835
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.86	0.58	1.00	0.29	0.79	1.00	0.46	0.67	0.84	0.12

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
17: South Kelly & SR29

27/06/2008

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	114	175	163	13	66	1805	74	58	2800	40
v/c Ratio	1.19	1.25	1.07	0.08	1.18	0.71	0.07	0.54	1.09	0.03
Control Delay	208.0	195.2	153.7	64.3	234.9	15.7	3.9	87.3	69.1	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	208.0	195.2	153.7	64.3	234.9	15.7	3.9	87.3	69.1	4.7
Queue Length 50th (ft)	~134	~161	~175	12	~77	547	9	56	~1615	7
Queue Length 95th (ft)	#268	#323	#329	35	#183	630	26	106	#1725	18
Internal Link Dist (ft)		1208		195		5905			1642	
Turn Bay Length (ft)	150		100		250		150	250		100
Base Capacity (vph)	96	140	153	165	56	2528	1132	118	2573	1166
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.19	1.25	1.07	0.08	1.18	0.71	0.07	0.49	1.09	0.03

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
17: South Kelly & SR29

29/05/2008

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	142	214	163	16	79	1805	74	58	2800	58
v/c Ratio	1.18	1.32	1.25	0.12	1.41	0.72	0.07	0.52	1.09	0.05
Control Delay	196.5	218.1	215.7	67.1	309.0	13.0	1.8	84.7	69.1	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	196.5	218.1	215.7	67.1	309.0	13.0	1.8	84.7	69.1	4.5
Queue Length 50th (ft)	~166	~218	~199	15	~105	559	0	56	~1615	11
Queue Length 95th (ft)	#312	#392	#353	41	m#217	643	m13	106	#1725	24
Internal Link Dist (ft)		1208		195		5905			1642	
Turn Bay Length (ft)	150		100		250		150	250		100
Base Capacity (vph)	120	162	130	139	56	2521	1129	120	2573	1168
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.18	1.32	1.25	0.12	1.41	0.72	0.07	0.48	1.09	0.05

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues

17: South Kelly & SR29

29/05/2008

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	81	85	75	38	199	2110	130	10	3125	205
v/c Ratio	0.42	0.56	0.82	0.34	1.08	0.57	0.11	0.10	1.01	0.20
Control Delay	46.6	32.2	97.6	45.6	130.1	7.2	1.5	44.2	39.6	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.6	32.2	97.6	45.6	130.1	7.2	1.5	44.2	39.6	4.5
Queue Length 50th (ft)	23	15	43	18	~131	166	1	6	~712	20
Queue Length 95th (ft)	46	#69	#125	50	#265	308	21	22	#804	51
Internal Link Dist (ft)		1208		195		5905			4727	
Turn Bay Length (ft)	150				300		150	300		150
Base Capacity (vph)	200	156	92	111	184	3684	1203	101	3080	1007
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.54	0.82	0.34	1.08	0.57	0.11	0.10	1.01	0.20

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
17: South Kelly & SR29

02/06/2008

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	96	94	75	45	206	2110	130	10	3125	224
v/c Ratio	1.09	0.64	0.83	0.41	1.05	0.58	0.11	0.15	1.04	0.23
Control Delay	165.7	39.1	102.3	49.2	117.6	6.9	1.2	48.2	49.3	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	165.7	39.1	102.3	49.2	117.6	6.9	1.2	48.2	49.3	4.5
Queue Length 50th (ft)	~62	18	43	22	~129	157	0	6	~712	22
Queue Length 95th (ft)	#160	#88	#125	57	#265	275	17	22	#804	54
Internal Link Dist (ft)		1208		195		5905			4727	
Turn Bay Length (ft)	150				300		150	300		150
Base Capacity (vph)	88	146	90	109	197	3659	1198	67	2997	988
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.09	0.64	0.83	0.41	1.05	0.58	0.11	0.15	1.04	0.23

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
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Queues

17: South Kelly & SR29

27/06/2008

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	150	251	170	17	56	3490	80	25	2680	83
v/c Ratio	0.88	1.18	1.02	0.10	0.53	1.00	0.07	0.45	0.82	0.08
Control Delay	101.4	155.9	133.0	44.1	76.6	35.5	4.7	86.7	20.7	5.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	101.4	155.9	133.0	44.1	76.6	35.5	4.7	86.7	20.7	5.3
Queue Length 50th (ft)	127	~206	~155	9	46	~1148	12	21	613	12
Queue Length 95th (ft)	#257	#380	#303	34	93	#1219	30	#58	682	33
Internal Link Dist (ft)		1208		195		5905			4727	
Turn Bay Length (ft)	150				300		150	300		150
Base Capacity (vph)	170	213	166	175	115	3499	1090	56	3288	1049
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.88	1.18	1.02	0.10	0.49	1.00	0.07	0.45	0.82	0.08

Intersection Summary

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95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
17: South Kelly & SR29

29/05/2008

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	165	265	170	20	59	3490	80	25	2680	93
v/c Ratio	0.79	1.10	1.02	0.11	0.71	1.02	0.07	0.48	0.82	0.09
Control Delay	84.8	130.8	135.0	49.1	105.4	43.3	5.7	96.5	22.0	5.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	84.8	130.8	135.0	49.1	105.4	43.3	5.7	96.5	22.0	5.7
Queue Length 50th (ft)	149	~231	~166	13	54	~1260	15	23	656	16
Queue Length 95th (ft)	#268	#415	#319	40	#131	#1326	35	#65	721	38
Internal Link Dist (ft)		1208		195		5905			4727	
Turn Bay Length (ft)	150				300		150	300		150
Base Capacity (vph)	210	241	167	177	84	3428	1067	52	3291	1051
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.79	1.10	1.02	0.11	0.70	1.02	0.07	0.48	0.81	0.09

Intersection Summary

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95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues

17: South Kelly & SR29

16/09/2007

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	27	38	59	5	156	2220	538	38	1414	27
v/c Ratio	0.35	0.36	0.56	0.04	0.67	0.84	0.41	0.39	0.66	0.03
Control Delay	50.0	29.3	60.7	37.0	47.0	15.1	2.5	49.1	14.0	5.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.0	29.3	60.7	37.0	47.0	15.1	2.5	49.1	14.0	5.2
Queue Length 50th (ft)	13	5	30	3	73	487	20	19	267	2
Queue Length 95th (ft)	#45	#36	#95	13	#136	#737	57	#53	352	13
Internal Link Dist (ft)		1208		195		5905			1642	
Turn Bay Length (ft)	150		100		250		150	250		100
Base Capacity (vph)	78	105	105	124	262	2630	1304	97	2127	867
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.36	0.56	0.04	0.60	0.84	0.41	0.39	0.66	0.03

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
17: South Kelly & SR29

16/09/2007

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	84	131	147	5	42	1484	63	47	2484	16
v/c Ratio	0.91	0.85	1.02	0.03	0.63	0.61	0.06	0.45	1.02	0.01
Control Delay	184.3	84.0	201.5	43.2	113.6	9.2	1.7	67.6	23.1	3.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	184.3	84.0	201.5	43.2	113.6	9.2	1.7	67.6	23.1	3.4
Queue Length 50th (ft)	54	36	~102	3	27	269	1	30	~903	2
Queue Length 95th (ft)	#149	#144	#226	15	#82	335	15	67	#1039	8
Internal Link Dist (ft)		1208		195		5905			1642	
Turn Bay Length (ft)	150		100		250		150	250		100
Base Capacity (vph)	92	155	144	155	67	2451	1104	106	2437	1103
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.91	0.85	1.02	0.03	0.63	0.61	0.06	0.44	1.02	0.01

Intersection Summary

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