APPENDIX L

TRAFFIC IMPACT ANALYSIS

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Supplemental Traffic and Circulation Impact Analysis for the Proposed Homes at Deer Hill Project

For the City of Lafayette

January 23, 2015

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Introduction and Summary

Introduction

This report presents the results of a transportation impact analysis for the proposed Terraces of Lafayette revised project that is also known as The Homes at Deer Hill in the City of Lafayette, supplementing analysis previously presented in the certified *Terraces of Lafayette EIR*. The proposed Revised Project consists of constructing 44 single-family detached homes, a soccer field, and approximately six acres of park area on a vacant parcel bounded by Deer Hill Road on the northwest, Pleasant Hill Road on the east, and SR 24 on the south. In addition, the proposed project also includes the construction of a dog park with 1.5 acres of enclosed dog play area (divided into one acre for large dogs and a half-acre for small dogs) north of Deer Hill Road adjacent to the proposed residential component. The proposed project vicinity is illustrated in Figure 1. The proposed site plan is shown in Figure 2.

This report includes a traffic analysis of study intersections that would potentially be affected by the proposed project, identification of any significant impacts on unacceptable traffic levels of service (LOS), and evaluation of potential mitigation measures to address those unacceptable traffic conditions. The report also analyzes the potential impacts of the proposed project on traffic safety, transit, pedestrian, and bicycle facilities, parking and passenger loading areas, emergency vehicle access, and Delay Indexes on Routes of Regional Significance, as well as traffic impacts during construction of the project.

Summary

TJKM has identified the following supplemental revisions to the significant impacts and mitigations from the certified *Terraces of Lafayette Final EIR*, which are numbered in the summary below to match their presentation in that document. For each impact below, any changes with the Revised Project have been briefly summarized, including why the impact would no longer result if that is the case, and substantive revisions from the original TJKM report are highlighted with strikeout or italic text. If the Revised Project causes new impacts not previously identified below, they have been added as "Supplemental Impact TRAF-__" with new numbers.

Impact TRAF-1: Under Existing *with Revised Project* conditions, the Deer Hill Road – Stanley Boulevard/Pleasant Hill Road intersection would operate at LOS F during the a.m. peak hour, with delay increasing by *26.2* seconds as a result of the project. *Although* the project would increase delay by more than five seconds at an intersection operating *at LOS F* ~~below the acceptable standard~~, *this is considered a less-than-significant impact based on the significance thresholds for this SEIR that eliminate consideration of intersection LOS on Pleasant Hill Road north of SR 24, in accordance with General Plan Policy C-1.2 of the Growth Management Chapter, the Lamorinda Action Plan, and CCTA guidelines. This intersection is not subject to an intersection LOS standard; it is part of a Route of Regional Significance that is subject to the Delay Index criteria.*

> ~~Mitigation Measure TRAF-1: An additional southbound lane on Pleasant Hill Road would improve traffic conditions in comparison to the Existing plus Project scenario but would result in significant secondary impacts and other undesirable effects. Therefore, this mitigation measure is not considered to be feasible.~~
>
> ~~Significance after Mitigation: Significant and Unavoidable~~

Impact TRAF-2: Under Existing *with Revised* Project conditions, northbound and southbound stop-controlled minor approaches on Brown Avenue at Deer Hill Road would continue operating at an unacceptable LOS F ~~during the a.m. and p.m. peak hours~~, with delay increases ~~substantially higher than five seconds~~ *of 13 seconds during the a.m. peak hour and 54.6 seconds during the p.m. peak hour*. The California Manual on Uniform Traffic Control Devices (MUTCD) peak hour traffic signal warrant would be met for both peak hours under both the Existing Conditions and Existing *with Revised* Project scenarios. The *Revised* project would increase delay by more than five seconds at an intersection operating below the acceptable standard, and result in inadequate emergency access to Deer Hill Road, resulting in *significant* impacts.

Mitigation Measure TRAF-2: *Prior to Project completion, t*he Project applicant shall ~~coordinate~~ *share* with the City ~~to contribute a fair share of~~ the cost~~, including an in-lieu payment,~~ to install ~~a traffic signal~~ *mitigation measures* at the Brown Avenue/Deer Hill Road intersection~~, which will be added to the City's Capital Improvement Projects (CIP) program~~. *A mitigation option is to install a traffic signal as part of the development project.* The traffic signal equipment shall include an emergency vehicle preemption system (Opticom), which would allow emergency response vehicles approaching the signalized intersection to activate a green signal for their travel direction. The State Route 24 freeway overpass structures on Brown Avenue could obstruct the Opticom activation device on responding emergency vehicles headed northbound on Brown Avenue from Mount Diablo Boulevard toward Deer Hill Road, which could substantially reduce the effectiveness of the traffic signal preemption. To avoid this problem, the traffic signal equipment shall include advance detection devices for the Opticom system as needed to assure effective traffic signal preemption for responding emergency vehicles on northbound Brown Avenue. *An alternative mitigation to installing a traffic signal would be the redesign of this intersection as a roundabout, which would improve the approach LOS for the minor approach volumes at this intersection. TJKM recommends additional analysis of this alternative mitigation.*

Significance after Mitigation: Under Existing with Revised Project conditions as shown in Table VII:

- With signalization, the Brown Avenue/Deer Hill Road intersection would operate at LOS *B* during the a.m. and p.m. peak hours, and the advance detection devices for traffic signal preemption would provide adequate emergency access.
- *With a roundabout, the Deer Hill Road/Brown Avenue intersection would operate at LOS B during the a.m. peak hour and LOS A during the p.m. peak hour, and would adequately accommodate emergency response vehicles.*

Either mitigation alternative would reduce the project impact to a less-than-significant level.

~~Impact TRAF-3~~ [Note: This impact was deleted from the Final EIR, per the "Revisions to the Draft EIR" document.]: ~~Under Existing plus Project conditions, the Project would reduce the average speed on northbound Pleasant Hill Road between the State Route 24 westbound off-ramp and Acalanes Avenue during the p.m. peak hour from 4.6 miles per hour (mph) to 3.8 mph, a 17 percent reduction. This speed reduction of more than ten percent is considered an unacceptable weaving condition that would substantially increase hazards, resulting in a *significant* impact.~~

~~Mitigation Measure TRAF-3: Prohibiting the left turn from northbound Pleasant Hill Road into the Project driveway would reduce weaving impacts but would significantly exacerbate Project impacts at the Deer Hill Road – Stanley Boulevard/Pleasant Hill Road intersection. Therefore, this mitigation measure is not considered feasible.~~

~~Significance after Mitigation: No feasible mitigation measure is available to reduce the Project impact on northbound Pleasant Hill Road between the State Route 24 westbound off-ramp and the Project driveway to less-than-significant levels. Therefore, this impact is considered significant and unavoidable.~~

Impact TRAF-3 [Note: This impact has been modified based on the revisions to the proposed Revised Project]: Project design features would increase traffic hazards because the potential for inadequate sight-distance would exist at all of the driveways for traffic exiting the Project. This would be a *significant* impact.

Mitigation Measure TRAF-3: The Project applicant shall implement the following measures:

- *East* of the *Soccer Drop-off* Driveway on Deer Hill Road: All landscaping along the south side of Deer Hill Road that is located in the line of sight for *w*estbound traffic within 360 feet *east* of the *Soccer Drop-off* Project driveway shall be limited to plants with foliage no more than 30 inches fully mature height above the closest adjacent curb elevation, or trees with canopy foliage no less than ~~seven~~ *ten* feet above the closest adjacent curb elevation~~, or other dimensions as specified by the City Engineer~~. The line of sight is defined as the area between the south curb on Deer Hill Road, and a straight line connecting a point 10 feet behind the back of the sidewalk on the centerline of the *Soccer Drop-off* driveway and a point 360 feet to the *east in the westbound lane on Deer Hill Road* where it intersects the south curb line, or as otherwise specified by the City Engineer.
- All other Project Driveways: All landscaping along the Project street frontage that is located in the line of sight of traffic approaching Project driveways in either direction shall be limited to plants with foliage no more than 30 inches fully mature height above the closest adjacent curb elevation, or trees with canopy foliage no less than ~~seven~~ *ten* feet above the closest adjacent curb elevation~~, or other dimensions as specified by the City Engineer~~. The line of sight is defined as an area within 10 feet behind the back of the sidewalk or shared-use path and within 50 feet of the driveway edge, or as otherwise specified by the City Engineer.
- Entryway Features: All monument signs, walls, slopes and other vertical features that could otherwise block visibility shall be no more than three feet higher than the adjacent driveway elevation in the area within 15 feet behind the back of the sidewalk or shared-use path and within 50 feet of the driveway edge, or as otherwise specified by the City Engineer.
- ~~The west Project driveway on Deer Hill Road shall be relocated at least 100 feet to the west of the location shown on the Project plans.~~

Significance after Mitigation: Less than Significant

Impact TRAF-4: [NOTE: This impact no longer occurs as the proposal for the Revised Project includes the redesign of the Residential/Dog Park driveway as a roundabout, which will mitigate hazards for westbound left-turn vehicles assuming implementation of design features to reduce approach speeds on Deer Hill Road, as recommended in the Existing with Revised Project section of this report under the heading Project Driveway Sight-Distance and Safety.] ~~Because westbound Deer Hill Road speeds increase as vehicles descend the hill east of the west Project driveway, westbound vehicles slowing or stopping in the westbound Deer Hill Road through lane before turning left into the west Project driveway~~

would present potential safety issues. This Project design feature would substantially increase traffic hazards, resulting in a *significant* impact.

Mitigation Measure TRAF-4: The Project applicant shall either:

- Widen Deer Hill Road as needed to add a striped westbound left turn lane and appropriate taper lengths approaching the west Project driveway, and maintain appropriate widths for bike lanes, traffic lanes, and proposed sidewalks, as well as legal left-turn access at the adjacent driveway on the north side of the roadway; or
- Post signs prohibiting left turns from westbound Deer Hill Road into the west driveway. In the mouth of the driveway on the south side of Deer Hill Road, a raised island designed to physically obstruct left turns into the driveway shall be constructed, if emergency access can be maintained to the satisfaction of the Contra Costa County Fire Prevention District (CCCFPD) and the eastbound bike lane is not obstructed. Raised centerline or median features to obstruct the westbound left turn are not recommended on Deer Hill Road at this location because of prevailing speeds, as well as potential obstruction of left turns out of the Project driveway and access at the adjacent driveway on the north side of the roadway.

Selection between these two alternative mitigation measures should be coordinated with the potential prohibition of left turns at the east Project driveway, which is not required as mitigation, but is recommended to address design and operational concerns.

Significance after Mitigation: Less than Significant

Impact TRAF-5 [Note: This impact no longer applies as the estimated Delay Index for northbound Pleasant Hill Road under Revised Project Conditions does not increase above 2.0 under Existing with Revised Project Conditions, and does not increase by more than 0.05 under Cumulative Year 2030 with Revised Project Conditions, as described in the Delay Index Results sections for each scenario, including Tables V, VIII, XII, and XV]: Under both Existing plus Project and Cumulative Year 2030 plus Project conditions, the Project's significant impact on p.m. peak-hour traffic speeds for northbound Pleasant Hill Road, which results in a significant impact on the Delay Index, between the off-ramp from westbound State Route 24 and the proposed Project driveway would result in inadequate emergency access to other areas of Lafayette served by Pleasant Hill Road between State Route 24 and Rancho View Drive. The result would be a *significant* impact.

Mitigation Measure TRAF-5: The Project applicant shall contribute a fair share to the cost of installing advance detection equipment for the existing Opticom system as needed to assure effective traffic signal preemption for responding emergency vehicles on northbound Pleasant Hill Road approaching the Deer Hill Road intersection and the other four signalized study intersections to the north. The advance detection system shall be designed to activate a green signal for northbound Pleasant Hill Road at Deer Hill Road with enough time before the emergency vehicle arrives to allow traffic congestion between State Route 24 and the intersection to clear sufficiently to facilitate passage of the emergency vehicle. At a minimum, the advance detection system shall allow emergency vehicles responding from CCCFPD Station 15 (located at 3338 Mount Diablo Boulevard) to activate traffic signal preemption for northbound Pleasant Hill Road at Deer Hill Road as soon as they turn north from eastbound Mount Diablo Boulevard.

~~Significance after Mitigation: Less than Significant~~

Impact TRAF-6: The emergency vehicle access shown on the Project site plans ~~does not comply with minimum turning radius requirements at several on-site driveway locations~~ *lacks provisions for turning around Fire District apparatus on dead-end emergency apparatus access roadways*. This would result in inadequate emergency access to the project site, which would be a *significant* impact.

Mitigation Measure TRAF-6: The Project site plans shall be revised *to meet the access and turnaround requirements of the CCCFPD, which may include revising the site plan to include turnarounds on dead-end access streets in excess of 150 feet in length, provision of an alternative emergency vehicle access point, or other means acceptable to the Fire Marshall*~~such that corner radii and medians at on-site driveway intersections provide a minimum inside turning radius of 25 feet and a minimum outside turning radius of 45 feet, per CCCFPD requirements~~.

Significance after Mitigation: Less than Significant

Impact TRAF-7 [Note: This impact has been modified per revisions to the original DEIR and modifications to the project proposal]: During the grading phase of construction on the Project site, large truck traffic on Pleasant Hill Road and Deer Hill Road and elimination of the existing passenger loading zone along the project frontage on Pleasant Hill Road would result in a temporary *significant* impact.

Mitigation Measure TRAF-7: The Project applicant shall prepare and submit a Construction Staging Plan for review and approval by the City Engineer. The Construction Staging Plan shall include elements such as flaggers for trucks entering and exiting the site, and a designated liaison to coordinate with the City, schools, and the public as needed, and shall implement the following measures:

- Large trucks involved in the grading phase of construction shall be prohibited from arriving at or departing from the Project site during the hours of 7:00 to 9:00 a.m. and 3:00 to 7:00 p.m. on any school day, and 7:00 to 9:00 a.m. and 4:00 to 7:00 p.m. on any non-school weekday.
- Large trucks shall be prohibited from making U-turn movements from northbound to southbound Pleasant Hill Road at the Deer Hill Road intersection during construction. The Construction Staging Plan shall specify for each construction phase whether access to the Project site from northbound Pleasant Hill Road will ~~be allowed by~~*require* providing a median opening for left turns directly into the site south of Deer Hill Road *as a temporary construction access, with flaggers to direct traffic for trucks entering and exiting the site*~~, or will require a left turn onto Deer Hill Road and a subsequent left turn into the site~~.
- If the Construction Staging Plan allows large trucks to turn left from northbound Pleasant Hill Road to Deer Hill Road, accommodation of their turning radius may require the following temporary measures: modifications to the south median within up to 15 feet from the nose; relocation of the limit line for eastbound Deer Hill Road traffic lanes by up to 15 feet behind the existing crosswalk marking; adjustments to vehicle detectors, any other affected traffic signal equipment, and traffic signal timing as required to maintain safe and effective operations; and, measures as otherwise specified by the City Engineer.
- The proposed locations and configuration of access points on Pleasant Hill Road and Deer Hill Road where large trucks would turn into or out of the Project site during construction

shall be subject to approval by the City Engineer, to ensure consideration of sight-distance constraints and implementation of appropriate safety precautions.

- During any construction phase when access to the existing passenger loading zone on the west curb of Pleasant Hill Road along the Project frontage would be unavailable on school days, one of the following measures:
  - Provide a safe, temporary alternative loading zone in the immediate area, subject to approval by the City Engineer. Potential alternatives may include temporary use of the property on the northwest corner of Pleasant Hill Road and Deer Hill Road, which would require surface improvements to facilitate safe vehicle and pedestrian access.
  - Stage construction on the subject portion of the site such that ~~during the school break for summer,~~*prior to discontinuing the availability of* the existing passenger loading zone, *the project shall* ~~would be demolished and replaced by~~ construct~~ion of~~ the *proposed Soccer/Park parking lot, including its off-street* ~~recommended roadway configuration and~~ passenger loading zone *and access driveway* on Pleasant Hill Road ~~Project frontage~~.
- The Construction Staging Plan shall require restriping of bike lanes and other pavement markings at the discretion of the City Engineer to address wear from construction traffic.
- Special school events, such as swim meets, shall be addressed by the designated liaison required in the Construction Staging Plan, or any additional measures that the City Engineer may require in that Plan.
- The Construction Staging Plan shall include an engineering analysis to estimate the percentage of the pavement service life that will be used by Project construction truck trips on Pleasant Hill Road and Deer Hill Road. Based on this analysis, appropriate mitigation of the resulting damage shall be required from the Project sponsor, which may include construction of pavement improvements to restore the lost service life, or an in-lieu contribution of equivalent value, at the discretion of the City Engineer.

Significance after Mitigation: Less than Significant

Impact TRAF-8 [Note: This impact has been modified given the revisions to the proposed Revised Project]: Project driveways would provide inadequate truck turning radii for large trucks. The resulting improper lane use and other potential unsafe maneuvers by trucks on heavily travelled public streets *and on-site roadways* would substantially increase hazards due to a design feature, which is a *significant* impact.

Mitigation Measure TRAF-8: The Project site plan shall be revised at the Project driveways such that adequate truck turning radii are provided, by widening the portion of the entry *and exit* roadway near each intersection, modifying the median configuration, increasing the corner radius, *and/or constructing the central island at the proposed roundabout with a traversable apron. At the proposed on-site roadways, the project applicant shall reduce the size of some of the proposed chokers near internal intersections and raised islands in the Soccer/Park Parking Lot and Soccer Dropoff as needed to provide additional roadway area for adequate truck turning radii.*

Significance after Mitigation: Less than Significant

Impact TRAF-9: Under the Cumulative Year 2030 with Revised Project scenario, the Brown Avenue/Deer Hill Road intersection would continue to operate at an unacceptable LOS F during the a.m. and p.m. peak hours, with delay increases substantially higher than five seconds. This would be a *significant* cumulative impact.

Mitigation Measure TRAF-9: Implement Mitigation Measure TRAF-2.

Significance after Mitigation: Under Cumulative Year 2030 with Revised Project conditions:

- With signalization, the Brown Avenue/Deer Hill Road intersection would operate at LOS *B during both* the a.m. and p.m. peak hours.
- *With a roundabout, the Deer Hill Road/Brown Avenue intersection would operate at LOS C during the a.m. peak hour and LOS B during the p.m. peak hour.*

Either mitigation alternative would reduce the project impact to *less than significant.*

Impact TRAF-10 [Note: This impact no longer applies given the revisions to the Revised Project which propose a roundabout at this driveway]: ~~Under the Cumulative Year 2030 plus Project scenario, Project traffic exiting the west Project driveway on Deer Hill Road would experience an LOS E delay during the a.m. peak hour. Although LOS E is acceptable at a one-way stop control intersection such as the driveway, the amount of delay suggests that drivers turning left out of the driveway would have some difficulty finding an acceptable gap in traffic flow on Deer Hill Road, at a location where prevailing speeds are relatively high. This would pose a traffic hazard, resulting in a *significant* cumulative impact.~~

- ~~Mitigation Measure TRAF-: Widen Deer Hill Road at the west Project driveway as needed to add a striped westbound median refuge lane to receive left turns from the driveway, provide appropriate taper lengths west of the refuge lane, and maintain appropriate widths for bike lanes, traffic lanes, and proposed sidewalks.~~

~~Significance after Mitigation: Less than Significant~~

Impact TRAF-11 [Note: This impact would no longer occur as the Revised Project is expected to increase the queue length by only one additional car length for northbound left-turns from Pleasant Hill Road at the Deer Hill Road intersection.]: ~~Under the Cumulative Year 2030 plus Project scenario, the peak estimated 95th-percentile left-turn queue length for northbound traffic on Pleasant Hill Road at Deer Hill Road would be 326 feet during the a.m. peak hour, which would exceed the capacity of the existing 250-foot storage lane. This would be a *significant* cumulative impact.~~

~~Mitigation Measure TRAF-11: An additional southbound lane on Pleasant Hill Road, a continuous left-turn storage lane serving northbound Pleasant Hill Road traffic at both the Project driveway and Deer Hill Road, or a longer left-turn lane allowed by prohibiting northbound left turns into the Project driveway would have the potential to mitigate northbound left-turn queue lengths at Deer Hill Road. However, these measures would result in significant secondary impacts and other undesirable effects. Therefore, these potential mitigation measures are not considered to be feasible.~~

~~Significant and Unavoidable~~

Impact TRAF-12 [Note: This impact no longer applies as the Revised Project does not propose a northbound left-turn at the project driveway on Pleasant Hill Road]: ~~Under the Cumulative Year 2030 plus Project scenario, the peak estimated 95th-percentile left-turn queue lengths for northbound traffic on Pleasant Hill Road at the Project driveway would be 124 feet and 177 feet during the school p.m. and commute p.m. peak hours, respectively, which would exceed~~

~~the capacity of the 100-foot storage lane proposed in the Project plans. This would be a *significant* cumulative impact.~~

~~Mitigation Measure TRAF-12: An extended left-turn storage lane serving northbound Pleasant Hill Road traffic at the Project driveway would have the potential to reduce queue lengths. However, this measure would result in significant secondary impacts and therefore this mitigation measure is not considered to be feasible. The Project applicant shall extend the proposed left-turn storage lane an additional 75 through 100 feet to the south by widening Pleasant Hill Road on the Project frontage to accommodate the peak left-turn queue length. Extending the entrance to the left-turn further south toward the off-ramp from westbound SR 24 would shorten the available weaving distance on northbound Pleasant Hill Road for left turns at the Project driveway, but this would not be considered a significant secondary impact, and therefore the mitigation is considered feasible~~

~~Significance after Mitigation: Less than Significant~~

~~Impact TRAF-14~~ [Note: This impact was deleted from the Final EIR, per the "Revisions to the Draft EIR" document.]: ~~Under Cumulative Year 2030 plus Project conditions, the Project would reduce the average speed on northbound Pleasant Hill Road between the State Route 24 westbound off-ramp and Acalanes Avenue during the p.m. peak hour from 2.7 miles per hour (mph) to 2.4 mph, an 11 percent reduction. This speed reduction of more than ten percent is considered an unacceptable weaving condition that would substantially increase hazards, resulting in a *significant* cumulative impact.~~

~~Mitigation Measure TRAF-14: Prohibiting the left turn from northbound Pleasant Hill Road into the Project driveway would reduce weaving impacts but would result in a significant cumulative Project impact at the Deer Hill Road – Stanley Boulevard/Pleasant Hill Road intersection. Therefore, this mitigation measure is not considered feasible.~~

~~Significance after Mitigation: No feasible mitigation measure is available to reduce the Project impact on northbound Pleasant Hill Road between the State Route 24 westbound off-ramp and the Project driveway to less-than-significant levels. Therefore, this impact is considered significant and unavoidable.~~

Impact TRAF-13 [Note: This impact has been modified based on the revised Delay Index Calculations for this SEIR]: Under Cumulative Year 2030 *with Revised* Project conditions, the addition of Project trips to Pleasant Hill Road would increase the peak hour peak direction Delay Index by approximately *0.22* for southbound traffic in the a.m. peak hour. Because the Delay Index would increase by more than 0.05 for peak hour peak direction traffic where the Delay Index exceeds 2.0 on Pleasant Hill Road, the result would be a *significant* cumulative impact.

Mitigation Measure TRAF-13: ~~Measures to address this impact include the provision of transit service in the Pleasant Hill Road/Taylor Boulevard corridor, measures to meter traffic flow on Pleasant Hill Road to discourage its use to bypass the Interstate 680/State Route 24 interchange, or the construction of additional capacity on Pleasant Hill Road north of State Route 24. However, these measures would either fail to reduce the cumulative Project impact to less than significant or are not considered to be feasible.~~
Measures to manage the Delay Index on Pleasant Hill Road are contained in the Lamorinda Action Plan. These include: the provision of transit service along the Pleasant Hill Road/Taylor Boulevard

corridor; increased pedestrian and bicycle mobility between area schools and surrounding neighborhoods; and traffic management measures, including implementing a gateway constraint north of the Revised Project location to meter traffic demand onto Pleasant Hill Road and discourage its use to bypass the Interstate 680/Highway 24 interchange.

The implementation of transit service and traffic management measures requires coordination and cooperation of other agencies outside of Lafayette and beyond the control of the Revised Project. As such, they are considered to be infeasible for the purpose of this Supplemental EIR. The Revised Project could include improvements to increase pedestrian and bicycle mobility between area schools, the Revised Project itself, and surrounding neighborhoods. Facilities currently included in the Revised Project provide good connectivity to Acalanes High School.

To improve connectivity to Springhill Elementary School, the Revised Project shall construct a pedestrian path along the west side of Pleasant Hill Road between Deer Hill Road and Springhill Road. This action would reduce the Revised Project's share of the cumulative Delay Index impacts and be consistent with Lafayette's Master Walkways Plan; however, it would not fully mitigate the cumulative Delay Index impacts to less than significant.

A mitigation option not included in the Lamorinda Action Plan is to construct additional capacity on Pleasant Hill Road north of Highway 24, such as an additional southbound lane starting north of Deer Hill Road/Stanley Boulevard and continuing to the Highway 24 westbound on-ramp. In the Certified EIR, this measure is determined to violate the Gateway Constraint Policy of the Lamorinda Action Plan, and result in secondary impacts that are inconsistent with Lafayette General Plan goals and policies. As such, this option is considered infeasible for the purpose of this Supplemental EIR.

Significance after Mitigation: Significant and Unavoidable

Impact TRAF-14 [Note: This impact would no longer occur as the Revised Project is expected to generate additional parking demand less than one percent of the existing parking lot capacity at the Lafayette BART station] : ~~The Project would generate an additional weekday parking demand for up to 50 spaces at the Lafayette BART station, which represents approximately three percent of the 1,526 spaces in the lot. Because the parking lot demand already exceeds capacity on weekdays, this would be a *significant* impact.~~

~~Mitigation Measure TRAF-14: The Project applicant shall provide subsidized, frequent shuttle service between the Project site and the Lafayette BART station during the a.m. and p.m. peak commute periods, until such time that a bus route on Pleasant Hill Road serving the BART station is implemented (as called for in the Lamorinda Action Plan), at which point the Project applicant may provide transit vouchers in lieu of a shuttle.~~

~~Significance after Mitigation: Less than Significant~~

Impact TRAF-15 [Note: This impact no longer applies as the site plan for the Revised Project proposes bus turnouts on southbound Pleasant Hill Road and eastbound Deer Hill Road which would permit buses to exit the travel lane during passenger boarding and alighting]: ~~The Project site plan does not include a loading and unloading area for school bus service, and peak hour traffic congestion on Pleasant Hill Road and Deer Hill Road would be exacerbated if all traffic would be required to stop for a school bus in the traffic lane. This would be a *significant* impact.~~

~~Mitigation Measure TRAF-15: The Project applicant shall coordinate with the Lamorinda School Bus Program to determine the appropriate locations and designs for bus stop pullouts along the Project frontage, which the Project applicant shall construct as part of the Project site frontage improvements. A bus stop on the southbound Pleasant Hill Road frontage may need to be located south of the Project driveway to avoid driveway sight distance issues as well as conflicts with passenger loading activity for Acalanes High School north of the driveway. On eastbound Deer Hill Road, a bus stop would need to be located to avoid sight distance issues at Project driveways.~~

~~Significance after Mitigation: Less than Significant~~

Impact TRAF-16 [Note: This impact has been modified per the revisions with the Revised Project]: *Some of t*he sidewalk *width*s proposed by the Project plans would be narrower than those existing in the immediate vicinity or recently approved by the City on arterial roadways*, and the project does not propose the construction of pedestrian facilities on Pleasant Hill Road south of the Soccer/Park Parking Lot driveway*. Therefore, the Project would be inconsistent with City guidelines for pedestrian facilities. This would be a *significant* impact.

Mitigation Measure TRAF-16: On the west side of Pleasant Hill Road along the Project site frontage *between Deer Hill Road and the westbound SR 24 on-ramp*, construct a new shared path for bicycles and pedestrians at a paved width of ten feet with a buffer strip at least four feet wide between the path and the curb, or *dimensions* as otherwise ~~specified~~*formally approved* by the City ~~Engineer~~. The buffer strip's surface treatment shall be appropriate to accommodate pedestrians accessing vehicles at curb parking and *bus stop* loading areas. *This configuration is expected to require a retaining wall along a portion of the Project frontage, which could result in a potential secondary impact on aesthetics that is addressed separately in Section 4.1 of the Supplemental EIR.* At the southwest corner of Pleasant Hill Road and Deer Hill Road, the path shall be designed to accommodate expected volumes of pedestrians and bicyclists waiting for the traffic signal. *This shared path shall connect with the proposed path traversing the project site at a point just south of the parking lot driveway and at a point just south of the southwest corner of Pleasant Hill Road and Deer Hill Road. These junctions shall provide seamless connections between the two paths, including design features to control conflicts between intersecting pedestrians and bicycles, while reducing conflicts between vehicles entering and exiting the project driveway and bicyclists and pedestrians by providing a single path crossing the driveway at a location a short distance away from vehicle turning movements at Pleasant Hill Road.* (This measure shall be in addition to *Supplemental* Mitigation Measure *TRAF-1* ~~TRAF-18, TRAF-19, TRAF-20, and TRAF-21~~ described below.)

Significance after Mitigation: Less than Significant

Impact TRAF-17 [Note: This impact has been modified per the revisions with the Revised Project]: Project driveways *accessing* Deer Hill Road and Pleasant Hill Road would interrupt the new sidewalks *and the proposed multiuse trail crossing west of the Pleasant Hill Road driveway,* and would cross existing, proposed*, and recommended Class I and* Class II bike ~~lanes~~ *facilities*. This would present conflicting vehicle traffic for pedestrians and bicyclists, which would be a *significant* impact.

Mitigation Measure TRAF-17: Implement Mitigation Measure TRAF-3. In addition, the Project applicant shall install stop signs for traffic exiting Project driveways, *except at the roundabout at the Residential/Dog Park driveway where yield signs are required,* and *pedestrian safety enhancement measures including* special *physical* design treatments, such as paving *and signage* to be specified by the City Engineer, to alert drivers *entering and* exiting the Project site that they are crossing pedestrian and bicycle facilities.

Significance after Mitigation: Less than Significant

Impact TRAF-18 [Note: This impact no longer applies as the Revised Project does not propose widening southbound Pleasant Hill Road and does not currently propose the construction of a Class II bicycle lane (see Supplemental TRAF-1)]: ~~Proposed widening of southbound Pleasant Hill Road to add a vehicle traffic lane includes adding a 5-foot wide Class II bike lane along the west curb north of the Project driveway. South of the Project driveway, the bike lane would be forced to shift to the left side of the additional southbound traffic lane that would become a right-turn-only lane for the on-ramp to westbound State Route 24. This configuration would cause unacceptable weaving conflicts with vehicle traffic for the planned southbound bike lane, resulting in a *significant* impact.~~

~~Mitigation Measure TRAF-18: The Project shall implement an alternative configuration for widening southbound Pleasant Hill Road, which would not add a vehicle traffic lane. Southbound Pleasant Hill Road shall be widened along the Project frontage to provide a six-foot wide Class II bike lane between an 8-foot wide curb loading and parking lane and the existing traffic lanes, or dimensions otherwise specified by the City Engineer. This configuration would maintain the existing curb loading and parking lane, except for a segment extending up to 100 feet north from the Project driveway, where the roadway shall be widened to accommodate an additional 12-foot wide right-turn lane along with the 6-foot wide Class II bike lane, or dimensions otherwise specified by the City Engineer. (This measure shall be in addition to Mitigation Measures TRAF-16-B, TRAF-19, TRAF-20, and TRAF-21.)~~

~~Significance after Mitigation: Less than Significant~~

Supplemental Impact TRAF-1 The site plan does not propose any bicycle facilities along the project site frontage on the west side of Pleasant Hill Road. The City's Bikeway's Master Plan envisions a complete Class II bicycle lane as part of the network on Pleasant Hill Road south of Deer Hill Road. Because the project site plan does not propose bicycle facilities on Pleasant Hill Road, the inconsistency between the project proposal and the City's Bikeways Master Plan is a *significant impact.*

Supplemental Mitigation Measure TRAF-1: The project applicant shall revise the proposal to include a southbound Class II bicycle lane to be consistent with the vision and intent of the City's Bikeway Master Plan. The bicycle lane shall be provided from the Deer Hill Road/Pleasant Hill Road intersection to the south side of the westbound State Route 24 on-ramp. To implement this mitigation, the Project applicant shall work with the City and Caltrans to provide a safe bicycle facility, including features to reduce safety conflicts at the State Route 24 on-ramp crossing (such features may include signage, striping, and/or other features recommended by the City Engineer). The design is expected to include widening the southbound roadway along the project frontage to provide a standard Class II bike lane while retaining the existing curb parking lane. This configuration would require a longer and higher

retaining wall along the Project frontage than that expected with Mitigation Measure TRAF-16. The potential secondary impacts of the retaining wall on aesthetics are addressed separately in Section 4.1 of the Supplemental EIR. For a segment of southbound Pleasant Hill Road extending north from the Soccer/Park Parking Lot driveway, additional widening may be required to accommodate the proposed bus turnout in addition to the Class II bike lane. (This measure shall be in addition to Mitigation Measure TRAF-16.)

Significance after Mitigation: Less than Significant

Impact TRAF-19 [Note: This impact has been modified per the revisions with the Revised Project, which proposes a multiuse path along the site's southern boundary adjacent to the SR-24, but does not currently propose an appropriate facility on the west side of Pleasant Hill Road (see Impact TRAF-16)] : Project plans ~~could preclude accommodation of a planned bike path along the Project boundary, and the plans~~ propose a narrower facility on the west side of Pleasant Hill Road than those recently constructed by the City for shared bicycle and pedestrian use*, and the project does not propose the construction of bicycle facilities on Pleasant Hill Road south of the Soccer/Park Parking Lot driveway*. Therefore, the Project would ~~interfere~~ *be inconsistent* with *City* plans *and guidelines for* bicycle facilities, resulting in a *significant impact.*

Mitigation Measure TRAF-19: Implement Mitigation Measure TRAF-16. ~~In addition, the Project applicant shall coordinate with the City and Caltrans to ensure that Project site improvements adjacent to the Caltrans State Route 24 right-of-way, such as grading, drainage, retaining walls, or other structures, do not preclude construction of a Class I bicycle path meeting applicable vertical and horizontal alignment standards, at a paved width of ten feet with graded shoulders at least two feet wide on both sides, or as otherwise specified by the City Engineer. The Project applicant shall dedicate additional right-of-way as needed to ensure the feasibility of constructing such a path. The Project applicant shall coordinate with the City to develop an appropriate alignment of the path to connect with the shared bicycle/pedestrian path described in Mitigation Measure TRAF-16-B while also intersecting the Project driveway on Pleasant Hill Road as described in Mitigation Measure TRAF-20.~~ (This measure shall be in addition to *Supplemental* Mitigation Measure *TRAF-1*, ~~TRAF-18 and TRAF-21~~.)

Significance after Mitigation: Less than Significant

Impact TRAF-20[Note: This impact no longer applies as the Revised Project does not propose left turns from northbound Pleasant Hill Road at the Project driveway, which would have caused the substantial hazards to bicyclists crossing the driveway on the multiuse path along the west side of Pleasant Hill Road (see Impact TRAF-17).]: ~~Traffic entering and exiting the proposed Project driveway on Pleasant Hill Road would interfere with the shared bicycle and pedestrian path that planned along the west side of the roadway, causing hazards to bicyclists at the driveway intersection. This would be a *significant* impact.~~

~~Mitigation Measure TRAF-20: The Project applicant shall coordinate with the City to develop an appropriate route and dedicate right-of-way on the Project site for a bike path/multiuse trail alignment that would intersect the driveway approximately 50 feet or more from Pleasant Hill Road. Additionally, the Project applicant shall provide the necessary grading and structural support on the site to allow for a Class I bike path that meets applicable width and slope standards, provides adequate sight-distance where it intersects the driveway, and connects with the shared bicycle/pedestrian path described in Mitigation Measure TRAF-1-B and the planned~~

bike path described in Mitigation Measure TRAF-1 on both ends. Where the driveway intersects the bike path, the Project applicant shall also install special design treatments, such as paving, to be specified by the City Engineer, to alert drivers that they are crossing a bike path. (This measure shall be in addition to Mitigation Measures TRAF- 16 and TRAF-19.)

Significance after Mitigation: Less than Significant

Impact TRAF-21 [Note: This impact no longer applies as the project site plans propose a parking lot adjacent to the Pleasant Hill Road/Deer Hill Road – Stanley Blvd. intersection that will provide a safe alternative to existing passenger loading area on Pleasant Hill Road, which would be eliminated under Revised Project Conditions.]: Project plans propose widening southbound Pleasant Hill Road between Deer Hill and the on-ramp to westbound State Route 24 to add a vehicle traffic lane and a bike lane along the west curb, where the plans show elimination of the existing curb parking and passenger loading zone. The proposed elimination of the existing designated spaces on the west curb of Pleasant Hill Road that are currently used for school passenger loading would result in additional hazardous passenger loading activity at unsuitable locations. The loss of these designated curb spaces used for passenger loading would substantially increase hazards for school pedestrians and vehicle traffic in the immediate area, resulting in a *significant* impact.

Mitigation Measure TRAF-21: Implement Mitigation Measure TRAF-18. The entire curb segment between Deer Hill Road and the recommended right-turn lane shall be designated as a passenger loading zone, which would accommodate eight cars in approximately the same location as the existing curb spaces used for passenger loading. (This measure shall be in addition to Mitigation Measures TRAF-16-B, TRAF-18, TRAF-19, and TRAF-20.)

Significance after Mitigation: This configuration would maintain the existing curb loading and parking lane, except for a segment extending up to 100 feet north from the Project driveway, and would accommodate only one vehicle less vehicle than the maximum observed curb loading space demand. This alternative configuration for widening southbound Pleasant Hill Road would reduce this impact to a *less than significant* level.

Impact TRAF-22 [Note: This impact no longer applies as the Revised Project driveway on Pleasant Hill Road will not be accessible via a northbound left-turn from Pleasant Hill Road]: The Project would increase travel time on the two weaving segments between the State Route 24 westbound off-ramp and the Project driveway by more than 10 percent and more than five seconds, resulting in a *significant* impact.

Mitigation Measure TRAF-22: To mitigate this impact, prohibition of left turns from northbound Pleasant Hill Road into the Project Driveway during the weekday commute PM peak hours (typically between 4:00 and 7:00 p.m.) would be required. Because a northbound left-turn-only storage lane in the Pleasant Hill Road median has been proposed at the Project driveway, effective implementation of the weekday PM peak hour left-turn prohibition would likely require daily deployment of cones or pylons, either manually or possibly using a mechanical system installed permanently in the roadway.

Significance after Mitigation: This mitigation would result in travel time increases on the study segments that are less than 10 percent or less than five seconds, reducing this impact to a *less than significant* level.

Supplemental Impact TRAF-2: The proposed Soccer Field/Park parking lot would generate additional demand for parking on weekdays beyond that which is estimated for the proposed soccer field and park based on potential diversion of existing parking demand from nearby Acalanes High School and on-street spaces on Pleasant Hill Road. This additional weekday demand would potentially not be accommodated by the proposed parking lot capacity, resulting in a *significant impact.*

Mitigation Measure Supplemental TRAF-2: To mitigate this impact, TJKM proposes the implementation of various parking restrictions within the Soccer Field/Park parking lot to prevent all-day parking and other abusive parking behavior that would potentially displace the Soccer Field/Park users for which the lot is intended. These restrictions will be deliberated through a public process by the appropriate Lafayette review board(s).

Significance after Mitigation: Implementation of this measure would result in a *less-than-significant* impact.

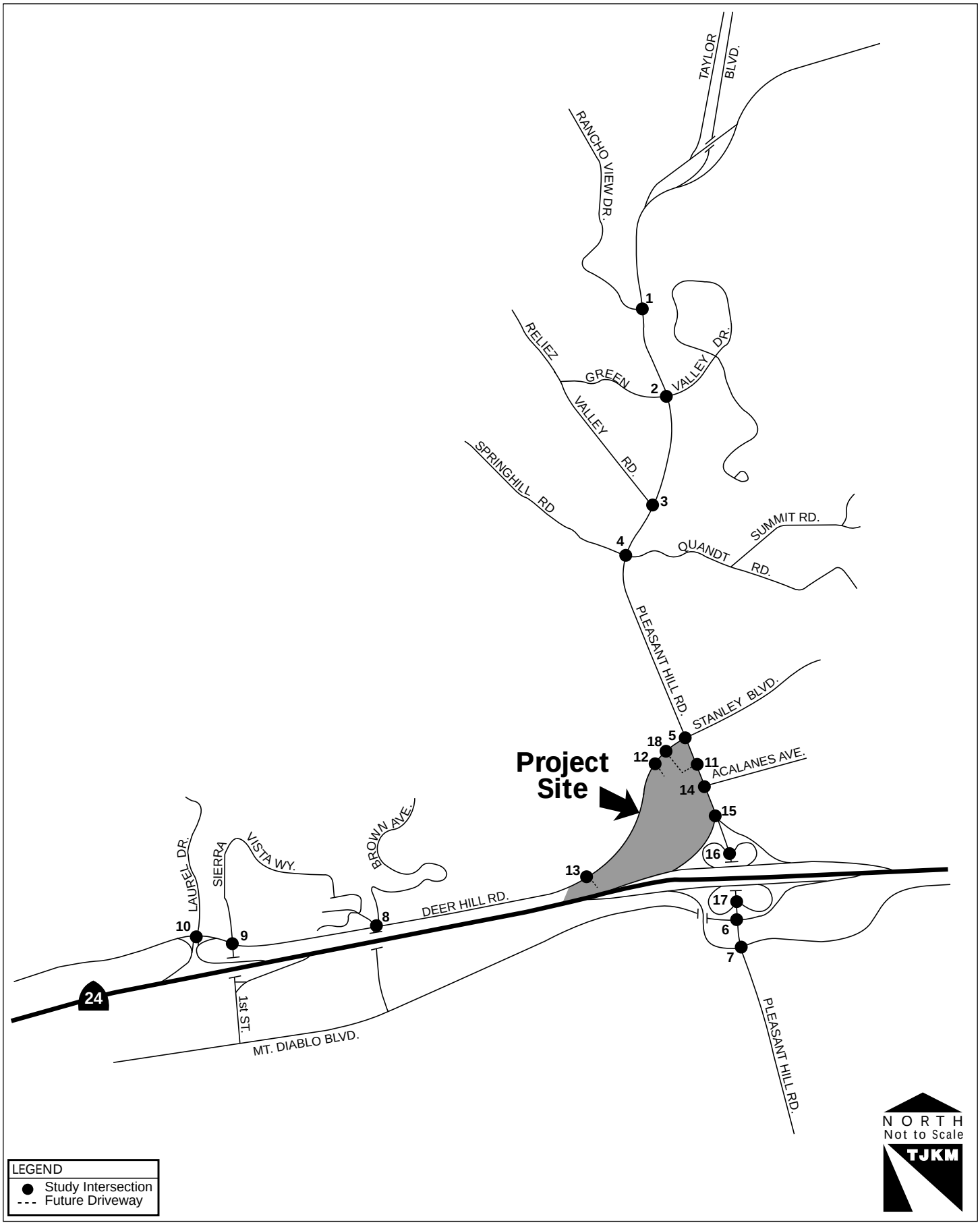
Although not required as mitigation for significant impacts, TJKM also recommends the following specifications to improve on-site design and operations:

- To maintain adequate sight-distance, all landscaping within 15 feet of on-site driveway intersections, *including the proposed multiuse trail crossing west of the Pleasant Hill Road driveway,* shall be limited to plants with foliage no more than 30 inches fully mature height above the closest adjacent curb elevation, or trees with canopy foliage no less than seven feet above the closest adjacent curb elevation, or other dimensions as specified by the City Engineer.

City of Lafayette - The Terraces of Lafayette EIR

Figure 1

Vicinity Map



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Site Plan

Figure 2

Traffic Operations Analysis Methodology

Study Scenarios

The following traffic scenarios were addressed in this study:

- *Existing Conditions* – This scenario evaluates existing (2011) traffic volumes and roadway conditions based on existing peak hour turning movement counts and field surveys.
- *Existing with Revised Project Conditions* – This scenario is identical to Existing Conditions, but with the addition of traffic expected to be generated by the proposed project and the connection of project driveways to the adjacent roadways.
- *Cumulative Year 2030 No Project Conditions* - This scenario is based on projecting Existing Conditions traffic volumes 20 years into the future using growth factors derived from the latest Contra Costa Transportation Authority (CCTA) travel demand model for Year 2035. This model includes future land use and transportation network assumptions for the entire county, including Lafayette, Pleasant Hill, Martinez, Walnut Creek, Moraga, and unincorporated areas. Because the CCTA model assumes development in the Project site area would generate traffic approximately similar in magnitude to traffic generated by the Revised Project, this scenario subtracts from the Year 2030 volume projections the traffic expected to be generated by the Revised Project to provide the No Project baseline.
- *Cumulative Year 2030 plus Revised Project Conditions* – This scenario is identical to Cumulative Year 2030 No Project Conditions, but includes the additional traffic expected to be generated by the proposed project and the connection of project driveways to the adjacent roadways.

It should be noted that the original Terraces of Lafayette project would generate traffic significantly higher in magnitude than the traffic volume forecasts from the CCTA travel demand model for its assumed development in the area that includes the project site. Therefore, in the EIR for the original project, the model forecasts for Year 2035 and corresponding derived growth factors used to estimate Year 2030 conditions served as an effective No Project scenario, which was used as the comparative baseline for determining impacts under Cumulative Year 2030 plus Project Conditions by adding project traffic to the derived 2030 model forecasts. However, as stated above, the CCTA model's land use assumptions for future development in the Project site area would generate traffic approximately similar in magnitude to traffic generated by the Revised Project. To account for this, TJKM assumed that the Cumulative Year 2030 model forecasts include development of the proposed project and therefore are used to analyze impacts under Cumulative Year 2030 plus Revised Project Conditions. Correspondingly, TJKM subtracted the estimated Revised Project trip assignments from these Cumulative Year 2030 with Revised Project Conditions traffic volumes to determine volumes under Year 2030 No Project Conditions.

Intersection Analysis Methodology

Study Intersections

The analysis evaluated traffic conditions at study intersections that the proposed project may potentially affect by adding a considerable number of peak hour trips. The following study intersections were analyzed:

1. Pleasant Hill Road / Rancho View Drive (Signalized)
2. Pleasant Hill Road / Green Valley Drive (Signalized)
3. Pleasant Hill Road / Reliez Valley Road (Signalized)
4. Pleasant Hill Road / Springhill Road – Quandt Road (Signalized)
5. Pleasant Hill Road / Deer Hill Road – Stanley Blvd. (Signalized)

6. Pleasant Hill Road / Mt. Diablo Blvd. / SR 24 Eastbound On-ramp (Signalized)
7. Pleasant Hill Road / SR 24 Eastbound Off-ramp – Old Tunnel Rd. (Signalized)
8. Deer Hill Road / Brown Avenue (Unsignalized)
9. Deer Hill Road / First Street – Sierra Vista Way (Signalized)
10. Deer Hill Road / SR 24 Westbound Ramps – Laurel Dr. (Signalized)
11. Pleasant Hill Road / Soccer Field/Park Driveway (Proposed – Unsignalized)
12. Deer Hill Road / Soccer Dropoff (Proposed – Unsignalized)
13. Deer Hill Road / Residential/Dog Park Driveway (Proposed – Roundabout)

All of the study intersections are outside of the Downtown area as defined in the Lafayette General Plan Circulation Chapter (p. II-5).

Level of Service Analysis Methodology

Level of service (LOS) is a qualitative description of intersection operations and is reported using an A through F letter rating system to describe travel delay and congestion. LOS A indicates free flow conditions with little or no delay, and LOS F indicates jammed conditions with excessive delays and long back-ups. The LOS methodology is detailed in Appendix A. In most cases, the level of service analysis is performed using intersection turning movement volumes during each of the a.m. and p.m. commute peak hours; the analysis presented herein also includes the mid-afternoon peak hour that occurs around school dismissal for the Pleasant Hill Road / Soccer Field/Park Driveway only. The original certified EIR included LOS analysis at all study intersections for the mid-afternoon school dismissal peak hour, which demonstrated that LOS and delay during that period were better than during the a.m. and p.m. commute peak hour, and the original Project impacts during that period would be less than significant. Because the Revised Project would generate fewer trips during the afternoon school dismissal peak than the original project, further LOS analysis of that peak period is not needed to conclude that the Revised Project impacts would be less than significant.

Operating conditions at the study intersections were evaluated using the 2000 Transportation Research Board Highway Capacity Manual (HCM 2000) Operations methodology. Peak hour traffic operational conditions for signalized intersections are reported as average control delay for the overall intersection in seconds per vehicle with corresponding levels of service. In addition to the control delay and level of service relationships shown in Appendix A, the City of Lafayette has the following definitions for signalized intersections as shown in Table I.

- "Good" LOS D is defined as 35 to 45 seconds of average control delay per vehicle.
- "Poor" LOS D is defined as 45 to 55 seconds of average control delay per vehicle.

Table I: Signalized Intersection Level of Service Criteria

LOS	*Description*	*Average Control Delay (Seconds)*
A	Free flow/non-congested operation. Turning movements are easily made and all queues clear in a single signal cycle.	≤ 10.0
B	Stable operation/minimal delays. An occasional approach phase is fully utilized. Drivers begin to feel somewhat restricted within platoons of vehicles.	> 10.0 to 20.0
C	Stable operation/acceptable delays. Major approach phases fully utilized. Backups may develop behind turning vehicles.	> 20.0 to 35.0
D	Approaching unstable operation/tolerable delays. Drivers may have to wait through more than one red signal indication. Queues may develop but dissipate rapidly, without excessive delays.	"Good" D: > 35.0 to 45.0
		"Poor" D: > 45.0 to 55.0
E	Unstable operation/significant delays. Volumes at or near capacity. Vehicles may wait through several signal cycles. Long queues form upstream of intersection.	> 55.0 to 80.0
F	Forced flow/excessive delays. Represents jammed conditions. Traffic demand exceeds the capacity. Queues may block upstream intersection.	> 80.0

Source: Transportation Research Board, 2000, *Highway Capacity Manual*; 2002 City of Lafayette General Plan.

For unsignalized intersections, average control delay is reported for the critical minor stop-controlled approach, with corresponding levels of service as shown in Appendix A.

For roundabouts, operating conditions were evaluated using the HCM 2010 Operations methodology in SIDRA roundabout analysis software. As with signalized intersections, peak hour traffic operational conditions for roundabouts are also reported as average control delay for the overall facility in seconds per vehicle with corresponding levels of service. Level of service criteria for roundabouts as determined by control delay is shown in Table II.

Table II: Roundabout Level of Service Criteria

LOS	*Average Control Delay (Seconds/vehicle)*
A	≤ 10.0
B	> 10.0 to 15.0
C	> 15.0 to 25.0
D	> 25.0 to 35.0
E	> 35.0 to 50.0
F	> 50.0

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

It should be noted that for the current study, the HCM and City of Lafayette level of service criteria described above are not used to determine significant impacts for the Pleasant Hill Road corridor, with the exception of the Pleasant Hill Road intersections at Mt. Diablo Blvd./SR 24 Eastbound On-ramp and at Old Tunnel Road/SR 24 Eastbound Off-Ramp. The Pleasant Hill Road Corridor, which includes all the intersections on Pleasant Hill Road from SR 24 to Rancho View Drive, is analyzed using the Routes of Regional Significance Delay Index Methodology described below (per General Plan Policy C-1.2 of the Growth Management Chapter, the Lamorinda Action Plan, and CCTA guidelines).

Pleasant Hill Road Corridor Traffic Simulation

The HCM 2000 LOS analysis was performed using Synchro traffic analysis software. To provide supplemental data regarding peak-hour vehicle queues, travel times and traffic delays on the Pleasant Hill Road corridor between the Rancho View Drive and SR 24 eastbound off- ramp/Old Tunnel Road intersections, the SimTraffic traffic simulation module of the Synchro software was utilized. Details regarding the Pleasant Hill Road traffic simulation are contained in the original certified EIR, and serve as the baseline for providing supplemental data for the currently proposed Revised Project.

Routes of Regional Significance Delay Index Methodology

The Contra Costa Transportation Authority (CCTA) serves as the Congestion Management Agency (CMA) for Contra Costa County. State Route 24 and Pleasant Hill Road north of State Route 24 are designated by CCTA as Routes of Regional Significance.

The adopted Final Lamorinda Action Plan Update (DKS Associates, December, 2009) and the 2009 Countywide Comprehensive Transportation Plan (adopted June 17, 2009) establish Multimodal Traffic Service Objectives (MTSOs) for CCTA-designated routes of Regional Significance in Lamorinda. An MTSO used to measure freeway and arterial operations is the peak hour peak direction Delay Index, which is defined as the ratio of peak period peak direction travel time to off-peak period travel time on each roadway segment. For example, a Delay Index of 2.0 means that it takes twice as long to travel a particular segment during the peak commute hour than during non-commute hours when traffic moves at free-flow speeds.

The original certified EIR included Delay Index analysis for SR 24, which demonstrated that the original Project impacts on SR 24 would be less than significant. Because the Revised Project would generate fewer peak hour trips on SR 24 than the original project, further Delay Index analysis is not needed to conclude that the Revised Project impacts would be less than significant on SR 24.

For the purposes of this report, TJKM conducted a new analysis of the peak hour peak direction Delay Index on Pleasant Hill Road between State Route 24 and Rancho View Drive, for the southbound direction during the a.m. peak hour and northbound during the p.m. peak hour. For Existing conditions, the analysis used travel time and speed observations provided by the City and conducted in 2013 for an update of the Lamorinda Action Plan. Based on the travel times for the applicable roadway segments designated in those observations, TJKM calculated the Existing Delay Index as the comparative baseline for the purpose of analyzing project impacts. The Synchro model used for the LOS analysis in this report was utilized to determine the changes in travel times on those segments between the Existing and the Existing with Revised Project conditions. For the travel time analysis used to determine Delay Index, the Synchro model assumed a peak hour factor (PHF) of 1.0 for all traffic volumes, which provides Existing travel time results more consistent with

the Existing peak hour observations conducted in 2013. The resulting changes in travel time were added to the Existing observed travel times to calculate the Delay Index on Pleasant Hill Road under Existing with Revised Project Conditions.

For Cumulative Year 2030 Conditions, TJKM assumed the Cumulative Year 2030 No Project a.m. and p.m. peak hour turning movement volumes, travel times and Delay Index results from the original EIR as representative of Cumulative Year 2030 with Revised Project Conditions in the current study, for the reasons described previously in the Study Scenarios section of this report. Once the resulting turning movement volumes for the new Cumulative Year 2030 No Project and Cumulative Year 2030 with Revised Project scenarios were determined (as described in the previous Study Scenarios section), the Synchro model used for the LOS analysis in this report was utilized to determine the differences in travel time on the Pleasant Hill Road corridor between those two scenarios. For the travel time analysis used to determine Delay Index, the Synchro model assumed a peak hour factor (PHF) of 1.0 for all traffic volumes, which provides Cumulative travel time and Delay Index results more consistent with previous studies. The resulting differences in travel time were subtracted from the previous Cumulative Year 2030 No Project travel times from the original EIR project, which are now assumed as the Cumulative Year 2030 with Revised Project conditions in the current study, to estimate travel times and corresponding Delay Indices for Cumulative Year 2030 No Project Conditions on Pleasant Hill Road. The resulting differences in Delay Index results with and without the Revised Project were used to evaluate its impact on the Pleasant Hill Road corridor.

Peak Hour Traffic Signal Warrant Criteria

TJKM conducted a signal warrant analysis for study intersections in which traffic signal installation is considered as a mitigation option under Existing with Revised Project Conditions and Cumulative 2030 with Revised Project Conditions. The 2010 California Manual on Uniform Traffic Control Devices (CA-MUTCD) was used to determine whether unsignalized study intersections operating at an unacceptable LOS meet the criteria for installation of a traffic signal. Installation should be considered if one or more of the warrant criteria described in the CA-MUTCD is met.

As part of this study, unsignalized study intersections operating at LOS F were evaluated using the 2010 CA-MUTCD peak hour warrant (Warrant 3). The peak hour signal warrant is intended for intersections where for a minimum of one hour of an average day, the minor-street traffic experiences undue delay when entering and crossing the major street. Entering peak hour intersection traffic volumes for a given analysis scenario are used as the basis for this evaluation.

Significant Impact Criteria

The project is considered to have a significant impact on traffic conditions if it would:

1. Cause a signalized "downtown" intersection (as identified in the General Plan) operations to deteriorate from LOS A, B, C, or D to LOS E or F.
2. Cause operations at a signalized intersection "outside downtown" to deteriorate from LOS A, B, C, or "good" D to "poor" LOS D or to LOS E or F, except for those signalized intersections on Pleasant Hill Road described in the Regional Routes of Significance Delay Index Methodology section, which are subject to the Delay Index criteria below (per General Plan Policy C-1.2 of the Growth Management Chapter, the Lamorinda Action Plan, and CCTA guidelines). "Good" LOS D is defined as 35 to 45 seconds of average control delay per vehicle. "Poor" LOS D is defined as 45 to 55 seconds of average delay.
3. Cause the overall level of service at an unsignalized all-way stop control intersection or roundabout to degrade from LOS D or better to LOS E or F.
4. Cause the level of service at an unsignalized one- or two-way stop control intersection to degrade from LOS E or better for the worst movement from the side street to LOS F, where the intersection also meets at least one warrant for the installation of a traffic signal.
5. Cause a Delay Index to increase from 2.0 or less to exceed 2.0 for the peak hour peak direction on State Route 24 or Pleasant Hill Road.
6. Cause delay to increase by five or more seconds at an intersection, or the Delay Index to increase by 0.05 or more for a roadway, where subject intersection or roadway is operating below the acceptable standard that is applicable, as outlined above.
7. Substantially increase hazards due to a design feature (e.g. sharp curves; intersections or driveways with restricted visibility, or causing unacceptable weaving conditions such as increasing travel time by ten percent or more and by five seconds or more on the weaving segment, etc.).
8. Generate added transit ridership that would increase the peak hour average ridership at a BART station by three (3) percent where average waiting time at fare gates also either:
   a) Already exceeds one minute, or
   b) Would exceed one minute as a result of ridership added by the project.
9. Generate added transit ridership that would increase the AM load factor on a County Connection bus line such that it would be over capacity during the AM peak hour (load factor greater than 1.0).
10. Create demand for public transit services above that which is provided or planned; disrupt or interfere with existing or planned transit services or facilities; or create inconsistencies with adopted transit system plans, guidelines, policies, or standards.
11. Disrupt existing bicycle or pedestrian facilities; interfere with planned bicycle or pedestrian facilities; or create inconsistencies with adopted bicycle or pedestrian system plans, guidelines, policies, or standards.

Mitigation measures would subsequently be evaluated that would potentially improve the impacted condition such that the subject threshold would not be exceeded.

Regarding threshold #1 above, none of the study intersections is "Downtown" as defined in the Lafayette General Plan Circulation Chapter (p. II-5).

Existing Conditions

Roadway Network

Regional roadway access to the project site is provided by Pleasant Hill Road and its interchange ramp connections with State Route 24. State Route 24 and Pleasant Hill Road north of State Route 24 are designated by the Contra Costa Transportation Authority (CCTA) as Routes of Regional Significance. Access to the project site at the local level is provided by Deer Hill Road.

The existing circulation network within the study area is composed of a State highway, as well as City arterials, collectors, and local streets. Primary roadways within the study area include the following:

- *State Route 24* is an east-west freeway that runs along the south boundary of the project site, connecting Interstate 680 in Walnut Creek with Interstate 980 and Interstate 880 in Oakland, via the Caldecott Tunnel. The freeway is an eight-lane, divided facility with BART tracks running along the median, including a BART station platform in downtown Lafayette. State Route 24 carries about 178,000 vehicles per day near the Pleasant Hill Road interchange, according to Caltrans data for year 2010. State Route 24 is a CCTA-designated Route of Regional Significance.
- *Pleasant Hill Road* is a four-lane arterial that runs north-south along the east boundary of the project site, and connects with State Route 24 at a full interchange immediately south of the project site frontage. It connects Deer Hill Road with Mount Diablo Blvd. and Olympic Blvd. to the south and the City of Pleasant Hill, City of Walnut Creek, City of Martinez, unincorporated Contra Costa County, and northeasterly areas of Lafayette to the north, and provides access to Acalanes High School and Springhill Elementary School. The road serves as an alternative route to I-680, particularly during periods of peak congestion on the freeway. Pleasant Hill Road is a CCTA-designated Route of Regional Significance north of State Route 24.
- *Deer Hill Road* is an east-west arterial street that runs along the northwesterly boundary of the project site, connecting Pleasant Hill Road on the east with Happy Valley Road on the west. It has two lanes between Pleasant Hill Road and First Street, and widens to four lanes with left-turn lanes and raised medians west of First Street, where it provides access to the Lafayette BART station and westbound State Route 24 freeway ramps. Along the northern edge of the project site, the road is at its steepest, and it curves before descending to meet Pleasant Hill Road. East of Pleasant Hill Road, the street name changes to *Stanley Boulevard*, a two-lane collector street that provides access to Acalanes High School and an alternative route to the City of Walnut Creek.
- *Mount Diablo Boulevard* is an east-west arterial street with two lanes in each direction and sections with either a center left-turn lane or dedicated left-turn lanes and raised medians, which extends from Acalanes Road on the west to Pleasant Hill Road on the east, providing access through the entire length of downtown Lafayette. At its easterly and westerly ends, Mount Diablo Boulevard connects with State Route 24 freeway ramps.
- *First Street* is a four-lane arterial between Mount Diablo Boulevard and Deer Hill Road that runs north-south and connects to State Route 24 with an eastbound freeway on-ramp. North of Deer Hill Road, First Street changes to Sierra Vista, which serves as a two-lane neighborhood collector.

- *Springhill Road* is a two-lane collector street extending northwesterly from its intersection from Pleasant Hill Road, providing access to Springhill Elementary school and a residential area. The east leg of the Springhill Road/Pleasant Hill Road intersection is *Quandt Road*, a two-lane collector extending easterly to provide access to a residential area.
- *Brown Avenue* is a two-lane collector street that runs north-south, connecting Deer Hill Road and Mount Diablo Blvd. via an underpass at State Route 24. North of Deer Hill Road, Brown Avenue splits into two 2-lane neighborhood collectors: Miller Road and Brown Avenue (private).
- *Reliez Valley Road* is a two-lane collector street extending northerly from its intersection with Pleasant Hill Road, providing access to residential areas westerly of Pleasant Hill Road and Taylor Boulevard, and connecting with Alhambra Valley Road in unincorporated area near the City of Martinez.
- Collector and local streets in the study area also include the following two-lane roadways that mostly serve residential areas: Acalanes Avenue, Green Valley Drive, Rancho View Drive, and Old Tunnel Road.

The key study intersection adjacent to the Project site is Pleasant Hill Road/Deer Hill Road – Stanley Boulevard, which is signalized. The traffic signal timing sequence provides separate green signal phases for left/U-turns from Pleasant Hill Road, eastbound traffic on Deer Hill Road, and westbound traffic on Stanley Boulevard. On southbound Pleasant Hill Road approaching the intersection, the curb lane is a shared bike lane from which right turns are permitted. The existing geometry of the southwest corner curb and resulting southbound roadway width on Pleasant Hill Road south of the intersection constrains the available radius for U-turns from northbound Pleasant Hill Road, which prevents long pickup trucks and larger trucks from completing U-turns in one continuous movement. The resulting stopping and backing up movements contribute to traffic delay and queues at the intersection.

Existing Traffic Volumes

Weekday a.m. (7:00 a.m. to 9:00 a.m.), school dismissal p.m. (2:00 to 4:00 p.m.) and commute p.m. (4:00 p.m. to 6:00 p.m.) peak turning movement counts were collected mostly in May 2011 or early December 2011, with schools in regular session, at study intersections #1 to #8, with the date exceptions at the Springhill Road/Pleasant Hill Road intersection (#4) as shown in Table III. In addition, school dismissal p.m. (2:00 to 4:00 p.m.) counts were collected at the Pleasant Hill Road/Deer Hill Road – Stanley Blvd. (#5) intersection in early December 2011. At the two more westerly intersections of Deer Hill Road - at First Street (#9) and at the SR 24 westbound ramps (#10) – counts were collected in September 2009. Counts for all three peak periods were also collected in early December 2011 at those Pleasant Hill Road junctions with SR 24 ramps that are uncontrolled merging or exiting movements. The existing peak hour turning movement volumes, as well as lane geometries and traffic controls at the study intersections, are shown in Figure 3. Note that U-turn volumes are shown separately from left-turn volumes only at those study intersections where a substantial number of U-turns were counted, and are otherwise included in the left-turn volumes shown at the intersections where U-turns are less frequent.

Table III: Dates of Peak Period Intersection Counts

ID	*Intersection*	*Count Date*	
		A.M. Peak	*P.M. Peak*
1	Rancho View Drive/Pleasant Hill Road	May 2011	May 2011
2	Green Valley Drive/Pleasant Hill Road	May 2011	May 2011
3	Reliez Valley Road/Pleasant Hill Road	May 2011	May 2011
4	Springhill Road – Quandt Road/Pleasant Hill Road	January 10, 2012	September 2010
5	Deer Hill Road – Stanley Blvd./Pleasant Hill Road	December 1, 2011	December 1, 2011
6	Mt. Diablo Boulevard/Pleasant Hill Road	May 2011	May 2011
7	SR 24 EB Off-Ramp/Pleasant Hill Road	May 2011	May 2011
8	Deer Hill Road/Brown Avenue	May 2011	May 2011
9	Deer Hill Road/First Street - Sierra Vista Way	September 2009	
10	Deer Hill Road/SR 24 WB Ramps - Laurel Drive		

Intersection Level of Service Analysis Results, Existing Conditions

Existing levels of service for each study intersection were calculated based on the existing intersection geometry, traffic control, and a.m., school dismissal p.m., and commute p.m. peak hour traffic volumes. Table IV illustrates the results of the level of service analysis using the HCM 2000 methodology for the study intersections under Existing Conditions. Detailed level of service calculations are contained in Appendix B. Under Existing Conditions, all of the signalized study intersections are operating within acceptable City LOS standards except the Deer Hill Road/SR 24 Westbound Ramps – Laurel Drive intersection, which operates at Poor LOS D during the a.m. and p.m. peak hours. The Deer Hill Road – Stanley Blvd./Pleasant Hill Road intersection operates at LOS F during the a.m. peak hour and LOS E during the p.m. peak hour; however, this intersection is not subject to an intersection LOS standard, but is part of the Pleasant Hill Road corridor north of SR 24 that is subject to the Delay Index criteria analyzed subsequently (per General Plan Policy C-1.2 of the Growth Management Chapter, the Lamorinda Action Plan, and CCTA guidelines).

At the only Existing unsignalized study intersection, the northbound and southbound stop-controlled minor approaches on Brown Avenue at Deer Hill Road currently operate at LOS F during the a.m. and p.m. peak hours. The California Manual on Uniform Traffic Control Devices (MUTCD) peak hour traffic signal warrant is met for both peak hours under Existing conditions.

Table IV: Peak Hour Intersection Levels of Service – Existing Conditions

ID	Intersection	Existing Conditions			
		A.M. Peak Hour		P.M. Peak Hour	
		Delay	LOS	Delay	LOS
1	Rancho View Drive/Pleasant Hill Road	7.3	A	5.3	A
2	Green Valley Drive/Pleasant Hill Road	5.8	A	4.9	A
3	Reliez Valley Road/Pleasant Hill Road	24.5	C	9.8	A
4	Springhill Road – Quandt Road/ Pleasant Hill Road	21.2	C	12.9	B
5	Deer Hill Road –Stanley Blvd./ Pleasant Hill Road	189.7	F	58.5	E
6	Mt. Diablo Boulevard - SR 24 EB On-ramp/ Pleasant Hill Road	14.7	B	16.9	B
7	SR 24 EB Off-Ramp – Old Tunnel Road/ Pleasant Hill Road	13.2	B	16.2	C
8	Deer Hill Road/Brown Avenue	**145.5**	**F**	**271.1**	**F**
9	Deer Hill Road/First Street –Sierra Vista Way	13.4	B	14.4	B
10	Deer Hill Road/SR 24 WB Ramps -Laurel Drive	**50.8**	**D**	**45.3**	**D**
11	Pleasant Hill Road/Project Driveway	Not Analyzed - Future Intersection			
12	Deer Hill Road/Soccer Dropoff Driveway	Not Analyzed - Future Intersection			
13	Deer Hill Road/Homes-Dog Park Driveway	Not Analyzed - Future Intersection			

Notes: 1) LOS=Level of Service, Delay = Average control delay per vehicle in seconds
2) Signalized and all-way stop controlled intersections - Delay / LOS is for overall intersection
3) Unsignalized one- and two-way stop controlled intersections - Delay / LOS is for critical minor stop-controlled approach.
4) **Bold** indicates unacceptable operational conditions based on applicable City standards.
5) At intersections 1-5, intersection LOS standard does not apply; Delay Index is the applicable standard for Pleasant Hill Road north of SR 24 per Lafayette General Plan.

Pleasant Hill Road Corridor Traffic Simulation

As part of the analysis of for the original EIR project, Existing conditions along the Pleasant Hill Road study corridor were observed, and the Existing conditions model was calibrated in SimTraffic and CORSIM to replicate observed/measured field conditions such as travel time, delay, queues, and saturation flow rates for both directions on Pleasant Hill Road for both peak periods. The results presented as follows provide important information to supplement the intersection LOS results, and the traffic conditions described were reflected in the SimTraffic and CORSIM simulation runs.

During the a.m. peak hour, traffic on southbound Pleasant Hill Road backs up from the intersection at Deer Hill Road – Stanley Boulevard and the queue extends past the intersection at Green Valley Drive. In effect, the LOS F conditions at the Deer Hill Road – Stanley Boulevard intersection also occur upstream at the Springhill Road/Quandt Road, Reliez Valley Road, and Green Valley Drive intersections, which impacts southbound Pleasant Hill Road traffic and other traffic movements that

conflict with southbound traffic at each intersection. For example, at the Springhill Road - Quandt Road intersection, left turns from northbound Pleasant Hill Road, left turns and through movements from westbound Quandt Road, and all traffic movements from eastbound Springhill Road, as well as southbound movements stuck in the queue, experience long delays and queues. However, the City's intersection LOS methods described in the previous Level of Service Analysis Methodology section are based on the LOS results calculated at each intersection individually, which are the results shown in Table IV for existing conditions and presented subsequently in this report for the other analysis scenarios. This evaluation standard is appropriate because the actual traffic capacity constraint, or bottleneck, occurs at a single intersection. Although the bottleneck backs up traffic into upstream intersections, any capacity-increasing improvement or mitigation would need to address the actual bottleneck location to be effective, because capacity increases at upstream locations would not relieve that bottleneck. In the case of southbound Pleasant Hill Road during the AM peak, the Deer Hill Road – Stanley Boulevard intersection is the actual bottleneck (LOS F) and capacity-increasing improvements at that intersection would improve traffic flow, while such improvements at the upstream intersections such as Springhill Road – Quandt Road would be ineffective.

During the commute p.m. peak hour, traffic on northbound Pleasant Hill Road backs up from the intersection at Deer Hill Road – Stanley Boulevard and the queue extends past the Acalanes Avenue intersection.

Pleasant Hill Road Corridor Delay Index Results

The Pleasant Hill Road corridor north of SR 24, a CCTA-designated Route of Regional Significance, is analyzed using the Delay Index Methodology (per General Plan Policy C-1.2 of the Growth Management Chapter, the Lamorinda Action Plan, and CCTA guidelines). Travel time and speed observations conducted in 2013 for an update of the Lamorinda Action Plan were used to calculate peak hour peak direction Delay Indexes on Pleasant Hill Road north of SR 24 for the Existing Conditions No Project Scenario. The Delay Index measures travel congestion and is expressed as the ratio of time required to travel between two points during the peak hour (the congested travel time) versus the time required during uncongested off-peak times. A Delay Index of 2.0, which is the acceptable standard of significance for peak hour peak direction travel on Pleasant Hill Road north of SR 24, means that congested travel time is twice as long as during an off-peak travel time.

For Pleasant Hill Road between SR 24 and Rancho View Drive, the Delay Indexes in the Existing Conditions No Project scenario were calculated for the southbound direction during the a.m. peak hour and for the northbound direction during the p.m. peak hour, and are summarized in Table V. As noted in the table, Pleasant Hill Road operates with an acceptable Delay Index of less than 2.0 for southbound traffic in the a.m. peak hour and northbound traffic in the p.m. peak hour under the Existing Conditions No Project scenario.

Table V: Existing No Project Delay Index - Pleasant Hill Road

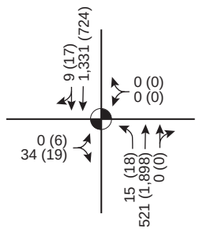
Scenario	*Travel Time (minutes)*		*Delay Index*	
	AM SB	*PM NB*	*AM SB*	*PM NB*
Existing No Project	3.45	3.74	1.3	1.4

City of Lafayette - The Terraces of Lafayette EIR

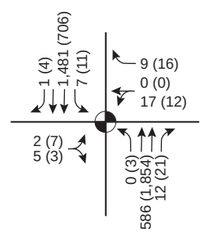
Existing Traffic Volumes, Lane Geometry, and Controls

Figure 3

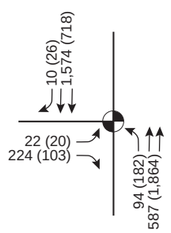
Intersection #1
Pleasant Hill Rd./Rancho View Dr.



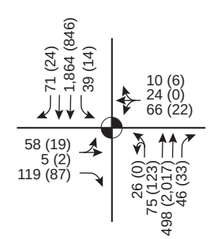
Intersection #2
Pleasant Hill Rd./Green Valley Dr.



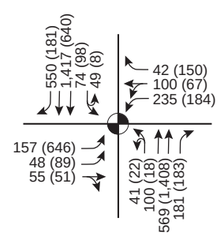
Intersection #3
Pleasant Hill Rd./Reliez Valley Rd.



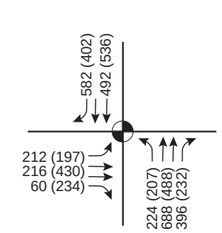
Intersection #4
Pleasant Hill Rd./Springhill Rd./
Quandt Rd.



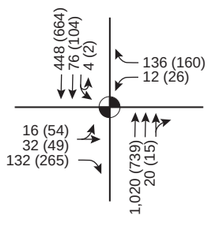
Intersection #5
Pleasant Hill Rd./Deer Hill Rd./
Stanley Blvd.



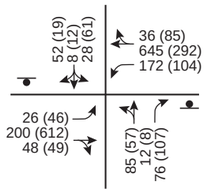
Intersection #6
Pleasant Hill Rd./Mt. Diablo Blvd./
SR 24 WB On Ramp



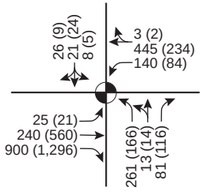
Intersection #7
Pleasant Hill Rd./Old Tunnel Rd./
SR 24 EB Off Ramp



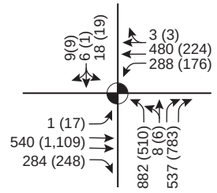
Intersection #8
Brown Ave./Deer Hill Rd.



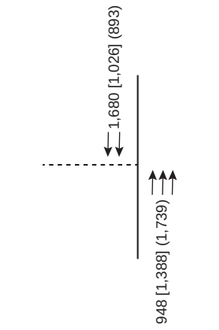
Intersection #9
First St./Sierra Vista Wy./Deer Hill Rd.



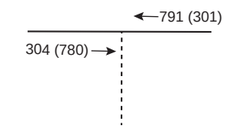
Intersection #10
SR 24 WB Ramps
Laurel Dr./Deer Hill Rd.



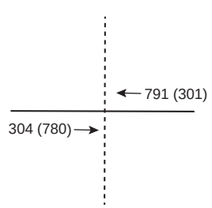
Intersection #11
Pleasant Hill Rd./Project Dwy.



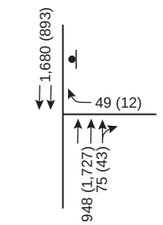
Intersection #12
Deer Hill Rd./Soccer Dropoff Dwy.



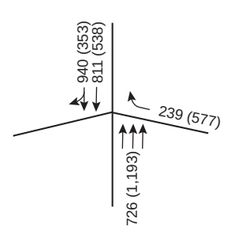
Intersection #13
Deer Hill Rd./West Project Dwy.



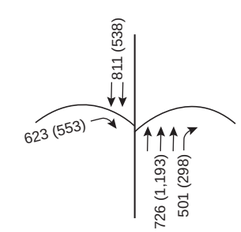
Intersection #14
Pleasant Hill Rd./Acalanes Ave.



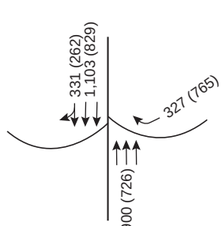
Intersection #15
Pleasant Hill Rd./
SR 24 WB Direct Ramps



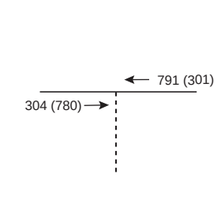
Intersection #16
Pleasant Hill Rd./
SR 24 WB Loop Ramps

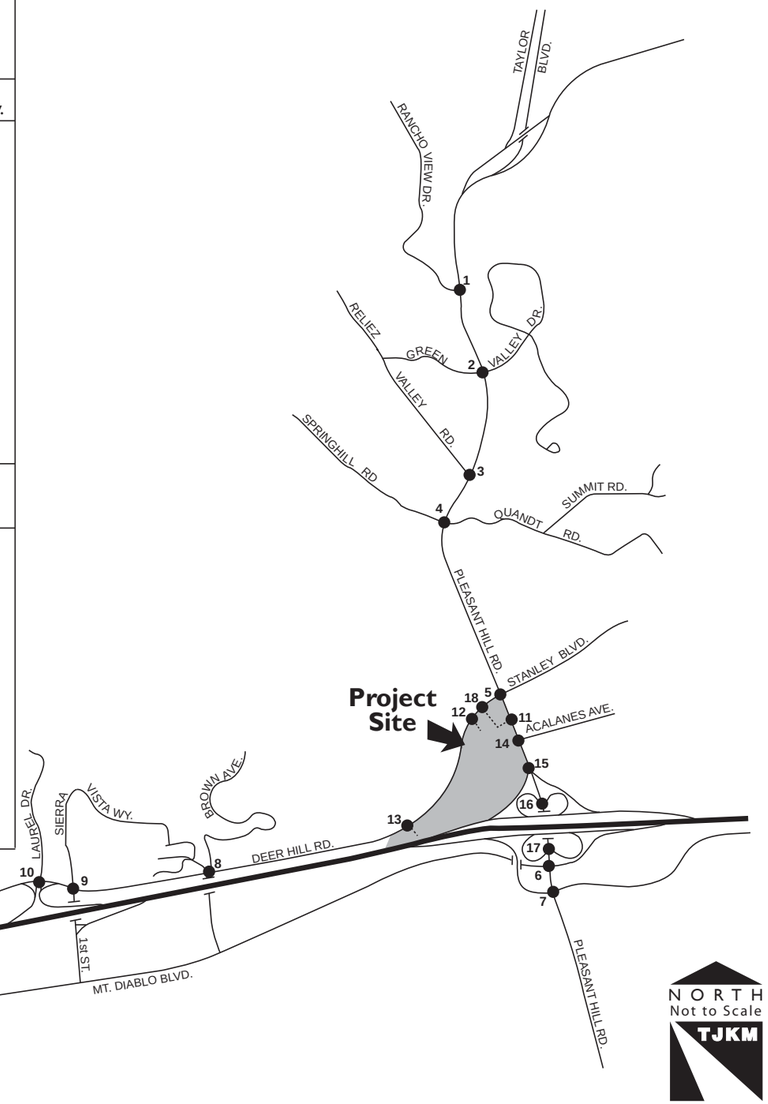


Intersection #17
Pleasant Hill Rd./
SR 24 EB Loop Ramps



Intersection #18
Deer Hill Rd./
Soccer Park Dwy.





LEGEND

- ● Study Intersection
- --- Future Driveway
- XX AM Peak Hour Volume
- [XX] School PM Peak Hour Volume
- (XX) PM Peak Hour Volume

Existing Transit Facilities

Public transit systems in Lafayette that are relevant to the project site, including both local bus and Bay Area Rapid Transit (BART) regional rail service, are described below.

BART

The project site is located approximately 1.5 miles east on Deer Hill Road from the Lafayette BART Station platform, which is located in the median of State Route 24 between Oak Hill Road and Happy Valley Road. The Pittsburg/Bay Point–San Francisco International Airport line serves the station seven days a week. Weekday service is provided between 4:00 a.m. and midnight, with Saturday service between 6:00 a.m. and midnight and Sunday service between 8:00 a.m. and midnight. Weekday service ranges from 5- to 10-minute headways in the peak direction (5- to 15-minutes in the non-peak direction) during the AM and PM peak commute periods, to 15- to 20-minute headways during off-peak midday and late evening periods. On weekends, 20-minute headways are provided all day.

According to the 2008 BART Station Profile Study, parking at the Lafayette BART Station consists of 1,526 spaces, including 380 monthly permit spaces and the remaining 1,146 requiring a daily fee. The number of parking spaces includes the small parking lot on the south side of the station accessed from Happy Valley Road. In addition, 122 bicycle spaces are provided at the station, consisting of 30 bike lockers and 92 bike rack slots. Bicycle access at the station's north side has relatively gentle grade connections to adjacent roadways, including bike lanes on Deer Hill Road. Based on observations conducted in October 2011, it is estimated that all parking spaces at the Lafayette BART Station typically fill up before 8:30 a.m. on weekdays, except on Fridays when parking demand is lower than on other days.

Bus Transit

Bus service is provided locally by the Central Contra Costa Transit Authority's (CCCTA) County Connection. One fixed-route bus line, Route 25, is available at a reasonable walking distance within one-half mile of the project site at bus stops near the intersection of Pleasant Hill Road and Mount Diablo Boulevard. As shown on the route map in Appendix F, Route 25 provides east-west service along Mount Diablo Boulevard and Olympic Boulevard, connecting the Lafayette and Walnut Creek BART Stations. Route 25 makes several local stops along Mount Diablo Boulevard between the Lafayette BART Station and Pleasant Hill Road, and a few stops on Pleasant Hill Road and Olympic Boulevard, then uses the Interstate 680 freeway before terminating at the Walnut Creek BART Station. Route 25 is designed to provide a continuous system ride, especially for employees in downtown Lafayette, between areas to the east of Lafayette and the downtown. County Connection riders can stay on that same transit system at the Walnut Creek BART station transit hub, rather than transferring to BART and paying an additional fare, to access Downtown Lafayette. This weekday-only route operates at hourly headways in both directions between 7:30 a.m. and 6:30 p.m. Route 25 buses operate at less than capacity with seating available; CCCTA data for February 2012 shows average weekday ridership of 50 passengers per day.

In addition to Route 25, County Connection provides supplemental service for schools in the area on school days, including Route 625 along Mount Diablo Boulevard, Pleasant Hill Road, Acalanes Avenue, and Stanley Boulevard, which serves Acalanes High School as shown on the route map in Appendix F. This bus operates at less than capacity with seating available. Based on TJKM field bus boarding observations on a regular school day in January 2012, approximately 15 to 20 Acalanes High School students ride Route 625 on its single morning and afternoon runs.

Other Local Transit Services

Lamorinda School Bus Program
The City of Lafayette participates in a collaborative program with the City of Orinda and Town of Moraga to provide school bus service in the Lamorinda area. The goal of the program is to mitigate traffic congestion in Lamorinda on roadways south of State Route 24 by reducing the number of drivers on these streets. The CCTA funds a significant portion of the program, with supplemental funding from fees paid by (parents of) riders and grant funding. The program serves Stanley Middle School and Springhill Elementary School, which have enrollment areas that include the project site, as well as Burton Valley School.

City of Lafayette Spirit Van
The City operates the Spirit Van program for its senior residents, with door-to-door service provided by volunteer drivers.

Existing Pedestrian and Bicycle Facilities

Pedestrian Facilities

The project site is currently served by very limited pedestrian facilities. Deer Hill Road has no sidewalks in the project vicinity, and pedestrians must use either the unimproved, irregular ground surface behind the raised curb or the Class II on-street, striped bicycle lane within the paved roadway. Pedestrian activity along Deer Hill Road is relatively light, except the section within 200 feet west of Pleasant Hill Road, where the south side of the roadway is frequently used by Acalanes High School (AHS) students being dropped off or picked up before and after school. The City's Master Walkways Plan includes adding a walkway on the north side of Deer Hill Road from Pleasant Hill Road west to Brown Avenue, and identifies this as a "Priority 4" project out of four priority categories. (The Plan permits that regardless of designated priority, walkway projects are intended to be implemented as opportunities arise.)

The west side of Pleasant Hill Road has very limited sidewalks in the project vicinity. No sidewalk exists along the immediate project frontage south of Deer Hill Road, an area frequently used by AHS students being dropped off or picked up before and after school as well as pedestrians who have parked vehicles at the curb spaces on that segment. These pedestrians must use the unimproved, irregular ground surface behind the raised curb, which becomes very narrow next to a retaining wall along the southerly portion of the project frontage. Near the southeast corner of the project site, approximately 300 feet north of the on-ramp to westbound SR 24, a sidewalk on the west side begins and extends to the south along Pleasant Hill Road. North of Deer Hill Road, the only existing sidewalk on the west side of Pleasant Hill Road is a short segment extending approximately 150 feet north from Deer Hill Road. The City's Master Walkways Plan includes adding a walkway on the west side of Pleasant Hill Road from the SR 24 westbound on-ramp to Reliez Valley Road, and identifies this as a "Priority 2" project out of four priority categories.

Continuous sidewalk is provided on the east side of Pleasant Hill Road across from the project site, extending north along AHS and south toward Olympic Boulevard. Approximately 600 feet south of the Quandt Road/Pleasant Hill Road intersection, the sidewalk ends at a connection with Hillview Lane, and pedestrians must walk along a narrow residential access roadway parallel to Pleasant Hill Road and separated by a landscaped fence. Stanley Boulevard has continuous sidewalk on the north side along AHS frontage and extending east into a residential neighborhood, but the sidewalk on the south side extends approximately 275 feet east from Pleasant Hill Road and ends at a residential driveway. The City's Master Walkways Plan includes completion of walkways on both sides of Stanley

Boulevard between Pleasant Hill Road and Camino Diablo to address missing links, and identifies this as a "Priority 2" project out of four priority categories.

Marked crosswalks and pedestrian signal indications are provided for crossing the west, south, and east legs of the signalized Deer Hill Road – Stanley Blvd./Pleasant Hill Road intersection, which is heavily used by AHS pedestrians before and after school. However, a large number of AHS pedestrians "jaywalk" across Stanley Boulevard within 100 to 275 feet east of the signalized intersection, with nearly 100 pedestrians observed crossing in this area on their way to AHS before school. Pedestrians apparently find crossing in this area more convenient than waiting for the signal to cross Stanley Boulevard at the intersection, which very few pedestrians were observed doing. Although crossing traffic in this illegal manner is somewhat hazardous, especially in the wider, multi-lane section close to the intersection, the large numbers of high school age pedestrians crossing mostly during a 20-minute period before and after school every day make them fairly visible to drivers. State-Wide Integrated Traffic Records System (SWITRS) data provided by the City's Engineering staff for a recent four-year period shows no reported accidents involving pedestrians in the project vicinity. Safer pedestrian behavior in this segment might be encouraged by installing a fence or barrier rail along the north curb of Stanley Boulevard between Pleasant Hill Road and the AHS exit driveway approximately 175 feet to the east, and installing a school crosswalk on Stanley Boulevard at that driveway. However, a fence or barrier along the curb could present a safety issue for drivers and a visual impact for the public, and installing an acceptable crosswalk design would be very challenging because of existing driveways and a drainage inlet on the north curb across from the AHS driveway.

Pedestrian safety and convenience walking along both sides of Pleasant Hill Road between the project site and Mount Diablo Boulevard is challenged at three to four crosswalks that require crossing uncontrolled free-flow traffic to and from SR 24 freeway ramps or a right turn to westbound Mount Diablo Boulevard. City staff has suggested potential improvement concepts for these crosswalks to Caltrans, which has jurisdiction over these freeway ramp junctions, but further action toward any improvements is undetermined and subject to actions by the State. The City is in the process of seeking funds to conduct a corridor study to improve pedestrian and bike access and safety between Mount Diablo Boulevard and Springhill Road/Quandt Road.

Bicycle Facilities

The project site is served reasonably well by existing bicycle facilities, but a gap exists along the project's Pleasant Hill Road frontage. A Class II (on-street, striped) bicycle lane is provided on southbound Pleasant Hill Road north of Deer Hill Road and south of Mount Diablo Boulevard, but not on the segment between those two roadways, where bicyclists must share a lane with motor vehicle traffic alongside curb parking. The City's Bikeways Master Plan shows continuous Class II bicycle lanes for this area of Pleasant Hill Road. Northbound Pleasant Hill Road and both directions on Deer Hill Road include continuous Class II bicycle lanes in the project vicinity. Stanley Boulevard has bicycle shared-lane pavement markings, known as "sharrows," which are consistent with the Bikeways Master Plan designation of Stanley Boulevard as a "Bike Boulevard." Traffic counts and observations indicate that several bicyclists per hour travel these roadways and facilities.

Steep grades on Deer Hill Road present a physical challenge for bicyclists, which may discourage potential bicycle travel. The City's Bikeways Master Plan proposes constructing a Class I (off-street) bicycle path between Pleasant Hill Road and the Brown Avenue/Deer Hill Road intersection on an alignment along the north side of the Caltrans SR 24 right-of-way. This alignment near the base of the hill that Deer Hill Road climbs over would provide much less elevation change and easier

grades for bicyclists. The Bikeways Master Plan also proposes extending the Class I bike path easterly of Pleasant Hill Road, but states that the method of crossing Pleasant Hill Road is to be determined. According to City Engineering staff, the most recent discussions of the planned bike path would propose crossing Pleasant Hill Road at the Deer Hill Road/Stanley Boulevard traffic signal, with an off-street path along the west side of Pleasant Hill Road connecting between the signal and the Caltrans right-of-way.

Bicyclist safety and convenience traveling in both directions on Pleasant Hill Road between the project site and Mount Diablo Boulevard is challenged at three to four locations where bicyclists encounter conflicting uncontrolled free-flow traffic to and from SR 24 freeway ramps or a right turn to westbound Mount Diablo Boulevard. City staff has suggested potential improvement concepts for these locations to Caltrans, which has jurisdiction over the subject freeway ramp junctions, but further action toward any improvements is undetermined. The City is in the process of seeking funds to conduct a corridor study to improve bicycle and pedestrian access and safety between Mount Diablo Boulevard and Springhill Road/Quandt Road. SWITRS data provided by the City's Engineering staff for a recent four-year period shows no reported accidents involving bicyclists in the project vicinity.

Existing Parking and Passenger Loading Areas

Fronting the project site along the southbound, west side of Pleasant Hill Road south of Deer Hill Road, parallel curb parking spaces are marked, with signs posted to prohibit parking all day on Saturdays, Sundays and holidays, and from 3:00 to 6:00 a.m. Monday through Friday. However, the portion immediately south of Deer Hill Road is designated by white curb and posted signs as a "Passenger Loading Zone" for approximately 80 feet, or four car lengths. Between the loading zone and the on-ramp to the westbound SR 24 freeway, 20 curb parking spaces are designated with white pavement markings. Additionally, the project site's private property has a gravel area that is accessible to vehicles at a curb opening on southbound Pleasant Hill Road, which is occasionally used for off-street parking and passenger loading.

South of the project site frontage, another 22 curb parking spaces are marked between the westbound freeway on-ramp and Mount Diablo Boulevard. On-street parking is prohibited on both sides of the roadway on all other segments of Pleasant Hill Road, on Deer Hill Road, and on Stanley Boulevard between Pleasant Hill Road and a point approximately 200 feet west of Camino Diablo.

In late January 2012, TJKM observed the usage of the existing parking and passenger loading areas fronting the project site along the west side of Pleasant Hill Road, as well as passenger loading activity at other locations in the vicinity. Observations were conducted before and after school on regular session days at Acalanes High School (AHS) during non-rainy weather. The observations of parking occupancy along the west side of Pleasant Hill Road are summarized as follows:

- A maximum of 13 vehicles parked along the curb between the loading zone and the on-ramp to westbound SR 24. (Several of these vehicles were parked by contractors working on a roadway improvement project toward the south end of Pleasant Hill Road, based on drivers observed being dropped off from the contractor's trucks in the afternoon; the improvement project has been completed.)
- No vehicles were observed parking on the project site property except for the short-term passenger loading activity described below.

- A maximum of six vehicles parked south of the westbound freeway on-ramp, no more than two of which parked in the northerly ten spaces between the westbound on-ramp and the westbound-to-southbound loop off-ramp, with the majority parked in the spaces closest to Mount Diablo Boulevard. At the maximum occupancy observed, 16 parking spaces remained available south of the westbound on-ramp.

Observations of passenger loading activity along the west side of Pleasant Hill Road south of Deer Hill Road are summarized as follows:

- In the morning before school, a maximum of 14 vehicles dropped off students at the curb loading zone. The maximum number of vehicles present at any given time did not exceed the four-car capacity of the loading zone. No vehicles entered the project site property during the morning observations.
- In the afternoon at school dismissal, a maximum total of 23 vehicles picked up students at the curb loading zone or project site property, with no more than six of the vehicles parking for a short time on the project site property to wait for students. A maximum total of 14 vehicles was present at one time, using the loading zone to capacity (4 vehicles), the project site property (5-6), and the curb area south of the loading zone (4-5) including vehicles briefly blocking the curb opening that provides access for the project site property.
- Vehicles arrived at this loading area via U-turns from northbound Pleasant Hill Road (at the Deer Hill Road intersection), through traffic on southbound Pleasant Hill Road, and a few right turns from eastbound Deer Hill Road.

TJKM also observed passenger loading activity for AHS students occurring at several other locations, including:

- On eastbound Deer Hill Road, up to 40 students were dropped off from vehicles stopped in the traffic queue extending back from the Pleasant Hill Road signal in the morning before school, and then walked east on the roadway in the bike lane to reach the intersection corner. In the afternoon after school, a small number of students were picked up in the right traffic lane on eastbound Deer Hill Road.
- On northbound Pleasant Hill Road, at least 12 students per day were dropped off from vehicles stopped in the traffic queue extending back from the Deer Hill Road/Stanley Blvd. signal in the morning before school. Students exited from vehicles in all traffic lanes (left, through and right), in an area extending at least 150 feet south from the intersection crosswalk. Some of the students dropped off from the left-turn lane walked north on the raised median to reach the crosswalk on the south leg of the intersection, but most walked across traffic lanes between cars to reach the east side of Pleasant Hill Road. At times, students had to cross moving traffic in the northbound right-turn lane. In the afternoon after school, a small number of students were picked up in the left-turn lane on northbound Pleasant Hill Road after walking west in the crosswalk to reach the lane. This activity on northbound Pleasant Hill Road south of Stanley Boulevard clearly presents hazards for the student pedestrians involved.
- A few students were dropped off or picked up at the gas station on the southeast corner of Pleasant Hill Road and Stanley Boulevard.
- On northbound Pleasant Hill Road north of the driveway for the AHS main parking lot, some passenger loading activity occurs in the bike lane, which is posted as a no parking zone. After dropping off students at this location, some drivers turn right at the high school driveway south of the tennis courts, make a U-turn using the parking lot aisle, and

exit the driveway by turning left onto southbound Pleasant Hill Road, which is a difficult movement during the morning peak hour.

- On westbound Stanley Boulevard, passenger loading along the north curb occurs mostly between the main AHS parking lot entrance driveway and the Springbrook Pool driveway, using the red curb area at the bus stop or along the traffic lane while stopped in the queue. Relatively little passenger loading activity was observed east of the Springbrook Pool driveway, and curb parking spaces remained available on the north side of Stanley Boulevard near Camino Diablo.
- A great portion of the passenger loading takes place on-campus along the AHS parking lot aisles, which are accessed at an entrance driveway and an exit driveway on Stanley Boulevard, and a right-turn-only driveway on Pleasant Hill Road. The parking lot aisles and the driveway intersections at Stanley Boulevard are congested during the peak times immediately before and after school.

Existing with Revised Project Conditions

This scenario uses Existing Conditions as a baseline, but adds traffic generated by the proposed Revised Project and evaluates the project's potential impacts on transportation as described below. The purpose of the Existing with Revised Project Conditions traffic analysis is to show the potential near-term effects of a full build-out of the proposed Revised Project for California Environmental Quality Act (CEQA) purposes.

Revised Project Description Summary
The proposed Revised Project consists of constructing 44 single-family detached homes, a soccer field, and approximately six acres of park area on the site, which is bounded by Deer Hill Road on the northwest, Pleasant Hill Road on the east, and SR 24 on the south. In addition, the proposed project also includes the construction of a dog park with 1.5 acres of enclosed dog play area (divided into one acre for large dogs and a half-acre for small dogs) north of Deer Hill Road adjacent to the proposed residential component. Vehicle access to the Revised Project site would be provided through four locations described below:

- One limited-access, right-in/right-out-only driveway on Pleasant Hill Road south of Deer Hill Road which will provide access to a proposed parking lot serving the city park and soccer field components (Intersection #11). It is anticipated that any vehicles entering this parking lot from the limited-access driveway on Deer Hill Road will exit onto southbound Pleasant Hill Road from this driveway.
- One limited-access, right-in-only driveway on Deer Hill Road at the easterly portion of the project site (Intersection #18), which will provide access to the parking lot mentioned above. The parking lot will include 78 marked spaces. Vehicles will be prohibited from exiting the project site at this driveway.
- One full-access driveway on Deer Hill Road west of the limited-access driveway, which will provide access to the proposed soccer field drop-off area and additional disabled access parking spaces (Intersection #12).
- Two full-access driveways on Deer Hill Road at the westerly portion of the project site which will provide access to the residential and dog park components of the proposed project. These driveways will function as the northern (dog park) and southern (residential) legs of a proposed roundabout on Deer Hill Road (Intersection #13).

In terms of pedestrian facilities, the proposal includes the construction of sidewalk segments along the Deer Hill Road and Pleasant Hill Road project frontages at the following locations. On Deer Hill Road, a sidewalk would be constructed at a proposed bus stop with a walkway leading to the residential component, and would only service/provide access to/from the bus stop passenger loading area. Additional sidewalks would be located along the site's northern frontage, providing access from the soccer field drop-off to the Deer Hill Road/Stanley Boulevard/Pleasant Hill Road intersection, and on the north side of Deer Hill Road just west of the Deer Hill Road/Homes-Dog Park driveway, which will provide access between the dog park and a proposed crosswalk on Deer Hill Road connecting to the south side at the multiuse trail described below.

While the proposal does not include the construction of a continuous sidewalk along the entirety of the Deer Hill Road frontage, it does include a multiuse trail which will extend from just west of the Deer Hill Road/Homes-Dog Park driveway to the southwest corner of the Deer Hill Road/Pleasant Hill Road intersection via a path parallel to the site's southern boundary between the

residential component and SR 24. This path would cross the Pleasant Hill Road driveway at a point approximately 50 feet behind the west curb and continue northerly before connecting to the public sidewalk at the Pleasant Hill Road/Deer Hill Road-Stanley Blvd. intersection.

In addition to the multiuse trail, the project also proposes various pedestrian facilities internal to the site that will provide connections between the various land uses and the external pedestrian infrastructure. At the dog park, a small walkway will connect the dog play areas to the parking lot, which will also provide a walkway connecting to the north side of Deer Hill Road. A pedestrian trail will also provide a connection between a pocket park along the site's southern boundary, the parking lot, the residential component via the soccer field, and the proposed park. Sidewalks will also facilitate pedestrian circulation throughout the residential component, which will include internal roadways permitting vehicular access to the residential units. The sidewalks and walkways within the residential component will provide access between the residential units and other trails and paths leading to the non-residential land uses and to the external pedestrian network.

Revised Project Trip Generation

Project trip generation was estimated based on the trip generation rates established via a survey of representative dog parks and soccer fields, as well as data presented in *ITE Trip Generation*, 9th Edition and the guidelines in the ITE *Trip Generation Handbook* for the park and single-family detached housing components. No trip reductions were applied because the site is not within reasonable walking distance of public transit services or significant complementary land uses, based on published research data. ("Reasonable walking distance" in the published data is typically considered to range from at least ¼-mile to ½-mile.) This is a slightly conservatively high assumption for project trip generation, given that the recreation facilities provide amenities within easy walking distance of the residential component, potentially reducing the portion of residential project-generated vehicle trips for recreation purposes.

It should be noted that the Institute of Transportation Engineers (ITE) *Trip Generation* manual does not presently provide trip rates for dog parks, and the proposed single soccer field is not within the range of the number of soccer fields at the sites surveyed for the data provided in *Trip Generation.* As a result, TJKM conducted trip generation surveys at three dog parks and a single soccer field site to establish daily, a.m. peak hour, and p.m. peak hour rates for application to the proposed dog park and soccer field components. Additional details regarding the trip generation surveys and derived trip rates for the proposed Revised Project is available in the *Trip Generation Survey and Project Estimate Technical Memorandum* dated May 8, 2014.

Table VI below summarizes the project trip generation results. The Revised project is expected to generate 1,224 daily trips, with 82 trips occurring during the a.m. peak hour (34 inbound and 48 outbound), and 175 trips occurring during the p.m. peak hour (95 inbound and 80 outbound).

Table VI: Revised Project Trip Generation

Land Use (ITE Code)	*Size*	*Daily*		*A.M. Peak Hour*					*P.M. Peak Hour*				
		Rate	*Trips*	*Rate*	*In:Out %*	*In*	*Out*	*Total*	*Rate*	*In:Out %*	*In*	*Out*	*Total*
Single-Family Detached Housing (210)[1,2]	44 DUs	11.22	493	0.93	25:75	10	31	41	1.16	63:37	32	19	51
Dog Park[3]	1 Park	265	265	13	60:40	8	5	13	34	59:41	20	14	34
Soccer Field[4]	1 Field	196	196	1.12	57:43	1	0	1	68	46:54	31	37	68
City Park (411)[1,5]	6 Acres	45	270	4.5	56:44	15	12	27	3.5	57:43	12	10	22
Total			**1,224**			**34**	**48**	**82**			**95**	**80**	**175**

Notes: DU = Dwelling Units
1. Source – *ITE Trip Generation*, 9th Edition
2. Rates for land use code 210 calculated based on Total trips (T) from regression equation divided by Size (DU):
Daily: Ln(T) = 0.92Ln(DU)+2.72; A.M. Peak: T=0.70(DU) + 9.74; P.M. Peak: Ln(T)=0.90Ln(DU)+0.51
3. Source: TJKM trip generation surveys of dog parks (described in Technical Memo dated May 8, 2014).
4. Source: Daily and p.m. peak hour per TJKM survey; a.m. peak hour per ITE land use code 488.
5. The daily rate for land use code 411 is estimated based on a factor of the trip generation rate during the weekday a.m. peak hour of adjacent street traffic (4.5 x 10 = 45 daily trips per acre)

Revised Project Trip Distribution and Assignment

Trip distribution is a process that determines in what proportion vehicles would travel between a project site and various destinations outside the project study area. The process of trip assignment determines the various routes that vehicles would take from the project site to each destination using the calculated trip distribution.

Trips that would be generated by the proposed Revised Project were assigned to the adjacent roadway network based on the land use distribution and prevailing traffic patterns in the surrounding area, as well as the location of freeway ramp connections and the proposed project access driveways. TJKM prepared separate distributions for the home-based trips and the recreation-based trips, due to the likely differences in trip origins and destinations for the two land uses, and the location of the proposed project driveways which will separately provide access to the individual proposed land uses. The resulting percentage directional distributions and assignment of project-generated trips to the adjacent roadways are shown in Figure 4. These assigned project trips were added to Existing Conditions traffic volumes to generate the Existing with Revised Project traffic volumes shown in Figure 5.

Intersection Lane Geometry and Traffic Controls

Figure 5 also shows the intersection lane geometries and traffic controls assumed in the analysis of Existing with Revised Project Conditions. The key assumptions are summarized as follows:

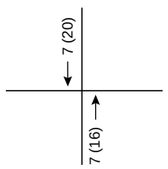
- At the Soccer Field Dropoff (Intersection #12) and Pleasant Hill Road (Intersection #11) driveways, TJKM recommends that stop signs controlling traffic exiting the driveways shall be required as Mitigation Measure TRAF-17, as assumed in the traffic analysis.
- At the Soccer/Park Parking Lot driveway (Intersection #18) on Deer Hill Road, proposed access would be limited to right turns into the site from the eastbound direction.

- The Pleasant Hill Road driveway (Intersection #11) would provide right-in/right-out-only access at southbound Pleasant Hill Road, where all vehicles leaving the project site from the Soccer/Park parking lot would exit. Left turns into or out of the site to/from northbound Pleasant Hill Road would be prohibited by a raised median.
- Intersection #13 would be constructed as a single-lane, yield-control roundabout with the north and south legs providing access to/from the dog park and residential component, respectively.

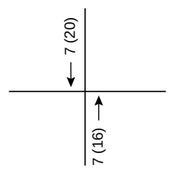
City of Lafayette - Terraces Supplemental EIR
Project Trip Distribution and Assignment

Figure 4

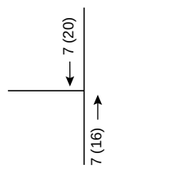
Intersection #1
Pleasant Hill Rd./Rancho View Dr.



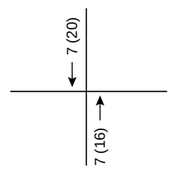
Intersection #2
Pleasant Hill Rd./Green Valley Dr.



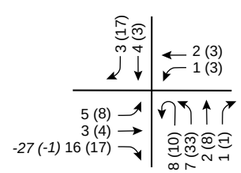
Intersection #3
Pleasant Hill Rd./Reliez Valley Rd.



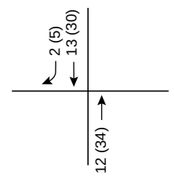
Intersection #4
Pleasant Hill Rd./Springhill Rd./ Quandt Rd.



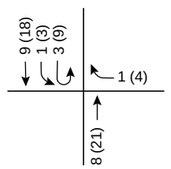
Intersection #5
Pleasant Hill Rd./Deer Hill Rd./ Stanley Blvd.



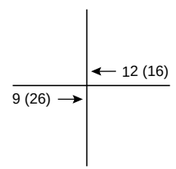
Intersection #6
Pleasant Hill Rd./Mt. Diablo Blvd./ SR 24 WB On Ramp



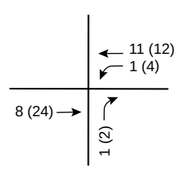
Intersection #7
Pleasant Hill Rd./Old Tunnel Rd./ SR 24 EB Off Ramp



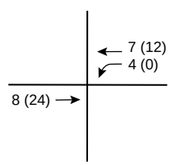
Intersection #8
Brown Ave./Deer Hill Rd.



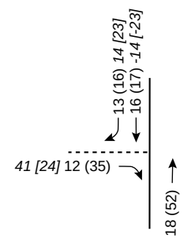
Intersection #9
First St./Sierra Vista Wy./Deer Hill Rd.



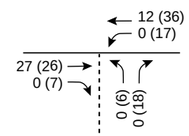
Intersection #10
SR 24 WB Ramps Laurel Dr./Deer Hill Rd.



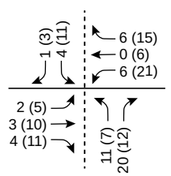
Intersection #11
Pleasant Hill Rd./Soccer Park Dwy.



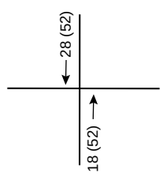
Intersection #12
Deer Hill Rd./Soccer Dropoff Dwy.



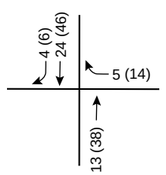
Intersection #13
Deer Hill Rd./Homes-Dog Park



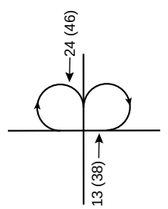
Intersection #14
Pleasant Hill Rd./Acalanes Ave.



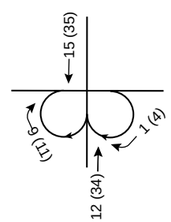
Intersection #15
Pleasant Hill Rd./ SR 24 WB Direct Ramps



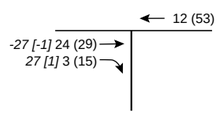
Intersection #16
Pleasant Hill Rd./ SR 24 WB Loop Ramps

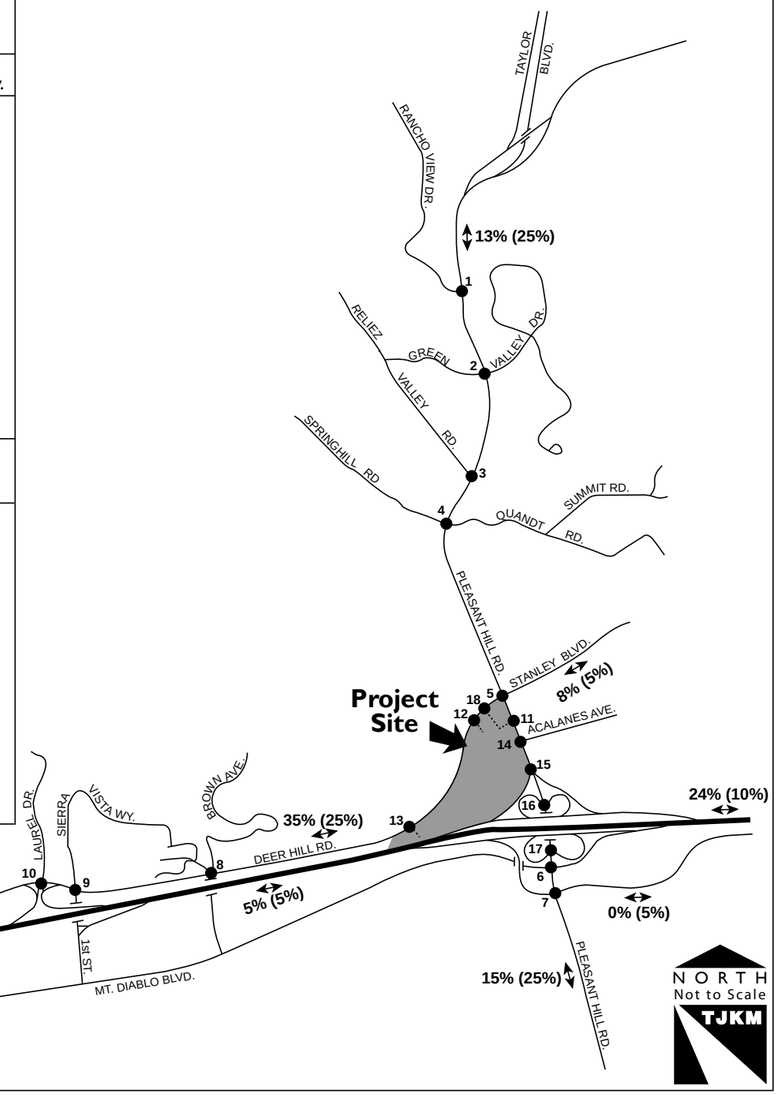


Intersection #17
Pleasant Hill Rd./ SR 24 EB Loop Ramps



Intersection #18
Deer Hill Rd./ Soccer Park Dwy.





LEGEND

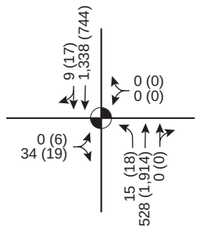
●	Study Intersection
---	Future Driveway
XX	AM Peak Hour Volume
(XX)	PM Peak Hour Volume
XX [XX]	School AM and Afternoon Peak Hour Adjustment
XX%	Residential Trip Distribution
(XX%)	Recreational Trip Distribution

City of Lafayette - The Terraces of Lafayette EIR

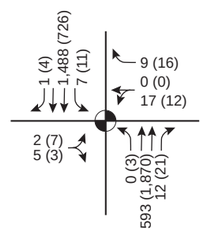
Existing plus Project Traffic Volumes, Lane Geometry, and Controls

Figure 5

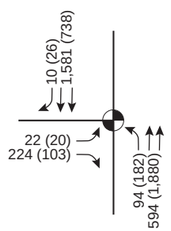
Intersection #1
Pleasant Hill Rd./Rancho View Dr.



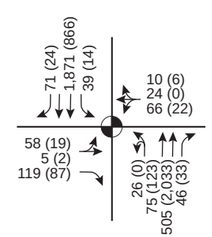
Intersection #2
Pleasant Hill Rd./Green Valley Dr.



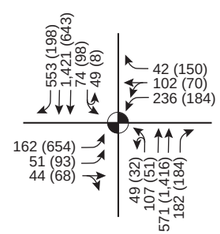
Intersection #3
Pleasant Hill Rd./Reliez Valley Rd.



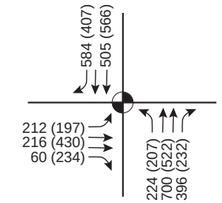
Intersection #4
Pleasant Hill Rd./Springhill Rd./
Quandt Rd.



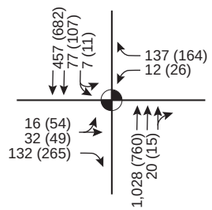
Intersection #5
Pleasant Hill Rd./Deer Hill Rd./
Stanley Blvd.



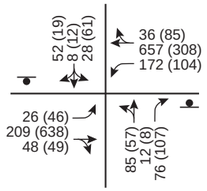
Intersection #6
Pleasant Hill Rd./Mt. Diablo Blvd./
SR 24 WB On Ramp



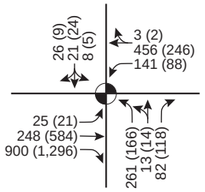
Intersection #7
Pleasant Hill Rd./Old Tunnel Rd./
SR 24 EB Off Ramp



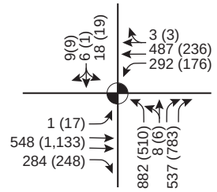
Intersection #8
Brown Ave./Deer Hill Rd.



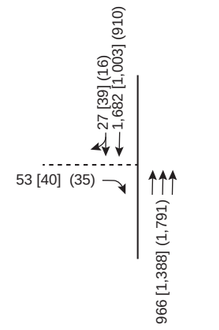
Intersection #9
First St./Sierra Vista Wy./Deer Hill Rd.



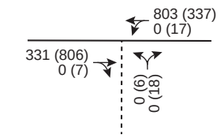
Intersection #10
SR 24 WB Ramps
Laurel Dr./Deer Hill Rd.



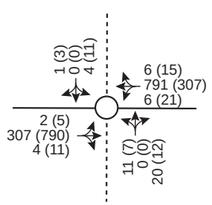
Intersection #11
Pleasant Hill Rd./Project Dwy.



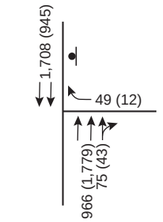
Intersection #12
Deer Hill Rd./Soccer Dropoff Dwy.



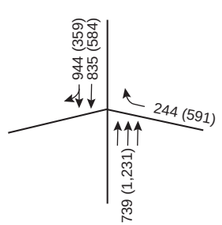
Intersection #13
Deer Hill Rd./Homes-Dog Park Dwy.



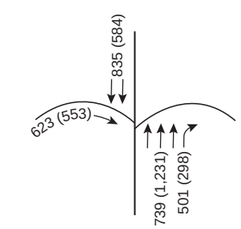
Intersection #14
Pleasant Hill Rd./Acalanes Ave.



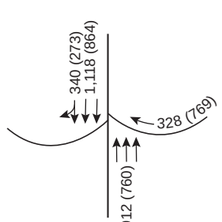
Intersection #15
Pleasant Hill Rd./
SR 24 WB Direct Ramps



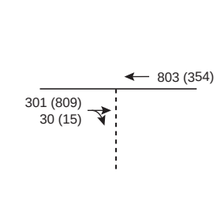
Intersection #16
Pleasant Hill Rd./
SR 24 WB Loop Ramps



Intersection #17
Pleasant Hill Rd./
SR 24 EB Loop Ramps



Intersection #18
Deer Hill Rd./
Soccer Park Dwy.



LEGEND

- ● Study Intersection
- --- Future Driveway
- XX AM Peak Hour Volume
- [XX] School PM Peak Hour Volume
- (XX) PM Peak Hour Volume
- ⊹ Roundabout

Intersection Level of Service Analysis Results, Existing with Revised Project Conditions

Table VII illustrates the results of the level of service analysis for the study intersections under Existing with Revised Project Conditions. Detailed level of service calculations are contained in Appendix C.

Table VII: Peak Hour Intersection Levels of Service – Existing with Revised Project Conditions

ID	*Intersection*	*Existing with Revised Project Conditions*			
		A.M. Peak Hour		*P.M. Peak Hour*	
		Delay	*LOS*	*Delay*	*LOS*
1	Rancho View Drive/Pleasant Hill Road	7.4	A	5.3	A
2	Green Valley Drive/Pleasant Hill Road	5.8	A	4.9	A
3	Reliez Valley Road/Pleasant Hill Road	24.6	C	9.9	A
4	Springhill Road – Quandt Road/ Pleasant Hill Road	21.3	C	13.0	B
5	Deer Hill Road – Stanley Blvd./ Pleasant Hill Road	215.9	F	62.1	E
6	Mt. Diablo Boulevard –SR 24 EB On-ramp/ Pleasant Hill Road	14.9	B	16.8	B
7	SR 24 EB Off-Ramp – Old Tunnel Road/Pleasant Hill Road	13.3	B	18.5	B
8	Deer Hill Road/Brown Avenue	**158.5**	**F**	**325.7**	**F**
	Mitigation - Signalize Intersection *Alternative Mitigation – Construct Roundabout*	*12.9* *11.2*	*B* *B*	*14.6* *9.8*	B A
9	Deer Hill Road/ First Street –Sierra Vista Way	13.7	B	14.9	B
10	Deer Hill Road/ SR 24 WB Ramps –Laurel Drive	**51.5**	**D**	**46.6**	**D**
11	Pleasant Hill Road/Parking Lot Driveway	10.4	B	9.2	A
12	Deer Hill Road/Soccer Dropoff Driveway	0.0	A	19.2	C
13	Deer Hill Road/Homes-Dog Park Driveway	8.1	A	8.5	A

Notes: 1) LOS=Level of Service, Delay = Average control delay per vehicle in seconds
2) Signalized, all-way stop controlled, and roundabout intersections - Delay / LOS is for overall intersection
3) Unsignalized one- and two-way stop controlled intersections - Delay / LOS is for critical minor stop-controlled approach.
4) **Bold** indicates unacceptable operational conditions based on applicable City standards.
5) At intersections 1-5, intersection LOS standard does not apply; Delay Index is the applicable standard for Pleasant Hill Road north of SR 24 per Lafayette General Plan.

Under Existing with Revised Project Conditions, with the addition of proposed project traffic, all signalized intersections are expected to continue operating under acceptable City LOS standards, except the Deer Hill Road/SR 24 Westbound Ramps – Laurel Drive intersection that already operates at an unacceptable LOS under Existing Conditions. This intersection would continue to operate at Poor LOS D during the a.m. and p.m. peak hours, with delay increasing by 0.7 seconds

and 1.3 seconds respectively. Because the project would increase delay by less than five seconds, the result would be a *less-than-significant impact*.

The Deer Hill Road – Stanley Blvd./Pleasant Hill Road would also continue operating at LOS F during the a.m. peak hour, with delay increasing by 26.2 seconds as a result of the Revised project, and at LOS E during the p.m. peak hour with delay increasing by 3.6 seconds as a result of the project. The Revised project would increase delay by more than five seconds at an intersection operating at LOS F during the a.m. peak hour. However, this is considered a less-than-significant impact based on the significance thresholds for this SEIR that eliminate consideration of intersection LOS on Pleasant Hill Road north of State Route 24, in accordance with General Plan Policy C-1.2 of the Growth Management Chapter, the Lamorinda Action Plan, and CCTA guidelines. This intersection is not subject to an intersection LOS standard; it is part of a Route of Regional Significance that is subject to the Delay Index criteria analyzed subsequently.

The unsignalized project driveway intersections would operate at LOS C or better, which is acceptable for these intersections. The Deer Hill Road/Homes-Dog Park intersection, which would be constructed as a roundabout, would operate at LOS A during the a.m. and p.m. peak hours. In addition, the Pleasant Hill Road/Soccer Field/Park driveway would operate at LOS B with an average control delay of 10.3 seconds during the School p.m. peak hour. However, at the only existing unsignalized study intersection, the northbound and southbound stop-controlled minor approaches on Brown Avenue at Deer Hill Road would continue operating at an unacceptable LOS F, with delay increases of 13 seconds during the a.m. peak hour and 54.6 seconds during the p.m. peak hour. The California Manual on Uniform Traffic Control Devices (MUTCD) peak hour traffic signal warrant would be met for both peak hours under both Existing and Existing with Revised Project conditions. The Revised project would increase delay by more than five seconds at an intersection operating below the acceptable standard, resulting in a *significant impact*.

Pleasant Hill Road Corridor Traffic Simulation

SimTraffic simulation results for Existing plus Project conditions prepared for the original EIR project were reviewed and compared with the Existing with Revised Project analysis presented above to supplement the intersection LOS results. During the a.m. peak hour, traffic on southbound Pleasant Hill Road that backs up from the intersection at Deer Hill Road – Stanley Boulevard would extend the queue further past the intersection at Green Valley Drive with the addition of project traffic. In effect, as described for Existing conditions, the LOS F conditions at the Deer Hill Road – Stanley Boulevard intersection would also occur upstream at the Springhill Road/Quandt Road, Reliez Valley Road, and Green Valley Drive intersections, which impacts southbound Pleasant Hill Road traffic and other traffic movements that conflict with southbound traffic at each intersection. However, the City's intersection LOS methods described in the previous Level of Service Analysis Methodology section are based on the LOS results calculated at each intersection individually, which are the results shown in Table VII. During the commute p.m. peak hour, traffic queues would continue to extend from the Pleasant Hill Road/Deer Hill Road-Stanley Boulevard intersection past the Acalanes Avenue intersection.

Routes of Regional Significance Delay Index Results

For Pleasant Hill Road between SR 24 and Rancho View Drive, the Delay Indexes in the Existing with Revised Project Conditions scenario were calculated for the southbound direction during the a.m. peak hour and for the northbound direction during the p.m. peak hour, and are summarized in Table VIII: Existing with Revised Project Delay Index - Pleasant Hill Road. As noted in the table, Pleasant Hill Road is expected to operate with an acceptable Delay Index of less than 2.0 for southbound traffic in the a.m. peak hour and northbound traffic in the p.m. peak hour under

Existing with Revised Project Conditions. Because the Delay Index would remain acceptable with the Revised Project, the result would be a *less-than-significant impact.*

Table VIII: Existing with Revised Project Delay Index - Pleasant Hill Road

Scenario	Travel Time (minutes)		Delay Index	
	AM SB	PM NB	AM SB	PM NB
Existing No Project	3.45	3.74	1.31	1.42
Existing with Revised Project	3.70	3.87	1.41	1.47

Notes: SB = Southbound, NB = Northbound

Intersection Mitigation

TJKM considered potential mitigation measures for the intersection that would have significant traffic delay impacts as a result of the project under Existing with Revised Project conditions. To mitigate the impact at the Deer Hill Road/Brown Avenue intersection, prior to project completion the project sponsor shall share with the City the cost to install one of the following mitigation measures at this intersection. One mitigation option is to install a traffic signal as part of the development project. The traffic signal equipment shall include an emergency vehicle preemption system (Opticom), which would allow emergency response vehicles approaching the signalized intersection to activate a green signal for their travel direction. The State Route 24 freeway overpass structures on Brown Avenue could obstruct the Opticom activation device on responding emergency vehicles headed northbound on Brown Avenue from Mount Diablo Boulevard toward Deer Hill Road, which could substantially reduce the effectiveness of the traffic signal preemption. To avoid this problem, the traffic signal equipment shall include advance detection devices for the Opticom system as needed to assure effective traffic signal preemption for responding emergency vehicles on northbound Brown Avenue. With signalization, the Deer Hill Road/Brown Avenue intersection would operate at LOS B during the a.m. and p.m. peak hours under Existing with Revised Project Conditions, reducing the project impact to *less-than-significant.*

An alternative mitigation to installing a traffic signal would be the redesign of the Deer Hill Road/Brown Avenue intersection as a roundabout, which would improve the approach LOS for the minor approach volumes at this intersection. A properly designed roundabout would adequately accommodate emergency response vehicles. A roundabout would also benefit this location by: 1) creating consistency in traffic control devices on the Deer Hill Road corridor, given the proposed roundabout to the east at a project driveway; 2) providing effective traffic calming in a corridor with reported speed concerns; 3) enhancing the safety of pedestrian crossings at the intersection; and 4) being more compatible with the less-urban character of the area. With a roundabout, the Deer Hill Road/Brown Avenue intersection would operate at LOS B during the a.m. peak hour and LOS A during the p.m. peak hour under Existing with Revised Project Conditions, reducing the project impact to *less-than-significant.* TJKM recommends additional analysis of this alternative mitigation.

Although not required as mitigation, LOS F delay at the Deer Hill Road – Stanley Blvd./Pleasant Hill Road intersection could be reduced somewhat with roadway widening to add a third lane for southbound through traffic on Pleasant Hill Road. A potential configuration would provide a third lane for southbound through traffic and a full-lane-width right-turn lane on southbound Pleasant Hill Road at the Deer Hill Road intersection, along with a standard Class II bike lane, replacing the existing southbound curb lane that is shared by right-turn-only traffic and bicycles approaching the intersection. The additional southbound lanes would start at least 150 feet north of Deer Hill Road and extend south along the entire project frontage on Pleasant Hill Road to become a right-turn-

only lane for the on-ramp to westbound SR 24. However, widening for the potential lane configuration would also require dedication of additional property along the west side of Pleasant Hill Road to allow for a Class II bike lane and maintain existing curb parking and a future bus stop along the west curb (addressed in a subsequent section of this report.) The potential roadway widening would increase the pedestrian crossing distance on the Pleasant Hill Road crosswalk at the Deer Hill Road – Stanley Boulevard signal. The additional capacity would also be inconsistent with the Lamorinda Action Plan's Gateway Constraint Policy, which includes measures to meter traffic flow on Pleasant Hill Road and maintain the existing number of travel lanes.

Left-Turn Queues

Left-turn queue lengths on westbound Deer Hill Road at the Soccer Dropoff driveway and for the northbound left-turn at Pleasant Hill Road/Deer Hill Road – Stanley Blvd. were also analyzed using Synchro results for Existing with Revised Project Conditions. For the northbound left-turn at the Pleasant Hill Road /Deer Hill Road – Stanley Blvd. intersection, peak estimated 95th-percentile left-turn queue lengths of 207 feet and 133 feet would occur with the addition of project traffic during the a.m. and p.m. peak hours, respectively. However, these left-turn queues would be adequately accommodated by the existing 250-foot storage lane. The additional project traffic used for this analysis includes U-turns from northbound to southbound Pleasant Hill Road to enter the Soccer/Park parking lot, and left turns to Deer Hill Road to access the Soccer Dropoff, Dog Park, and Homes driveways, as well as additional conflicting project traffic on southbound Pleasant Hill Road headed toward the recreation facilities and Homes.

At the proposed Soccer Dropoff/ADA parking driveway on Deer Hill Road, the estimated 95th-percentile left-turn queue lengths during the a.m. and p.m. peak periods would be no more than one car length. Although a westbound left-turn storage lane is not proposed at this intersection, vehicles stopped in the travel lane waiting to make the left-turn should not pose a significant hazard for westbound through vehicles; the positive grade approaching the driveway will adequately limit westbound approach speeds, and adequate sight-distance between queuing vehicles and traffic approaching from both directions will be available (see next section). Although not required as mitigation, TJKM recommends the following additional measures to further reduce the potential for queuing on Deer Hill Road at the Soccer Dropoff driveway:

- Install signs and white painted curb around the circular Soccer Dropoff drive on the project site (excluding the disabled access parking stalls) to implement "No Parking Anytime" and "Passenger Loading Only" restrictions with a recommended time limit of one minute.
- Install "No Stopping Any Time" signs on both sides of Deer Hill Road near the Soccer Dropoff driveway.

Project Driveway Sight-Distance and Safety

Access at the Pleasant Hill Road driveway is proposed to be limited to right-in/right-out, as left-turns out of and into the site to/from northbound Pleasant Hill Road would be prohibited by a raised median. With this configuration, turning movements at the driveway would conflict with only southbound Pleasant Hill Road traffic. Visibility of the driveway along southbound Pleasant Hill Road is unobstructed for at least 750 feet, providing more than adequate sight-distance. In addition, the driveway would be located approximately 180 feet south (measured from the south side) of the intersection at Deer Hill Road – Stanley Boulevard, providing more than adequate sight-distance for vehicles turning onto southbound Pleasant Hill Road.

TJKM analyzed the sight-distance parameters at the proposed project driveway locations on Deer Hill Road, including the two full-access driveways as shown on Figures 6 and 7. Sight-distance analysis at the proposed Deer Hill Road driveway locations accounted for the visibility obstructions presented by the horizontal and vertical curvature of the roadway and roadside features such as adjacent hillsides and vegetation, as well as the effect of steep grades on prevailing vehicle speeds. City Engineering staff confirmed that observed 85th-percentile speeds on Deer Hill Road would be used to determine the required sight-distance at the proposed driveway locations. Speed data was collected at several locations on Deer Hill Road when local schools were in regular session, including the relevant critical points for available sight-distance. Caltrans *Highway Design Manual* standards for stopping sight-distance based on speed were used to determine the required sight-distance at the proposed project driveways for the observed 85th-percentile speed in each direction at the critical points.

Table IX shows the results of the sight-distance analysis for the proposed Deer Hill Road full-access driveway locations.

Table IX: Deer Hill Road Project Driveway Sight-Distance

Driveway	*Approach Direction*	*Existing 85th-Percentile Speed (mph)*	*Required Sight-Distance (feet)*	*Available Sight-Distance (feet)*	*Meets Standard?*
Residential/Dog Park	Eastbound	56	516	<500	Yes[1]
	Westbound	44	350	350	Yes
Soccer Dropoff	Eastbound	38	300	300	Yes
	Westbound	<40	300	<300[2]	**No**[2]

1. Assumes a roundabout and associated design features to reduce eastbound speed.
2. Assumes no trimming of vegetation along project frontage east of driveway to improve sight-distance.

As shown in the table, visibility of both driveways for westbound and eastbound traffic on Deer Hill Road will provide adequate sight-distance based on observed 85th-percentile speeds. However, existing trees located approximately 250-300 feet west of the proposed Dog Park driveway and approximately 75-100 feet east of the proposed Soccer Dropoff driveway obstruct the line of sight of eastbound traffic for the Dog Park driveway and westbound vehicles for the Soccer Dropoff driveway on Deer Hill Road, respectively. These existing trees present a higher potential for inadequate sight-distance at the project driveways on Deer Hill Road because of roadway curvature. At the Dog Park driveway, however, the proposed roundabout and design features pertaining to the cross-slope of the eastbound portion of its circulatory roadway (described subsequently) would mitigate the inadequate sight-distance caused by the existing foliage by encouraging eastbound drivers to reduce speeds substantially, reducing the sight-distance hazard at this driveway to a *less-than-significant* level.

Because of the potential for inadequate sight-distance caused by foliage on the south side of Deer Hill Road east of the Soccer Dropoff driveway, the existing trees would substantially increase traffic hazards, resulting in a *significant impact.*

To mitigate this impact, TJKM recommends the following measures:

- East of the Soccer Drop-off Driveway on Deer Hill Road: All landscaping along the south side of Deer Hill Road that is located in the line of sight for westbound traffic within 360 feet east of the Soccer Drop-off Project driveway shall be limited to plants with foliage no more than 30 inches fully mature height above the closest adjacent curb elevation, or trees

with canopy foliage no less than ten feet above the closest adjacent curb elevation. The line of sight is defined as the area between the south curb on Deer Hill Road, and a straight line connecting a point 10 feet behind the back of the sidewalk on the centerline of the Soccer Drop-off driveway and a point 360 feet to the east in the westbound lane on Deer Hill Road where it intersects the south curb line, or as otherwise specified by the City Engineer.

- All other Project Driveways: All landscaping along the Project street frontage that is located in the line of sight of traffic approaching Project driveways in either direction shall be limited to plants with foliage no more than 30 inches fully mature height above the closest adjacent curb elevation, or trees with canopy foliage no less than ten feet above the closest adjacent curb elevation. The line of sight is defined as an area within 10 feet behind the back of the sidewalk or shared-use path and within 50 feet of the driveway edge, or as otherwise specified by the City Engineer.
- Entryway Features: All monument signs, walls, slopes and other vertical features that could otherwise block visibility shall be no more than three feet higher than the adjacent driveway elevation in the area within 15 feet behind the back of the sidewalk or shared-use path and within 50 feet of the driveway edge, or as otherwise specified by the City Engineer.

Implementation of these measures would result in a *less-than-significant impact.*

Though not required as a mitigation, TJKM additionally recommends trimming and maintaining the existing trees along the north side of Deer Hill Road located in the line of sight for eastbound traffic within 516 feet west of the Homes-Dog Park driveway such that the canopy foliage is no less than ten feet above the closest adjacent curb elevation, or other dimensions as specified by the City Engineer. The line of sight is defined as the area between the north curb on Deer Hill Road, and a straight line connecting a point 10 feet behind the back of the sidewalk on the centerline of the Dog Park driveway and a point 516 feet to the west in the eastbound lane on Deer Hill Road where it intersects the south curb line, or as otherwise specified by the City Engineer.

Given that the Revised Project is still in the environmental review phase, much of the Project design is still in concept form, including the proposed design of the roundabout. The environmental impact analyses assume that the roundabout will be designed in accordance with all applicable engineering standards and practices to achieve the intended function. Specifically, the design must include features to address two main issues observed under prevailing conditions at the location of the proposed facility:

- Site topography, which limits visibility to potential vehicle queuing at the proposed roundabout by approaching westbound traffic;
- High prevailing speed approaching and traversing through the proposed roundabout location, partly due to the downgrade in the road from east to west.

Design features responding to these issues will include some appropriate combination of advance warning signs, object markers, flashing beacons, speed feedback signs, and/or advance dynamic warning signs to alert westbound drivers that they should reduce their speeds to a level suitable for approaching and maneuvering the roundabout. The cross-slope of the pavement within the roundabout will be designed in recognition of the new prevailing approach speeds. The design will also include street lights to provide adequate illumination of the roundabout intersection and enhance the visibility of pedestrians during hours of darkness. (The installation of street lights may

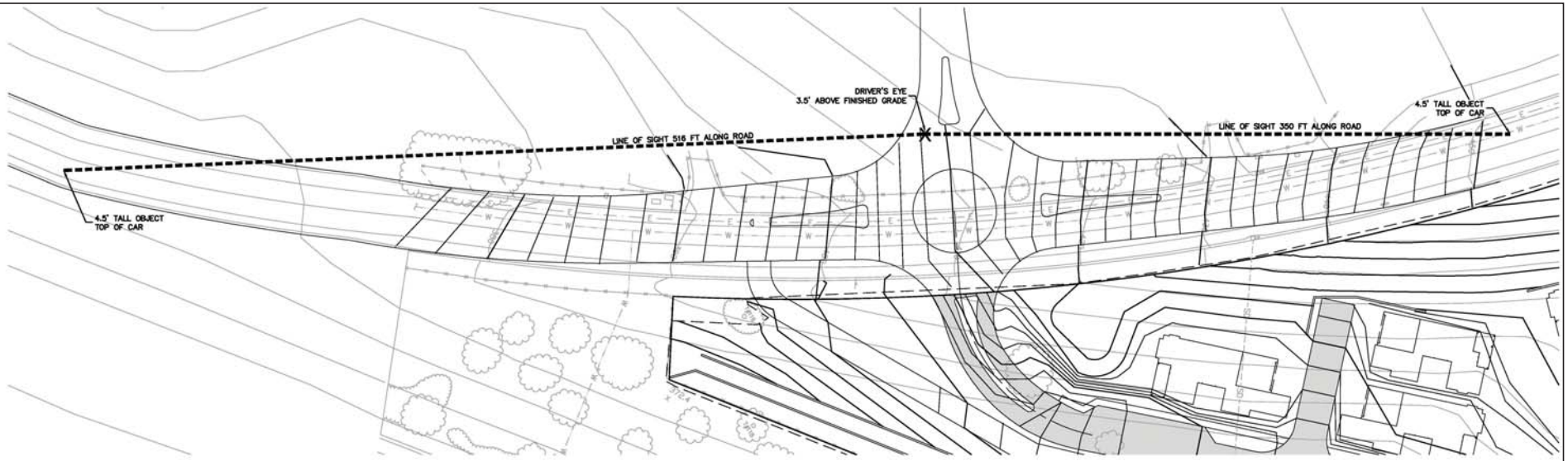
result in a secondary environmental impact, which is discussed further in Chapter 4.1, Aesthetics and Visual Resources, of this Supplemental EIR.) At the pedestrian crossing west of the roundabout location, high-visibility crosswalk enhancements such as a rectangular rapid-flash beacon system should be considered. After the installation of the roundabout with the above recommended features, an engineering and traffic survey will be conducted to determine and post a new, legally enforceable speed limit for Deer Hill Road in this vicinity.

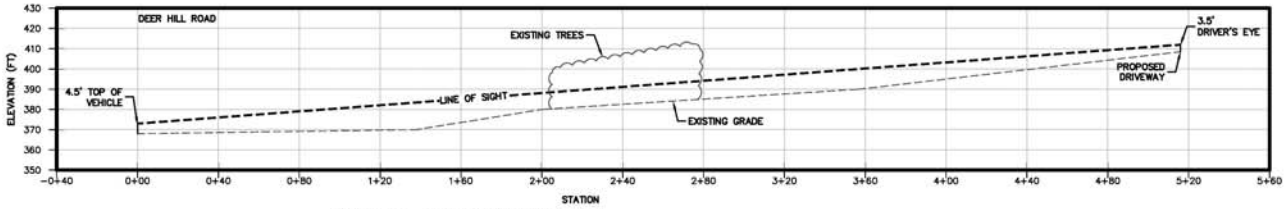
Implementation of the roundabout in the manner described above, which the City would require as a condition of approval of the Project, would result in a less-than-significant impact.

In addition to the full-access driveways described above, access to the Soccer Field/Park parking lot at the southwest corner of Pleasant Hill Road and Deer Hill Road would include a driveway for only right-turn access entering from eastbound Deer Hill Road. Traffic would be prohibited from entering via a left-turn from westbound Deer Hill Road or exiting in any direction at this driveway. Visibility would be adequate for eastbound Deer Hill Road traffic approaching from behind other eastbound vehicles slowing to turn right into this driveway, allowing enough distance for the vehicles approaching from behind to slow or stop safely. As such, this Project driveway does not result in a significant impact.

Sight-Distance at Homes-Dog Park Driveway on Deer Hill Road

Figure 6

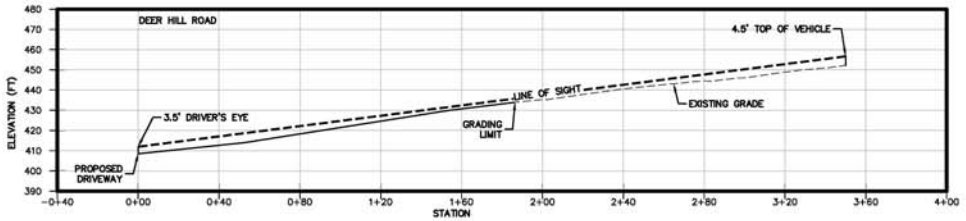




PROFILE - DOG PARK DRIVEWAY
EASTBOUND TRAFFIC
SCALE: V: 1"=30'
H: 1"=30'

MITIGATION OPTION:

TREES AND FOLIAGE TO BE TRIMMED AND MAINTAINED TO PROVIDE ADEQUATE LINE OF SIGHT.



PROFILE - DOG PARK DRIVEWAY
WESTBOUND TRAFFIC
SCALE: V: 1"=30'
H: 1"=30'

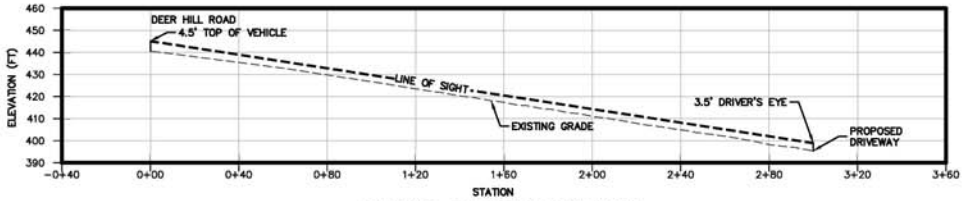
NORTH
Not to Scale

TJKM

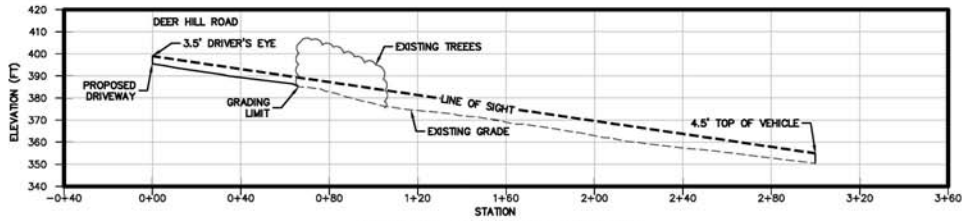
Source: BkF

Sight-Distance at Soccer Dropoff Driveway on Deer Hill Road

Figure 7



PROFILE - SOCCER DRIVEWAY
EASTBOUND TRAFFIC
SCALE V: 1"=30'
H: 1"=30'



PROFILE - SOCCER DRIVEWAY
WESTBOUND TRAFFIC
SCALE V: 1"=30'
H: 1"=30'

MITIGATION OPTION

TREES AND FOLIAGE TO BE TRIMMED AND MAINTAINED TO PROVIDE ADEQUATE LINE OF SIGHT.

NORTH
Not to Scale

TJKM

Source: BkF

Transit Facilities

Potential project impacts on public transit systems in Lafayette, including both local bus and Bay Area Rapid Transit (BART) regional rail service, are described below. The project would potentially increase ridership on these systems, particularly during commute peak hours. Note that regardless of the estimated potential number of transit trips generated by the project that is described below, no vehicle-trip reductions were assumed in the traffic analyses presented in this report because the Project site is not within reasonable walking distance of significant public transit services, based on published research data. "Reasonable walking distance" in the published data is typically considered to range from at least ¼-mile to ½-mile.

Survey data from the 2010 Census for Lafayette residents citywide indicates that approximately 12 percent use of transit for commuting. Assuming that 12 percent of the commute peak-hour project trip generation shown in Table VI for the homes, soccer field and park would use transit, the project would add 8 transit trips during the a.m. peak hour and 17 transit trips during the p.m. peak hour. (TJKM assumed that the dog park would generate negligible transit use because of its lack of proximity to transit service and the nature of its use. However, the 12 percent transit use for commute peak-hour trip generation by the soccer field and park is a conservatively high assumption.)

BART

The 2008 BART Station Profile Study and online BART ridership figures were reviewed for the available ridership data to determine the potential impacts of the proposed project on BART. Based on the BART data sources, average weekday passenger entries and exits at the Lafayette BART Station totaled approximately 6,900 trips in January 2012.

TJKM assumed that only the residents of the project homes would use BART, because of the nature of the dog park, soccer field, and park uses and their relatively inconvenient access to BART. Using a conservative assumption that all of the expected peak-hour transit trip generation from the project homes would use BART in the peak-hour peak direction, it is estimated that the project would generate five new BART Station passenger entries during the a.m. peak hour and six new passengers exiting during the p.m. peak hour. These project-generated BART trips would add approximately 0.9 percent to existing average weekday peak period ridership entering and exiting at the Lafayette station. Table X shows the results of the project-added BART trip share analysis.

Table X: Estimated Project-Added Trips at Lafayette BART Station

	Existing Average Weekday BART Trips	*Project-Added BART Trips*	*% Increase*
AM Peak Hour	575	5	0.9%
PM Peak Hour	665	6	0.9%

Source: Based on BART Station Profile Study (2008), BART ridership data (2012),

The project is not expected to increase the peak hour average ridership at the Lafayette BART Station by more than 3 percent during peak hours, which is one of the two thresholds that must both be met to result in a significant impact on BART. The other threshold is peak hour average waiting time at fare gates that would exceed one minute. Based on observations by TJKM at the Lafayette BART station, the peak hour average waiting time at fare gates is less than 15 seconds, including the worst-case p.m. peak hour when passengers exit in large groups from arriving trains. The six new p.m. peak hour BART passengers added by the project, who would be distributed among ten eastbound (p.m. peak direction) and six westbound (p.m. off-peak direction) arriving trains, are not expected to increase the average waiting at fare gates to more than one minute.

Because neither the peak hour ridership percent increase nor average waiting time at fare gates at the Lafayette BART Station would be met with the project, the result would be a *less-than-significant impact*.

TJKM used observations conducted in October 2011 to estimate that all parking spaces at the Lafayette BART Station typically fill up before 8:30 a.m. on weekdays, except on Fridays when parking demand is lower. Based on the previously cited Census data on transit use by Lafayette resident commuters and the project-generated peak one-hour BART trips shown in Table X, TJKM estimates that the project would generate additional weekday parking demand for up to 15 spaces, which is less than one percent of the 1,526 spaces in the lot and is considered a *less-than-significant impact*.

Bus Transit

TJKM estimated the portion of transit riders generated by the project that are expected to use County Connection's Route 25 bus line as the total number of project-generated transit trips described previously less the estimated number of project-generated BART trips shown in Table X. The remaining number was used to determine the potential impacts to County Connection bus service.

Route 25 is the only fixed-route bus line with stops within reasonable walking distance of the project site. According to 2009 data provided by County Connection staff, Route 25 had an average weekday ridership of approximately 60 passengers in Spring 2009. The January 2011 County Connection Mini SRTP indicates that average weekday ridership on Route 25 amounted to 47 passengers in November 2010. The project is expected to add three trips to this route for the a.m. peak hour and eleven trips for the p.m. peak hour. The County Connection ridership data indicates that this route currently operates well below capacity during peak periods. The addition of 11 trips during any peak hour would not be significant so as to increase the load factor above 1.0 (seats full).

Route 625 is the County Connection bus route service for Acalanes High School students, with one bus arriving before school in the morning and one bus leaving after school in the afternoon using streets near the project site to access the bus stop on the north side of Stanley Boulevard. Because project residents attending Acalanes High School could easily walk or bike to the campus across the street from the site, the project would not add riders to Route 625.

No existing bus stops are located on the project site's street frontage, and the only existing bus route that runs along the project frontage is Route 625 with two bus trips per school day passing by on southbound Pleasant Hill Road. Therefore, the project impact on existing County Connection bus service and facilities would be *less than significant*.

The Lamorinda Action Plan (adopted December 2009) includes a Multimodal Transportation Service Objective (MTSO) for Pleasant Hill Road to "Establish CCCTA bus service on Pleasant Hill Road and/or Taylor Boulevard that has a composite frequency of at least two buses per hour during peak commute and school times (6:30 – 9:30 a.m. and 3:30 – 6:30 p.m.) and direct connection to the Lafayette BART station." It also includes as an Action for Pleasant Hill Road, "support the provision of" such service, for which the City of Lafayette is identified as the responsible party. If implemented, such future bus service would likely attract riders from the project and Acalanes High School, and include a new bus stop along the project frontage on Pleasant Hill Road and/or Deer Hill Road near the intersection of those roadways. Although

neither CCCTA nor the City has adopted specific plans or identified funding for implementation of such new bus service on Pleasant Hill Road, the project site plan proposes bus stops with pullout areas along the project frontages on eastbound Deer Hill Road and southbound Pleasant Hill Road, both of which could potentially be served by future routes providing a "direct connection to the Lafayette BART station", as specified in the Lamorinda Action Plan. Because bus stops with pullout areas are proposed along the Pleasant Hill Road and Deer Hill Road frontages of the project, although no specific plan or funding has been identified for the bus service, the result is a *less-than-significant* impact.

Other Local Transit Services

Lamorinda School Bus Program
With the addition of residential units in the Lafayette School District, the proposed project has the potential to add to the rider demand for the Lamorinda School Bus Program. The program includes service to Stanley Middle School and Springhill and Burton Valley Elementary Schools. The project is expected to generate approximately nine middle school and nine elementary school grade students. Most of the project's elementary school students are expected to attend Springhill Elementary School, and the bus program would not be available to them because the school is located within walking distance approximately one-half mile north of the project site. For the project's assumed nine Stanley Middle School students, applying the historical 20 percent ratio of bus program annual passes for the Stanley Routes vs. total Stanley Middle School enrollment would result in approximately two additional riders on the bus program's Stanley Routes.

The Lamorinda School Bus Program Manager[1] has indicated that up to 30 additional riders could be accommodated on the Stanley Routes, although possible funding issues could affect future service capacity. Participation in the program requires Lamorinda parents to submit an application for their children to be added to the school bus service and to prepay for that service for the school year. These annual passes fund approximately one-third of the program budget, with Measure J County sales tax allocations funding most of the remainder. Because additional seat capacity is available and parents would pay a significant amount of the program cost if they choose to subscribe, the additional ridership demand from the project is expected to have minor effects that the Lamorinda School bus program can accommodate.

Accommodations for the forty-foot buses to stop for passenger loading and unloading at locations reasonably convenient to the project site are proposed with the project. The proposed bus turnouts would allow these school buses to pull off to the side of the road completely out of traffic lanes for passenger loading activity, thereby avoiding the requirement to activate flashing red lights requiring all traffic on the adjacent roadway to stop. Morning buses to Stanley Middle School would arrive at the project site on southbound Pleasant Hill Road, and afternoon buses would arrive on either northbound Pleasant Hill Road or eastbound Deer Hill Road. Northbound Pleasant Hill Road across from the project site does not have room for a bus to pull out of traffic lanes; however, the project site plans propose bus turnouts along the site frontage on southbound Pleasant Hill Road and eastbound Deer Hill Road. Each of these proposed bus stops would be connected with the project's residential units by sidewalks and trails proposed on-site. The proposed turnouts would allow approaching buses to exit the traffic lane during boarding and alighting, while allowing adjacent through-lane traffic to continue unimpeded. Because the bus turnouts would allow peak hour traffic on those roadways to continue unimpeded without

[1] Hansen, Juliet. Program Manager, Lamorinda School Bus Program. Personal communication with Rich Haygood, TJKM. February 2012.

exacerbating congestion, the project-generated demand for school bus service would result in a *less-than-significant impact.*

City of Lafayette Spirit Van
With the addition of residential units within Lafayette, the project has the potential to add senior residents to the rider demand for the Spirit Van program. Because precise senior resident numbers are not yet known for the project, it is speculative to quantify the potential impacts to the Spirit Van service that would result from additional riders.

Pedestrian and Bicycle Facilities

Pedestrian Facilities

The project site plans propose constructing a sidewalk along the project site frontage as follows: on the south side of Deer Hill Road at the bus turnout, which connects with an on-site walkway to access the project's residential units, and from just west of the Soccer Drop-off driveway to the Pleasant Hill Road intersection; and, on the west side of Pleasant Hill Road extending south from Deer Hill Road to the Soccer/Park parking lot driveway. The proposed sidewalk on Deer Hill Road is five-feet wide at the bus turnout and between the Soccer Drop-off driveway and the Soccer/Park parking lot entrance driveway, and expands to a width of six-feet past the Soccer/Park parking lot driveway up to the Pleasant Hill Road intersection. The site plan shows a landscaped buffer strip between the proposed sidewalk on Deer Hill Road and the curb. On Pleasant Hill Road, the proposed sidewalk is ten-feet wide; no landscape buffer is shown on the site plan for this sidewalk segment, which would also serve a proposed bus stop pullout. In addition, a pedestrian trail would traverse the site from the southern edge of the residential component to the sports field, and a ten-foot wide multiuse trail would connect from the westernmost portion of the Project site on Deer Hill Road to the southwest corner of the Pleasant Hill Road/Deer Hill Road intersection. The added sidewalk on the west side of Pleasant Hill Road from Deer Hill Road to the parking lot driveway would provide a portion of the walkway specified for completion in the City's Master Walkways Plan. Although the Master Walkways plan specifies adding a walkway on the north side of Deer Hill Road, the proposed multiuse trail traversing the project site and avoiding the steep grades to the crest of Deer Hill Road would improve pedestrian access for the public. This would serve as an appropriate mitigation for the lack of a continuous walkway on Deer Hill Road, which would constitute a less-than-significant impact.

However, the project site plan does not propose sidewalks along the project site frontage on Pleasant Hill Road south of the Soccer/Park parking lot driveway. On Pleasant Hill Road north of Olympic Boulevard, the City constructed a shared path for pedestrians and bicycles that is ten feet wide with a four- to five-foot wide landscape strip between the path and the roadside curb. The City is also seeking grant funding to conduct a corridor study of Pleasant Hill Road between Mount Diablo Boulevard and Springhill Road to develop a cross section including improved pedestrian and bicycle facilities. This corridor section would be an extension of the improvements to the south on Pleasant Hill Road. Because the project plans do not propose sidewalk on the Pleasant Hill Road project site frontage south of the Soccer/Park parking lot driveway, and propose a narrower sidewalk than anticipated along the Project frontage on Pleasant Hill Road north of the parking lot driveway, the project would be inconsistent with City guidelines for pedestrian facilities, resulting in a *significant impact.*

To mitigate this impact, TJKM recommends the following measure:

- On the west side of Pleasant Hill Road along the entire project site frontage between Deer Hill Road and the westbound SR 24 on-ramp, construct a new shared path for bicycles and pedestrians at a paved width of ten feet with a buffer strip at least four feet wide between the path and the curb, or dimensions as otherwise formally approved by the City. The buffer strip's surface treatment shall be appropriate to accommodate pedestrians accessing vehicles at curb parking and the bus stop loading area. This configuration is expected to require a retaining wall along a portion of the Project frontage, which could result in a potential secondary impact on aesthetics that is addressed separately in Section 4.1, Aesthetics and Visual Resources, of the Supplemental EIR. At the southwest corner of Pleasant Hill Road and Deer Hill Road, the path shall be designed to accommodate expected volumes of pedestrians and bicyclists waiting for the traffic signal. This shared path shall connect with the proposed path traversing the project site at a point just south of the parking lot driveway and at a point just south of the southwest corner of Pleasant Hill Road and Deer Hill Road. These junctions shall provide seamless connections between the two paths, including design features to control conflicts between intersecting pedestrians and bicycles, while reducing conflicts between vehicles entering and exiting the project driveway and bicyclists and pedestrians by providing a single path crossing the driveway at a location a short distance away from vehicle turning movements at Pleasant Hill Road. (This path would be in addition to the multiuse trail traversing the Project site from the westernmost portion on Deer Hill Road to the southwest corner of the Pleasant Hill Road/Deer Hill Road intersection, and to other improvements recommended as mitigations in the Bicycle Facilities section below.)

Implementation of this measure would result in a *less-than-significant impact.*

Project driveways accessing Deer Hill Road and Pleasant Hill Road would interrupt the new sidewalks and the proposed multiuse trail crossing west of the Pleasant Hill Road driveway, and present conflicting vehicle traffic for pedestrians. This would be a *significant* impact. To mitigate this impact, TJKM recommends the following measures:

- Implement the driveway sight-distance mitigations and recommendations in the previous Project Driveway Sight-Distance and subsequent On-Site Circulation and Parking sections of this report, which would provide adequate visibility between pedestrians and drivers.
- Install stop signs for traffic exiting the driveways, except the roundabout at the Homes-Dog Park driveway where yield signs are required, and pedestrian safety enhancement measures including special physical design treatments, such as paving and signage to be specified by the City Engineer, to alert drivers entering and exiting the Project site that they are crossing pedestrian and bicycle facilities.

With these mitigations, project driveways would not disrupt or result in unusual hazards for pedestrian facilities, and the project impact would be *less than significant*.

The project would generate additional pedestrians in the vicinity of the site. The Acalanes Union High School District anticipates that between eight and eleven additional high school students would be generated from the proposed residential development. Most of these students would be expected to walk to and from the project site to attend Acalanes High School (AHS), crossing at the signalized Pleasant Hill Road/Deer Hill Road/Stanley Boulevard intersection. The project's proposed park and soccer field would also increase the number of pedestrians crossing at this

intersection. Additionally, as described in a subsequent section, the soccer/park parking lot at the southwest corner of Pleasant Hill Road/Deer Hill Road is proposed to accommodate passenger loading for AHS students before and after school. However, this is mostly expected to accommodate pick-ups and drop-offs that currently occur on the west curb of Pleasant Hill Road and on eastbound Deer Hill Road near that southwest corner of their intersection, resulting in no more than a negligible increase in pedestrians crossing the intersection. The traffic level of service analysis presented in other sections of this report already assumes the maximum condition of pedestrians crossing this intersection on every signal cycle during peak hours, and the additional pedestrians would have a *less-than-significant* impact on intersection traffic operations.

The project-generated pedestrians would likely join the existing large number of AHS pedestrians (nearly 100 each morning) that "jaywalk" across Stanley Boulevard within 100 to 275 feet east of the signalized intersection. Although crossing traffic in this illegal manner is somewhat hazardous, the large numbers of high school age pedestrians crossing mostly during a 20-minute period before and after school every day make them fairly visible to drivers, and accident data provided by the City's Engineering staff for a recent four-year period shows no reported accidents involving pedestrians in this area. As suggested previously in the report to address this existing condition, safer pedestrian conditions in this segment might be encouraged by installing a fence or barrier rail along the north curb of Stanley Boulevard between Pleasant Hill Road and the AHS exit driveway approximately 175 feet to the east, and installing a school crosswalk on Stanley Boulevard at that driveway. However, a fence or barrier along the curb could present a safety issue for drivers and a visual impact for the public, and installing an acceptable crosswalk design would be very challenging because of existing driveways and a drainage inlet on the north curb across from the AHS driveway. Because of the nature of this existing condition, additional high school pedestrians generated by the project would not substantially increase hazards, and the project impact is considered *less than significant*.

The project is expected to generate approximately nine additional elementary school (K-5) students, and most are expected to attend Springhill Elementary School, which is approximately one-half mile north of the project site on Pleasant Hill Road. A substantial portion of these students could walk this distance to and from Springhill School, accompanied by a parent as appropriate, if a more direct walkway connection was provided. However, no walkway exists on the west side of Pleasant Hill Road between Deer Hill Road and Springhill School. To make this trip on improved walkways, pedestrians must cross Pleasant Hill Road at the Deer Hill Road signal and at the Springhill Road/Quandt Road signal to use the sidewalk on the east side, which has a gap of approximately 500 feet between Quandt Road and Hillview Lane where pedestrians must walk along a narrow residential access roadway. A crossing guard is provided before and after school at the Springhill Road/Quandt Road signal, but not at the Deer Hill Road signal. These existing obstacles are likely to significantly limit the number of project-generated Springhill students walking to and from school. The City's Master Walkways Plan includes adding a walkway on the west side of Pleasant Hill Road in this area. The existing topography between Deer Hill Road and Springhill Elementary School includes an area where a steep embankment slopes up immediately adjacent to the roadway, presenting a significant engineering challenge for an acceptable walkway design. Construction of a walkway on a relatively flat area along the top of the embankment approximately 25 feet west of the Pleasant Hill Road curb, with connections to typical curbside elevations at the north and south ends, appears feasible. However, ADA accessibility and acquisition of right-of-way are potential issues.

The project would contribute to the need for a walkway on the west side of Pleasant Hill Road between Deer Hill Road and Springhill Elementary School, but a safe alternative is provided by the existing sidewalk on the east side, and this condition would not substantially increase hazards or

disrupt existing or planned pedestrian facilities. Because this condition does not meet the significant impact criteria based on CEQA guidelines, this pedestrian impact is considered *less than significant*. However, to reduce the project's share of cumulative Delay Index impacts on Pleasant Hill Road (as detailed in the subsequent Cumulative Year 2030 with Revised Project Conditions section), Mitigation Measure TRAF-13 requires the project sponsor to construct a walkway on the west side of Pleasant Hill Road.

Data from the 2010 U.S. Census shows that approximately 1.4 percent of Lafayette residents and 1.6 percent of Contra Costa County residents commuting to work did so by walking. Assuming that 1.5 percent of the commute peak-hour project trip generation for the residential, dog park, city park, and soccer field land uses shown in Table VI would walk, the project would generate one walking trip during the a.m. peak hour and three walking trips during the p.m. peak hour. If these additional pedestrians walk to and from the south on Pleasant Hill Road to access employment sites on Mt. Diablo Boulevard or homes to the south, and are added to those expected to walk to and from County Connection bus stops as described in a previous section, the combined total would be approximately 4 pedestrians in the a.m. peak hour and 14 in the p.m. peak hour. This number of project-generated pedestrians and the conflicting project-added vehicle-trips (see Figure 4) would contribute to possible justification for desirable pedestrian improvements along Pleasant Hill Road at the uncontrolled SR 24 freeway ramp crossings. However, the existing crosswalks meet CAMUTCD standards, and this condition would not substantially increase hazards or disrupt existing or planned pedestrian facilities. Because this condition does not meet the significant impact criteria based on CEQA guidelines, the resulting project impact on pedestrian facilities would be *less than significant*. This finding does not preclude the City from potentially requiring the project sponsor to contribute toward construction of pedestrian safety improvements at the SR 24 freeway ramp crossings as a condition of project approval. Although not required as mitigation, TJKM recommends installation of pedestrian crossing warning signs and high-visibility pavement markings at the SR 24 freeway ramp crosswalks.

Project-generated vehicle traffic would increase existing traffic volumes on adjacent roadways by the following percentages:

- Pleasant Hill Road south of the project driveway - less than five percent
- Deer Hill Road west of the project driveways – less than four percent
- Stanley Boulevard - less than two percent
- Pleasant Hill Road north of Deer Hill Road - less than two percent

These increases are within the range of typical daily fluctuations in traffic volumes, which can vary by five to ten percent from day to day, and would not significantly impact the pedestrian experience on adjacent sidewalks. Additionally, the small percentage increase on Stanley Boulevard would not significantly impact the AHS pedestrian "jaywalking" condition described above. The project would increase traffic volumes on Deer Hill Road west of Pleasant Hill Road by a somewhat higher percentage. However, the potential impact on pedestrians would be offset by the project's proposed construction of the multiuse trail traversing the Project site from the Deer Hill Road connection at the west project limit to the southwest corner of the Pleasant Hill Road/Deer Hill Road intersection. This would allow pedestrians to avoid walking along Deer Hill Road and the steep grades to its hillcrest. The resulting project impacts on the pedestrian experience on adjacent sidewalks would be *less than significant.*

Bicycle Facilities

The site plan does not propose any bicycle facilities along the project site frontage on the west side of Pleasant Hill Road. The City's Bikeway's Master Plan envisions a complete Class II bicycle lane as part of the network on Pleasant Hill Road south of Deer Hill Road. Because the project site plan does not propose bicycle facilities on Pleasant Hill Road, the inconsistency between the project proposal and the City's Bikeways Master Plan is a *significant impact.*

To mitigate this impact, TJKM recommends the project applicant revise the proposal to include a southbound Class II bicycle lane to be consistent with the vision and intent of the City's Bikeway Master Plan. This added bike lane shall be provided on southbound Pleasant Hill Road from the Deer Hill Road intersection to the south side of the westbound SR 24 on-ramp, which would provide a portion of the bike lanes included in the City's Bikeways Master Plan that is currently missing, but a gap would remain between the westbound on-ramp and Mount Diablo Boulevard. However, current right-of-way and lane geometry constraints on this segment of southbound Pleasant Hill Road would necessitate either the elimination of on-street parking or widening the southbound roadway along the project frontage. The elimination of parking may potentially result in increasing on-street parking demand on nearby adjacent roadways, especially if possible future extension of the bike lane south of the westbound on-ramp were to eliminate additional existing curb parking, in which case a secondary impact could result. Therefore, to implement this mitigation, the Project applicant shall work with the City and Caltrans to provide a safe bicycle facility, including features to reduce safety conflicts at the State Route 24 on-ramp crossing (such features may include signage, striping, and/or other features recommended by the City Engineer). The design is expected to include widening the southbound roadway along the project frontage to provide a standard Class II bike lane while retaining the existing curb parking lane. This configuration would require a longer and higher retaining wall along the Project frontage than that expected with other mitigation requiring construction of a new shared path for bicycles and pedestrians on the west side of Pleasant Hill Road along the project site frontage, as recommended in the previous Pedestrian Facilities section and a subsequent paragraph in this section of the report. The retaining wall could result in a potential secondary impact on aesthetics, which is addressed separately in Section 4.1, Aesthetics and Visual Resources, of the Supplemental EIR. For a segment of southbound Pleasant Hill Road extending north from the Soccer/Park Parking Lot driveway, additional widening may be required to accommodate the proposed bus turnout in addition to the Class II bike lane. (This configuration would be in addition to the other improvements recommended as mitigations in the Pedestrian Facilities, Bicycle Facilities, and the Street Parking and Passenger Loading Areas sections below.)

Implementation of these measures to mitigate the impact of the inconsistency between the Bikeways Master Plan and the proposal shown on the project site plans would result in a *less-than-significant impact*. An appropriate bike lane striping treatment or other accommodation for southbound bicyclists on Pleasant Hill Road crossing vehicle traffic at the on-ramp to westbound SR 24 will be developed in coordination with Caltrans, but the project would not contribute significantly to the need for such facility, as further discussed below.

Traffic entering and exiting project driveways accessing Deer Hill Road and Pleasant Hill Road would cross the existing, proposed and recommended Class I and Class II bike facilities, including the proposed multiuse trail crossing west of the Pleasant Hill Road driveway, and present conflicting vehicle traffic for bicyclists. The volumes of conflicting vehicle traffic using the project driveways, as well as the volume of bicyclists expected to cross those driveways on the bike lanes and multi-use trail that are envisioned as primary links in the City's Bikeways Master Plan network

(as described in other paragraphs in this section of the report), would be substantial. This would be a *significant* impact. To mitigate this impact, TJKM recommends the following measures:

- Implement the driveway sight-distance mitigations and recommendations in the previous Project Driveway Sight-Distance and subsequent On-Site Circulation and Parking sections of this report, which would provide adequate visibility between bicyclists and drivers.
- Install stop signs for traffic exiting the driveways, except the roundabout at the Homes-Dog Park driveway where yield signs are required, and safety enhancement measures including special physical design treatments, such as paving and signage to be specified by the City Engineer, to alert drivers entering and exiting the Project site that they are crossing pedestrian and bicycle facilities.

With these mitigations, project driveways would not disrupt or result in unusual hazards for the existing, proposed, and recommended bicycle facilities, and the project impact would be *less than significant*.

The City's Bikeways Master Plan proposes constructing a Class I (off-street) bicycle path between Pleasant Hill Road and the Brown Avenue/Deer Hill Road intersection on an alignment along the north side of the Caltrans SR 24 right-of-way. The Bikeways Master Plan also proposes extending the Class I bike path easterly of Pleasant Hill Road, and the most recent City discussions propose crossing Pleasant Hill Road at the Deer Hill Road/Stanley Boulevard traffic signal, with an off-street path along the west side of Pleasant Hill Road connecting between the signal and the Caltrans right-of-way. The project site borders the north side of the Caltrans right-of-way and the west side of Pleasant Hill Road where these bicycle facilities are planned.

As mentioned in the Pedestrian Facilities section, the project site plan proposes construction of a multiuse trail traversing the project site between the residential component and SR 24, extending from west of the Homes-Dog Park driveway to the southwest corner of the Pleasant Hill Road/Deer Hill Road intersection. This added multiuse trail would provide a portion of the EBMUD Aqueduct/Caltrans ROW Trail recommended in the City's Bikeway's Master Plan, which would also run between Brown Avenue north of SR 24 and the Walter Costa Trail north of the Lafayette Reservoir.

On the west side of Pleasant Hill Road, the project site plans propose constructing a ten-foot wide sidewalk along the project site frontage between Deer Hill Road and the project driveway. The proposed multiuse path traversing the project site would connect with the proposed sidewalk just south of the southwest corner of the Deer Hill Road/Pleasant Hill Road intersection.

However, the project site plan is not consistent with recent project approvals facilitating the installation of Class I bicycle facilities, and does not propose the construction of bicycle facilities on Pleasant Hill Road south of the Soccer/Park Parking Lot driveway. As mentioned in the Pedestrian Facilities section, the City recently completed construction of a shared path for pedestrians and bicycles that is ten feet wide with a four- to five-foot wide landscape strip between the path and the roadside curb on Pleasant Hill Road north of Olympic Boulevard. The City is also seeking grant funding to conduct a corridor study of Pleasant Hill Road between Mount Diablo Boulevard and Springhill Road to develop a cross section including improved bicycle and pedestrian facilities. This corridor section would be an extension of the improvements to the south on Pleasant Hill Road. Because the project plans propose a narrower facility on the west side of Pleasant Hill Road than those recently constructed by the City for shared bicycle and pedestrian use and those anticipated

at that location, and the project does not propose the construction of bicycle facilities on Pleasant Hill Road south of the Soccer/Park Parking Lot driveway, the project would interfere with planned bicycle facilities, resulting in a *significant impact*.

To mitigate this impact, TJKM recommends the following measure:

- On the west side of Pleasant Hill Road along the project site frontage between Deer Hill Road and the westbound SR 24 on-ramp, as recommended in the previous Pedestrian Facilities section of this report, construct a new shared path for bicycles and pedestrians at a paved width of ten feet with a buffer strip at least four feet wide between the path and the curb, or dimensions as otherwise formally approved by the City. The buffer strip's surface treatment shall be appropriate to accommodate pedestrians accessing vehicles at curb parking and bus stop loading areas. This configuration is expected to require a retaining wall along a portion of the Project frontage, which could result in a potential secondary impact on aesthetics that is addressed separately in Section 4.1, Aesthetics and Visual Resources, of the Supplemental EIR. At the southwest corner of Pleasant Hill Road and Deer Hill Road, the path shall be designed to accommodate expected volumes of pedestrians and bicyclists waiting for the traffic signal. This shared path shall connect with the proposed path traversing the project site at a point just south of the parking lot driveway and at a point just south of the southwest corner of Pleasant Hill Road and Deer Hill Road. These junctions shall provide seamless connections between the two paths, including design features to control conflicts between intersecting pedestrians and bicycles, while reducing conflicts between vehicles entering and exiting the project driveway and bicyclists and pedestrians by providing a single path crossing the driveway at a location a short distance away from vehicle turning movements at Pleasant Hill Road.

Implementation of this measure would result in a *less-than-significant impact.*

Data from the 2010 U.S. Census shows approximately 0.72 percent of Lafayette residents and 0.7 percent of Contra Costa County residents commuting to work by bicycle. Assuming that one percent of the commute peak-hour project trip generation for the residential, park, and soccer field land uses shown in Table VI would be bike trips, the project would generate one bike trip during the a.m. peak hour and one to two bike trips during the p.m. peak hour. This number of project-generated bike trips and the conflicting project-added vehicle-trips (see Figure 4) would not contribute significantly to the need for bicycle facilities, including improvements along Pleasant Hill Road at the uncontrolled SR 24 freeway ramp crossings. The existing design at these locations meets CAMUTCD standards, and this condition would not substantially increase hazards or disrupt existing or planned bicycle facilities. Because this condition does not meet the significant impact criteria based on CEQA guidelines, the resulting project impact on bicycle facilities would be *less than significant*. This finding does not preclude the City from potentially requiring the project sponsor to contribute toward detailed study and construction of bicycle safety improvements on Pleasant Hill Road at the SR 24 freeway ramp crossings as a condition of project approval.

Project-generated vehicle traffic would increase existing traffic volumes on adjacent roadways by the following percentages:

- Pleasant Hill Road south of the project driveway - less than five percent
- Deer Hill Road west of the Homes/Dog Park driveway – less than four percent
- Deer Hill Road east of the Homes/Dog Park driveway – less than seven percent
- Stanley Boulevard - less than two percent
- Pleasant Hill Road north of Deer Hill Road - less than two percent

These increases are within the range of typical daily fluctuations in traffic volumes, which can vary by five to ten percent from day to day, and would not significantly impact bicyclist operations or safety on adjacent bike lanes or the Bike Boulevard on Stanley Boulevard. The project would increase traffic volumes on Deer Hill Road west of Pleasant Hill Road by up to nine percent (Figure 4 shows project-added trips). However, the potential impact on bicyclists would be offset by the project's proposed construction of the multiuse trail traversing the Project site from the Deer Hill Road connection at the west project limit to the southwest corner of the Pleasant Hill Road/Deer Hill Road intersection. This would allow bicyclists to avoid this segment of Deer Hill Road and the steep grades to its hillcrest. The resulting project impacts on bicyclist operations and safety on bicycle facilities would be *less than significant*.

Street Parking and Passenger Loading Areas

Project plans propose construction of a bus turnout on southbound Pleasant Hill Road between Deer Hill Road and the Soccer Field/Park parking lot driveway, where the plans show elimination of up to five existing curb parking spaces and the existing passenger loading zone. However, the maximum observed parking demand of 13 vehicles in the 20 existing curb parking spaces between Deer Hill Road and the SR 24 westbound on-ramp indicates that five of these spaces could be eliminated without shifting the parking demand to nearby adjacent streets. In addition, the proposed elimination would be further accommodated by the minimum of 16 curb spaces observed to remain available south of the westbound on-ramp, where a total of 22 spaces are marked.

A maximum accumulation of nine vehicles at one time was observed at the existing designated passenger loading zone and adjacent curb parking on Pleasant Hill Road, and a maximum of six additional vehicles was observed parking on the site property (when it was previously accessible), waiting to pick up Acalanes High School students after school. If not replaced with alternative accommodation, the proposed elimination of the existing designated spaces on the west curb of Pleasant Hill Road that are currently used for school passenger loading would result in additional hazardous passenger loading activity at unsuitable locations, which already occurs as described in the Existing conditions section. However, the proposed Soccer Field/Park parking lot and access driveways will function as an alternative loading zone; the design will include adequate traffic controls and signage to provide pedestrian safety within the parking lot. The relocation of these designated curb spaces used for passenger loading from Pleasant Hill Road to the proposed parking lot and adjacent access driveway would result in a *less-than-significant impact*.

It should be noted that the proposed Soccer Field/Park parking lot has the potential to attract the existing on-street parking demand along the Pleasant Hill Road frontage, which may increase demand for parking in the parking lot beyond the number of spaces proposed. This impact is addressed in the subsequent On-site Circulation and Parking section.

Emergency Vehicle Access

TJKM consulted with the Contra Costa County Fire Protection District (CCCFPD) to assist in evaluating the project impacts on emergency vehicle access. The TJKM evaluation considered the additional traffic delay impacts resulting from the project under Existing with Revised Project conditions, as well as the proposed configuration of project access driveways.

A CCCFPD Fire Inspector[2] reviewed the additional traffic delay impacts of the original Terraces of Lafayette project described in the original EIR report. Based on that CCCFPD review, and comparison of the traffic delay impacts of the Revised Project described in the preceding sections of this report to those from the original project EIR, TJKM has evaluated the Revised Project impacts as follows. Station 15 at 3338 Mount Diablo Boulevard, approximately one-half mile west of Pleasant Hill Road, is the primary responding station for the project vicinity. Emergency response to the project site could be routed to the proposed Revised Project driveways on Deer Hill Road via Brown Avenue or Pleasant Hill Road.

On the Deer Hill Road response route, the Revised Project's significant impact on delay at the Brown Avenue/Deer Hill Road intersection would result in inadequate emergency access, which would be a *significant impact*. The impact on traffic delay would be mitigated to less-than-significant by requiring that prior to project completion, the project sponsor will share with the City the cost to install one of the following mitigation measures at this intersection. One mitigation option is to install a traffic signal as part of the development, as described in a previous section of this report. To mitigate the impact on emergency access, the traffic signal equipment would be required to include an emergency vehicle preemption system (Opticom), which allows emergency response vehicles approaching a signalized intersection to activate a green signal for their travel direction. However, the SR 24 freeway overpass structures on Brown Avenue could obstruct the Opticom activation device on responding emergency vehicles headed northbound on Brown Avenue from Mount Diablo Boulevard toward Deer Hill Road, which could substantially reduce the effectiveness of the traffic signal preemption. To avoid this problem, TJKM recommends that the installation of traffic signal equipment to mitigate the project's delay impact at the Brown Avenue/Deer Hill Road intersection shall include advance detection devices for the Opticom system as needed to assure effective traffic signal preemption for responding emergency vehicles on northbound Brown Avenue. An alternative mitigation to installing a traffic signal would be the redesign of this intersection as a roundabout, which would improve the approach LOS for the minor approach volumes at this intersection and would be designed to accommodate access by emergency response vehicles. TJKM recommends additional analysis of this alternative mitigation. With either mitigation alternative, the project impact on emergency access routes using Brown Avenue or Deer Hill Road would be *less than significant*.

The emergency response route along Pleasant Hill Road would be northbound from Mount Diablo Boulevard, originating from Station 15. Because the response route is northbound and not southbound, the project's less-than-significant impact on p.m. peak-hour travel time and Delay Index for northbound Pleasant Hill Road north of SR 24 would not significantly impact emergency access to areas of Lafayette served by Pleasant Hill Road between SR 24 and Rancho View Drive. (Areas north of Rancho View Drive would be served adequately by Station 2, located on Geary Road at Larkey Lane.) The result would be a *less-than-significant impact*.

CCCFPD more recently reviewed a preliminary version of the Revised Project site plans (since superseded as described below) regarding emergency access. According to a letter from CCCFPD Fire Inspector Ted Leach dated July 21, 2014, which is included as Appendix G, that version of the Revised Project site plans did not comply with Fire District requirements for emergency vehicle access for the following reasons:

[2] Leach, Ted. Fire Inspector, Contra Costa County Fire Protection District. Personal communication with Rich Haygood, TJKM. February 22 and March 8, 2012.

- The median at the entrance to the subdivision at the Deer Hill Road/Home-Dog Park driveway does not allow for the minimum required unobstructed access width of 20 feet.
- Access through the proposed subdivision does not appear to meet the minimum required outside turning radius of 45 feet and the minimum inside turning radius of 25 feet.
- The Revised Project includes dead-end emergency apparatus access roadways in excess of 150 feet in length, which do not include required provisions for the turning around of Fire District apparatus.

Subsequent to the CCCFPD review letter, the project applicant submitted updated project site plans (BKF plans dated 8/25/14 and 8/26/14). The updated project site plans show that:

- The median at the entrance to the subdivision at the Deer Hill Road/Home-Dog Park driveway provides lanes on both sides of the median with a minimum unobstructed access width of 12 feet, which the CCCFPD letter identified as acceptable.
- Corner radii and medians at on-site driveway intersections provide a minimum inside turning radius of 25 feet and a minimum outside turning radius of 45 feet, per CCCFPD requirements.

Detailed review of the site plan identified potential inadequate turning radii at the Deer Hill Road/Home-Dog Park driveway roundabout. Given that the project is still in the environmental phase, the roundabout design is still in concept form; the City Engineer will require the final design to increase the corner radii and/or construct the central island and possibly the entry side of the subdivision entrance median with a traversable apron as needed to provide adequate turning radii for emergency apparatus at the roundabout. However, the lack of provisions for turning around Fire District apparatus on dead-end emergency apparatus access roadways would result in inadequate emergency access to the project site, which is a *significant impact*.

To mitigate this impact, TJKM recommends revising the project site plans to meet the access and turnaround requirements of the CCCFPD, which may include revising the site plan to include turnarounds on dead-end access streets in excess of 150 feet in length, provision of an alternative emergency vehicle access point, or other means acceptable to the Fire Marshall.

Implementation of this measure to mitigate inadequate emergency access to the site would result in a *less-than-significant impact*.

Although the Soccer/Park driveway on Pleasant Hill Road would not be directly accessible from the northbound Pleasant Hill Road response route because left turns are prohibited by the existing raised median, the July 21, 2014 CCCFPD letter reviewing the Revised Project did not identify this as an issue. Emergency vehicle access to the Soccer Field and the Park would be available from northbound Pleasant Hill Road via left turns at Deer Hill Road and at the Soccer Dropoff driveway, and the resulting impact on emergency vehicle access would be *less than significant*. As an alternative that would enhance emergency vehicle access, which is not required as mitigation, TJKM recommends consideration of reconstructing a short section of the median on Pleasant Hill Road opposite the Soccer/Park driveway to safely and effectively obstruct left turns by the public but provide more direct emergency vehicle access to the parking lot, using beveled curbs or other designs that emergency vehicles can cross safely.

On-Site Circulation and Parking

TJKM reviewed the project site plans with regard to on-site circulation, including pedestrian and truck access, as well as parking. Figure 2 shows an overview of the site plan.

The vehicle circulation plan appears adequate for passenger cars and light-duty trucks. To maintain adequate sight-distance, TJKM recommends that all landscaping within 15 feet of on-site driveway intersections, including the proposed multiuse trail crossing west of the Pleasant Hill Road driveway, shall be limited to plants with foliage no more than 30 inches fully mature height above the closest adjacent curb elevation, or trees with canopy foliage no less than seven feet above the closest adjacent curb elevation, or other dimensions as specified by the City Engineer. At the central, four-way on-site intersection on the east-west collector roadway providing access to/from the residential units, TJKM recommends installation of two-way stop sign control on the short local access roadways that comprise the north and south intersection legs.

TJKM reviewed exhibits dated June 11, 2014 that the project architect provided, which depict the turning paths for a 39.5-foot truck (single-unit with no trailer) accessing the residential site driveways. For determining the adequacy of site access driveways, the vehicle depicted in the exhibits is representative of the largest vehicle expected for the great majority of delivery and service vehicles, and many of the moving trucks, that would access the site. However, a very large moving van, which typically consists of a tractor truck with a trailer up to 53 feet long, has significantly larger turning radius requirements, which were not depicted on the exhibits provided to TJKM.

Based on TJKM's review of the exhibits provided by the project architect, the on-site circulation roadways for the residential site appear to provide inadequate turning radii for truck access due to the size of some of the proposed chokers near internal intersections. In addition, the truck turning paths depicted at the Deer Hill Road/Homes-Dog Park driveway indicate that the proposed entry and exit driveway widths would not accommodate trucks making the westbound left-turn into and northbound left-turns out of the residential project. Additionally, although not depicted on the exhibits provided by the project architect, the proposed entry and exit driveway width would not accommodate a very large moving truck making an eastbound right-turn into and northbound right-turn out of this driveway. The infrequent occasions when very large moving vans would need to access the 44-home development would require that they enter and exit via these right turns to and from eastbound Deer Hill Road, and this driveway need not be designed to allow these very large trucks to make left turns in or out. The Soccer Dropoff and Soccer/Park Parking Lot Driveways and internal roadways also appear to provide inadequate truck turning radii to accommodate waste collection and large equipment delivery (i.e. 40-foot long, or SU-40 design vehicle) trucks making right turns in or out of the driveways and circulating through those areas, based on TJKM's review of exhibits provided by the project architect.

The inadequate truck turning radii at the project entry driveways and internal roadways would substantially increase hazards due to a design feature, which is a *significant impact*.

To mitigate this impact, TJKM recommends revising the project site plans at the project driveways such that adequate truck turning radii are provided, which requires: widening the portion of the driveway entry and exit lane widths near each intersection, including on the southern leg of the Homes-Dog Park driveway by modifying the width of the southern-leg splitter island; increasing the corner radii; and/or constructing the central island at the proposed roundabout with a traversable apron. In addition, TJKM recommends reducing the size of some of the proposed chokers near internal intersections and raised islands in the Soccer/Park Parking Lot and Soccer Dropoff as needed to provide additional roadway area for adequate truck turning radii. Implementation of these measures to mitigate inadequate truck turning radius provisions at the project entry driveways and internal roadways would result in a *less-than-significant impact*.

TJKM reviewed pedestrian access on the site, especially between on-site recreation/activity centers and residential units, and connections to and from public sidewalks. In addition to the proposed multiuse trail, the project also proposes various pedestrian facilities internal to the site that will provide connections between the various land uses and the external pedestrian infrastructure. At the dog park, a walkway will connect the dog play areas to the crosswalk at the proposed roundabout on Deer Hill Road, via the dog park parking lot. A pedestrian trail will also provide a connection between a pocket park adjacent to the residential component along the site's southern boundary and the park/soccer field parking lot. Sidewalks and walkways will also facilitate pedestrian circulation throughout the residential component, and provide access between the residential units and other trails and paths leading to the non-residential land uses and to the external pedestrian network, including the bus pullouts on Deer Hill Road and Pleasant Hill Road.

TJKM evaluated the proposed parking supply based on review of the project site plan and City code requirements. Currently, the project proposal does not specify a ratio of off-street residential parking, which will be provided in a private garage at each residential unit, with additional parking to be provided along the curb of the two east-west roadways on-site. The exact ratio of parking provided for the residential component will be subject to requirements established by the City as part of the design review process and in accordance with parking requirements for the site's rezoning as PUD, which is assumed would meet the expected parking demand.

To provide an additional reference point for the potential parking demand of the project's recreation components, TJKM conducted parking accumulation analysis using driveway counts at three representative dog parks in Dublin, Foster City, and San Ramon, and at a soccer field in the community of Blackhawk, which are presented in Appendix H. In addition, TJKM reviewed data presented in *Parking Generation, 4th Edition* published by the Institute of Transportation Engineers. In that publication, the land use categories applicable to the project are City Park (411) M and Soccer Complex (488), which present data from suburban study sites including peak period parking rates for parks and soccer fields. For the City Park land use, *Parking Generation* estimates peak parking demand ratios of 2.3 and 2.8 vehicles per acre for Saturday and Sunday, respectively, but does not provide ratios for weekday peak parking demand, which TJKM assumed as 2.3 vehicles per acre. For the soccer field, TJKM assumed the *Parking Generation* 85th-percentile peak parking demand ratios of 60.5, 65.2, and 69.3 vehicles per field during weekdays, Saturdays, and Sundays, respectively, which were higher than the demand ratios estimated at Blackhawk Field. Application of these parking demand ratios based on the current project proposal estimates that the project will result in weekday, Saturday, and Sunday peak period parking demand of 74, 79, and 86 vehicles, respectively. The project site plan proposes 78 parking spaces in the parking lot adjacent to the Deer Hill Road/Pleasant Hill Road intersection, with four additional disabled-access spaces located at the Soccer Field drop-off area accessible from Deer Hill Road. Based on these parking demand estimates, the proposed soccer field and park are expected to generate parking demand that would be accommodated by the proposed parking lot on weekdays, but greater than the proposed parking lot supply on Saturdays and Sundays. However, the maximum overflow demand of eight vehicles on Sunday could be accommodated by the 15 on-street parking spaces on Pleasant Hill Road that would remain in place south of the proposed project driveway, if the current prohibition of weekend parking along that curb area is eliminated. TJKM recommends that the City repeal the prohibition of weekend parking on the west side of Pleasant Hill Road between the westbound SR 24 on-ramp and the proposed Soccer Field/Park parking lot driveway to accommodate the potential peak parking demand for the soccer field and park on weekends.

However, the proposed Soccer Field/Park parking lot has the potential to generate additional parking demand on weekdays beyond that described above. This additional weekday demand would be generated given the proximity of the parking lot to Acalanes High School and the existing on-street parking on Pleasant Hill Road, and the elimination of existing on-street parking spaces in the vicinity of the proposed driveway and bus turnout. Absorbing this potential diverted demand in the parking lot would limit the availability of parking during the weekday afternoon peak demand periods for the proposed soccer field and park and passenger loading activity, resulting in a *significant impact.*

To mitigate this impact, TJKM proposes the implementation of various parking restrictions within the Soccer Field/Park parking lot to prevent all-day parking and other abusive parking behavior that would potentially displace the Soccer Field/Park users for which the parking lot is intended. These restrictions will be deliberated through a public process by the appropriate Lafayette review board(s). Implementation of this measure would result in a *less-than-significant* impact.

For the proposed dog park, exhibits provided by the project architect propose 22 off-street parking spaces north of Deer Hill Road. Based on the average peak period parking accumulation of 18 vehicles observed at the three representative dog parks, the proposed parking supply for the dog park is expected to be adequate. In summary, because the proposed parking supply, assuming the recommended repeal of the prohibition on weekend parking on Pleasant Hill Road and mitigation to implement restricted parking in the Soccer Field/Park lot on weekdays, is expected to meet the estimated demand for all proposed land uses, the Revised project's impact on parking facilities is expected to be *less-than-significant.*

TJKM also reviewed the parking dimensions proposed on the project site plans. All of the proposed parking would be at a 90-degree angle to the aisles, for which the City's off-street parking dimensions require a minimum aisle width of 26 feet and a minimum stall depth of 18 feet. All parking aisles appear to meet the minimum width standard. However, the parking stalls are labeled with a depth of 16 feet between the back of the stall markings and the raised curb near the front of the vehicle, which is acceptable if the remaining two feet that is assumed for vehicle front overhang is a flat area with approximately the same height as the curb (typically six inches).

The proposed parking design features would not substantially increase hazards, and the resulting impact would be *less-than-significant.* TJKM recommends that the site plan be revised to address the potential issues related to stall depth and vehicle front overhang during the design review process.

Construction

According to the Project Description, construction activities, including the removal of debris from the demolition of existing on-site infrastructure and the delivery of construction materials to the Revised Project site, would result in approximately 6,000 trips distributed over a ten-month period. Grading on the project site during construction will result in no net export or import of soil, so there would be no trips for grading haul . All truck trips for the hauling of demolition and construction materials are expected to arrive at and depart from the project vicinity using the SR 24 freeway and ramps at the Pleasant Hill Road interchange, in compliance with the City's truck route ordinance and standard requirements of a Construction Staging Plan that would be a condition of approval of the project. As a result, truck trips for this hauling operation are expected to be prohibited on Deer Hill Road west of the project site boundary. However, exceptions allowing trucks to use Deer Hill Road west of the project site during selected construction phases, when truck operations for access via Pleasant Hill Road might prove to be undesirable as

determined by the City Engineer, may be permitted in the Construction Staging Plan subject to approval by the City Engineer.

Based on the analysis of Existing and Existing with Revised Project traffic conditions presented in the previous sections of this report, the truck trips generated during the demolition and construction phases of the project site could result in the following conditions:

- Potential large truck turning movements during the a.m. peak hour at the Deer Hill Road/Pleasant Hill Road intersection would conflict with congested southbound Pleasant Hill Road traffic and significantly increase delay at the intersection.
- Large trucks potentially attempting U-turn movements from northbound to southbound Pleasant Hill Road at the Deer Hill Road intersection would be forced into stopping and backing up movements because of the constrained intersection geometry, contributing to traffic delay and queues at the intersection.
- Large trucks potentially attempting left turns from northbound Pleasant Hill Road to Deer Hill Road could be forced into stopping and backing up movements, or possibly drive over the south raised median on Pleasant Hill Road or conflict with eastbound vehicles stopped at the crosswalk limit line on Deer Hill Road, because of the constrained intersection geometry. These conditions would contribute to traffic delay and queues at the intersection and substantially increase hazards.
- Large trucks are expected to enter northbound Pleasant Hill Road from the westbound SR 24 off-ramp and weave across northbound lanes to turn left at Deer Hill Road, or possibly at a temporary median opening that would provide direct access to the project site south of Deer Hill Road as a temporary construction access. During the p.m. peak hour when this segment of northbound Pleasant Hill Road is congested, these large truck weaving movements would significantly reduce traffic speeds and substantially increase hazards.
- Potential large truck turning movements on Deer Hill Road to access the project site could occur at locations with inadequate sight-distance, which would substantially increase hazards.
- Potential large truck traffic during the a.m. and school p.m. peak hours on Pleasant Hill Road and Deer Hill Road would conflict with pedestrians and passenger loading activity generated by Acalanes High School and other schools in the area on school days, substantially increasing hazards for school pedestrians.
- Elimination of the existing passenger loading zone on the west curb of Pleasant Hill Road along the project frontage, which is currently used intensely for school passenger loading during peak arrival and dismissal periods, would substantially increase hazards for school pedestrians and vehicle traffic by resulting in additional hazardous passenger loading activity at unsuitable locations.

During the grading phase of construction on the project site, these conditions would result in *temporary significant impacts*.

To mitigate these construction impacts, TJKM recommends that the project sponsor prepare and submit a Construction Staging Plan for review and approval by the City Engineer. The Construction Staging Plan shall include elements such as flaggers for trucks entering and exiting the site, and a designated liaison to coordinate with the City, schools, and the public as needed, and shall implement the following measures:

- Large trucks involved in the grading phase of construction shall be prohibited from arriving at or departing from the project site during the hours of 7:00 to 9:00 a.m. and 3:00 to 7:00 p.m. on any school day, and 7:00 to 9:00 a.m. and 4:00 to 7:00 p.m. on any non-school weekday.
- Large trucks shall be prohibited from making U-turn movements from northbound to southbound Pleasant Hill Road at the Deer Hill Road intersection during construction. The Construction Staging Plan shall specify for each construction phase whether access to the Project site from northbound Pleasant Hill Road will require providing a temporary median opening for left turns directly into the site south of Deer Hill Road as a temporary construction access, with flaggers to direct traffic for trucks entering and exiting the site.
- If the Construction Staging Plan allows large trucks to turn left from northbound Pleasant Hill Road to Deer Hill Road, accommodation of their turning radius may require the following temporary measures: modifications to the south median within up to 15 feet from the nose; relocation of the limit line for eastbound Deer Hill Road traffic lanes by up to 15 feet behind the existing crosswalk marking; adjustments to vehicle detectors, any other affected traffic signal equipment, and traffic signal timing as required to maintain safe and effective operations; and, measures as otherwise specified by the City Engineer.
- The proposed locations and configuration of access points on Pleasant Hill Road and Deer Hill Road where large trucks would turn into or out of the project site during construction shall be subject to approval by the City Engineer, to ensure consideration of sight-distance constraints and implementation of appropriate safety precautions.
- During any construction phase when access to the existing passenger loading zone on the west curb of Pleasant Hill Road along the project frontage would be unavailable on school days, one of the following measures:
    - Provide a safe, temporary alternative loading zone in the immediate area, subject to approval by the City Engineer. Potential alternatives may include temporary use of the property on the northwest corner of Pleasant Hill Road and Deer Hill Road, which is not part of the project site but is owned by the same property owner, and would require surface improvements to facilitate safe vehicle and pedestrian access.
    - Stage construction on the subject portion of the site such that prior to discontinuing the availability of the existing passenger loading zone, the project shall construct the proposed Soccer/Park parking lot, including its off-street passenger loading zone and access driveway on Pleasant Hill Road.
- The Construction Staging Plan shall require restriping of bike lanes and other pavement markings at the discretion of the City Engineer to address wear from construction traffic.
- Special school events, such as swim meets, shall be addressed by the designated liaison required in the Construction Staging Plan, or any additional measures that the City Engineer may require in that Plan.
- The Construction Staging Plan shall include an engineering analysis to estimate the percentage of the pavement service life that will be used by Project construction truck trips on Pleasant Hill Road and Deer Hill Road. Based on this analysis, appropriate mitigation of the resulting damage shall be required from the Project sponsor, which may include construction of pavement improvements to restore the lost service life, or an in-lieu contribution of equivalent value, at the discretion of the City Engineer.

Implementation of these measures would result in a *less-than-significant impact.*

Cumulative Year 2030 No Project Conditions

Future Traffic Conditions

This section details expected traffic conditions under Cumulative Year 2030 No Project Conditions for the study intersections and roadways in the project vicinity. For purposes of this traffic analysis, the Cumulative Year 2030 No Project Condition approximates no change from existing conditions at the project site. This scenario provides a basis of comparison for expected traffic generated by the project under Cumulative Year 2030 with Revised Project Conditions.

In terms of land use and roadway network assumptions for the project vicinity, TJKM used the latest approved version of the Contra Costa Transportation Authority (CCTA) travel demand model, which assumes future development in the project site area would generate traffic approximately similar in magnitude to traffic generated by the Revised Project. The CCTA model estimates traffic growth between a base year of 2005 and future cumulative year of 2035. TJKM used a linear interpolation method to factor 30-year traffic growth from the model down to 20-year growth factors, to represent the approximate growth period between the Existing Conditions traffic counts performed in 2011 and the 2030 horizon year. The 20-year growth factors were applied to the Existing Conditions volumes at the study intersections based on knowledge of the study area. Approximately two percent growth per year over the 20-year period was added to the Existing Conditions through volumes on Pleasant Hill Road to generate Cumulative Year 2030 peak-hour volumes at the study intersections. However, because the CCTA travel demand model assumes future development in the project site area would generate traffic approximately similar in magnitude to traffic generated by the Revised Project, the model forecasts would overestimate roadway volumes for Cumulative Year 2030 No Project Conditions. To account for this overestimation, TJKM assumed that the Cumulative Year 2030 model forecasts include development of the proposed Revised Project and are therefore used to analyze impacts under Cumulative Year 2030 plus Revised Project Conditions. Correspondingly, TJKM subtracted the estimated traffic to be generated by the Revised Project from the Cumulative Year 2030 volumes derived from the CCTA travel demand model to estimate Cumulative Year 2030 No Project Conditions.

The traffic forecasting methodology described above was used for all study intersections except intersection #9 - Deer Hill Road/First Street – Sierra Vista Way and #10 - Deer Hill Road/SR 24 WB Ramps -Laurel Drive, where the Cumulative volumes from the Lafayette Downtown Specific Plan (DSP) EIR traffic section were used. The DSP Cumulative traffic forecasts are based on a more detailed model of projected growth in Downtown Lafayette, which is more accurate for use at these two study intersections that are closer to Downtown.

The Cumulative Year 2030 No Project Conditions turning movement volumes at the study intersections resulting from application of the methodology described above are shown in Figure 8. Anticipated traffic controls and lane geometries for the study intersections, which are the same as Existing Conditions, are also included in the figure.

Intersection Level of Service Analysis Results, Cumulative Year 2030 No Project

Table XI illustrates the results of the level of service analysis for the study intersections under Cumulative Year 2030 No Project Conditions. Detailed level of service calculations are contained in Appendix D. Under Cumulative Year 2030 No Project Conditions, all of the signalized study intersections would operate within acceptable City LOS standards except the Deer Hill Road/SR 24 Westbound Ramps – Laurel Drive intersection, which would operate at LOS E during the a.m. and p.m. peak hours. The Springhill Road – Quandt Road/Pleasant Hill Road intersection would

operate at LOS E during the a.m. peak hour, and the Deer Hill Road – Stanley Blvd./Pleasant Hill Road intersection would operate at LOS F during the a.m. and p.m. peak hours. However, these intersections are not subject to an intersection LOS standard, but are part of the Pleasant Hill Road corridor north of SR 24 that is subject to the Delay Index criteria analyzed subsequently (per General Plan Policy C-1.2 of the Growth Management Chapter, the Lamorinda Action Plan, and CCTA guidelines).

At the only unsignalized study intersection in the Cumulative Year 2030 No Project Condition, the northbound and southbound stop-controlled minor approaches on Brown Avenue at Deer Hill Road would operate at LOS F with extreme delays during the a.m. and p.m. peak hours. The California Manual on Uniform Traffic Control Devices (MUTCD) peak hour traffic signal warrant would be met for both peak hours under Cumulative Year 2030 No Project Condition, which is also the case under Existing conditions.

Table XI: Peak Hour Intersection Levels of Service – Cumulative Year 2030 No Project Conditions

ID	*Intersection*	*Cumulative Year 2030 No Project*			
		A.M. Peak Hour		*P.M. Peak Hour*	
		Delay	*LOS*	*Delay*	*LOS*
1	Rancho View Drive/Pleasant Hill Road	8.4	A	7.6	A
2	Green Valley Drive/Pleasant Hill Road	7.2	A	7.7	A
3	Reliez Valley Road/Pleasant Hill Road	33.0	C	15.0	B
4	Springhill Road – Quandt Road/ Pleasant Hill Road	68.5	E	38.9	D
5	Deer Hill Road –Stanley Blvd./ Pleasant Hill Road	203.7	F	139.2	F
6	Mt. Diablo Boulevard - SR 24 EB On-ramp/Pleasant Hill Road	17.3	B	17.6	B
7	SR 24 EB Off-Ramp – Old Tunnel Road/Pleasant Hill Road	20.9	C	20.9	C
8	Deer Hill Road/Brown Avenue	**> 300**	**F**	**> 300**	**F**
9	Deer Hill Road/First Street – Sierra Vista Way	18.7	B	24.6	C
10	Deer Hill Road/SR 24 WB Ramps -Laurel Drive	**56.9**	**E**	**65.8**	**E**
11	Pleasant Hill Road/Project Driveway	Not Analyzed - Future Intersection			
12	Deer Hill Road/Soccer Dropoff Driveway	Not Analyzed - Future Intersection			
13	Deer Hill Road/Homes-Dog Park Driveway	Not Analyzed - Future Intersection			

Notes: 1) LOS=Level of Service, Delay = Average control delay per vehicle in seconds
2) Signalized and all-way stop controlled intersections - Delay / LOS is for overall intersection
3) Unsignalized one- and two-way stop controlled intersections - Delay / LOS is for critical minor stop-controlled approach.
4) **Bold** indicates unacceptable operational conditions based on applicable City standards.
5) At intersections 1-5, intersection LOS standard does not apply; Delay Index is the applicable standard for Pleasant Hill Road north of SR 24 per Lafayette General Plan.

Pleasant Hill Road Corridor Traffic Simulation

SimTraffic simulation results for Cumulative Year 2030 No Project Conditions prepared for the original EIR project were reviewed and compared with the new Cumulative Year 2030 No Project analysis presented above to supplement the intersection LOS results. During the a.m. peak hour, traffic on southbound Pleasant Hill Road would back up from the intersections at Deer Hill Road – Stanley Boulevard and Springhill Road – Quandt Road, extending the queue past the junction at Taylor Boulevard. This back up would extend much further than the queue that extends past Green Valley Drive under Existing Conditions. In effect, as described for Existing conditions, the LOS F conditions at the Deer Hill Road – Stanley Boulevard intersection would also occur upstream at the Springhill Road/Quandt Road, Reliez Valley Road, Green Valley Drive, and Rancho View Drive intersections, which impacts southbound Pleasant Hill Road traffic and other traffic movements that conflict with southbound traffic at each intersection. However, the City's intersection LOS methods described in the previous Level of Service Analysis Methodology section are based on the LOS results calculated at each intersection individually, which are the results shown in Table XI.

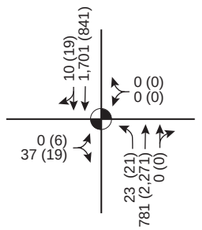
During the commute p.m. peak hour, traffic on northbound Pleasant Hill Road would continue to back up from the intersection at Deer Hill Road – Stanley Boulevard and the queue would extend past the off-ramp from westbound SR 24 as well as onto that off-ramp toward the freeway mainline.

City of Lafayette - The Terraces of Lafayette EIR

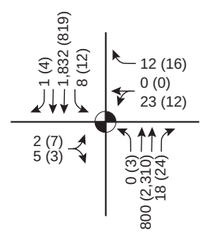
Cumulative No Project Traffic Volumes, Lane Geometry, and Controls

Figure 8

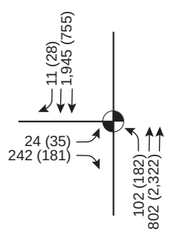
Intersection #1
Pleasant Hill Rd./Rancho View Dr.



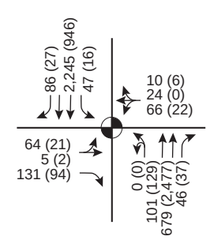
Intersection #2
Pleasant Hill Rd./Green Valley Dr.



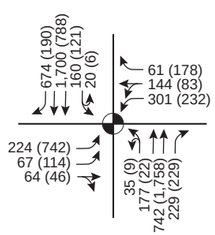
Intersection #3
Pleasant Hill Rd./Reliez Valley Rd.



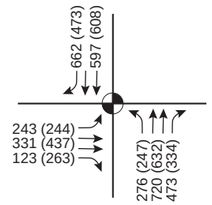
Intersection #4
Pleasant Hill Rd./Springhill Rd./
Quandt Rd.



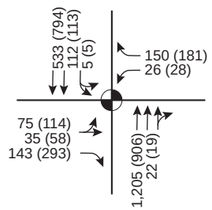
Intersection #5
Pleasant Hill Rd./Deer Hill Rd./
Stanley Blvd.



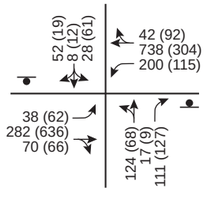
Intersection #6
Pleasant Hill Rd./Mt. Diablo Blvd./
SR 24 WB On Ramp



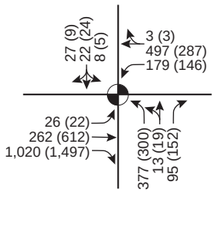
Intersection #7
Pleasant Hill Rd./Old Tunnel Rd./
SR 24 EB Off Ramp



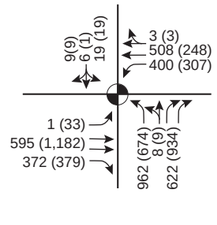
Intersection #8
Brown Ave./Deer Hill Rd.



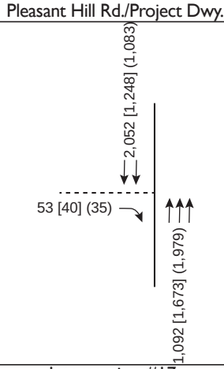
Intersection #9
First St./Sierra Vista Wy./Deer Hill Rd.



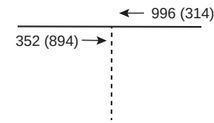
Intersection #10
SR 24 WB Ramps
Laurel Dr./Deer Hill Rd.



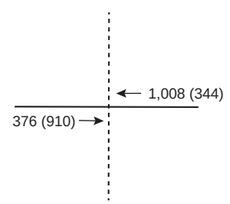
Intersection #11
Pleasant Hill Rd./Project Dwy.



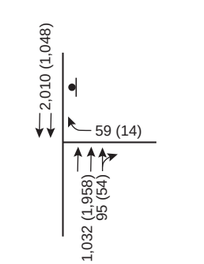
Intersection #12
Deer Hill Rd./Soccer Dropoff Dwy.



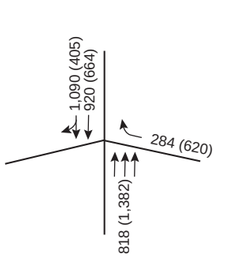
Intersection #13
Deer Hill Rd./Homes-Dog Park Dwy.



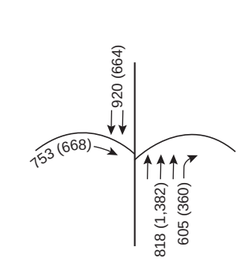
Intersection #14
Pleasant Hill Rd./Acalanes Ave.



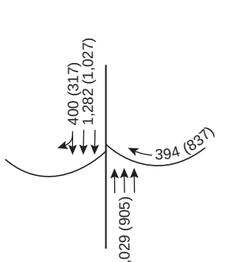
Intersection #15
Pleasant Hill Rd./
SR 24 WB Direct Ramps



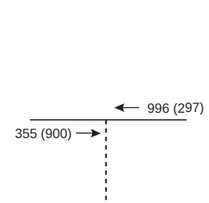
Intersection #16
Pleasant Hill Rd./
SR 24 WB Loop Ramps



Intersection #17
Pleasant Hill Rd./
SR 24 EB Loop Ramps



Intersection #18
Deer Hill Rd./
Soccer Park Dwy.



LEGEND

●	Study Intersection
---	Future Driveway
XX	AM Peak Hour Volume
[XX]	School PM Peak Hour Volume
(XX)	PM Peak Hour Volume

Routes of Regional Significance Delay Index Results

For Pleasant Hill Road north of State Route 24, which is a CCTA-designated Route of Regional Significance, the Cumulative Year 2030 No Project forecasts were developed by subtracting the estimated traffic to be generated by the Revised Project from the Cumulative Year 2030 volumes derived from the CCTA travel demand model, as described previously in this report. Delay Indexes on Pleasant Hill Road north of State Route 24 during the a.m. and p.m. peak hours were determined for the Cumulative Year 2030 No Project scenario. The Delay Index measures travel congestion and is expressed as the ratio of time required to travel between two points during the peak hour (the congested travel time) versus the time required during uncongested off-peak times. A Delay Index of 2.0, which is the acceptable standard of significance for peak hour peak direction travel on Pleasant Hill Road north of State Route 24, means that congested travel time is twice as long as during an off-peak travel time.

The original certified EIR included Delay Index analysis for SR 24, which demonstrated that the original Project impacts on SR 24 would be less than significant. Because the Revised Project would generate fewer peak hour trips on SR 24 than the original project, further Delay Index analysis is not needed to conclude that the Revised Project impacts would be less than significant on SR 24.

For Pleasant Hill Road in both the northbound and southbound direction between State Route 24 and Rancho View Drive, the Delay Indexes in the Cumulative Year 2030 No Project scenario were calculated during the a.m. and p.m. peak hours, and are summarized in Table XII. As noted in the table, Pleasant Hill Road will operate with an unacceptable Delay Index of over 2.0 for southbound traffic in the a.m. peak hour and northbound traffic in the p.m. peak hour under the Cumulative Year 2030 No Project scenario.

Table XII: Cumulative Year 2030 No Project Delay Index - Pleasant Hill Road

Scenario	*Travel Time (minutes)*		*Delay Index*	
	AM SB	*PM NB*	*AM SB*	*PM NB*
Cumulative Year 2030 No Project	8.18	9.71	3.12	3.70

SB = Southbound, NB = Northbound

Cumulative Year 2030 with Revised Project Conditions

This scenario is similar to Cumulative Year 2030 No Project Conditions, but includes the additional traffic generated by the proposed project as described in the Existing plus Project section of this report. Except for the project and its proposed driveways, the assumed roadway network and nearby area development is the same under this analysis scenario as for Cumulative Year 2030 No Project Conditions.

Project Trip Generation, Distribution, and Assignment

The proposed project trip generation, distribution, and assignment assumed under Cumulative Year 2030 with Revised Project Conditions is identical to that assumed under Existing with Revised Project Conditions. The resulting assigned project trips, which were excluded from the Cumulative Year 2030 No Project Conditions traffic volumes as described previously in this report, are included in the Cumulative Year 2030 with Revised Project traffic volumes.

Figure 9 illustrates the resulting traffic volumes under Cumulative Year 2030 with Revised Project Conditions.

Intersection Level of Service Analysis Results, Cumulative Year 2030 with Revised Project

Table XIII presents the results of the level of service analysis for the study intersections in the project under Cumulative Year 2030 with Revised Project Conditions. Detailed level of service calculations are contained in Appendix E.

Under Cumulative Year 2030 with Revised Project Conditions with the addition of proposed project traffic, all signalized intersections are expected to continue operating under acceptable City LOS standards, except the Deer Hill Road/SR 24 Westbound Ramps – Laurel Drive intersection that would also operate at an unacceptable LOS under Cumulative Year 2030 No Project Conditions. This intersection would continue to operate at LOS E during the a.m. and p.m. peak hours, with delay increasing by 0.7 seconds and 0.4 seconds respectively. Because the project would increase delay by less than five seconds, the result would be a *less-than-significant impact*.

The Springhill Road – Quandt Road/Pleasant Hill Road intersection would continue operating at LOS E during the a.m. peak hour, with delay increasing by one second. The Deer Hill Road – Stanley Blvd./Pleasant Hill Road intersection would also continue operating at LOS F during the a.m. and p.m. peak hours, with delay increasing by 21.3 seconds and 0.6 seconds respectively. The a.m. peak hour delay at the Deer Hill Road – Stanley Boulevard/Pleasant Hill Road intersection would increase by more than five seconds with the addition of traffic from the Revised Project. However, these intersection delay increases are considered a less-than-significant impact based on the significance thresholds for this SEIR that eliminate consideration of intersection LOS on Pleasant Hill Road north of SR24, in accordance with General Plan Policy C-1.2 of the Growth Management Chapter, the Lamorinda Action Plan, and CCTA guidelines. These intersections are not subject to an intersection LOS standard; they are part of a Route of Regional Significance that is subject to the Delay Index criteria analyzed subsequently.

The Revised project driveways assumed to be controlled with a one-way stop sign at intersections would operate at LOS C or better, which is acceptable. In addition, the Deer Hill Road/Homes-Dog Park intersection, which would be constructed as a roundabout, would operate at LOS B during the a.m. and p.m. peak hours, and the Pleasant Hill Road/Soccer Field/Park driveway would operate at LOS B with an average stop-control delay of 10.3 seconds during the School dismissal p.m. peak hour. However, at the only unsignalized study intersection existing in the No Project condition, the northbound and southbound stop-controlled minor approaches on Brown Avenue at Deer Hill Road would continue operating at an unacceptable LOS F during the a.m. and p.m. peak hours, with delay increases substantially higher than five seconds. The California Manual on Uniform Traffic Control Devices (MUTCD) peak hour traffic signal warrant is met for both peak hours under both Cumulative Year 2030 No Project and Cumulative Year 2030 with Revised Project conditions. The Revised project would increase delay by more than five seconds at an intersection operating below the acceptable standard, resulting in a *significant impact*.

Table XIII: Peak Hour Intersection Levels of Service – Cumulative Year 2030 with Revised Project

ID	Intersection	*Cumulative Year 2030 Plus Project Conditions*			
		A.M. Peak Hour		*P.M. Peak Hour*	
		Delay	*LOS*	*Delay*	*LOS*
1	Rancho View Drive/Pleasant Hill Road	8.5	A	7.7	A
2	Green Valley Drive/Pleasant Hill Road	7.2	A	8.2	A
3	Reliez Valley Road/Pleasant Hill Road	33.5	C	15.4	B
4	Springhill Road – Quandt Road/ Pleasant Hill Road	69.5	E	40.8	D
5	Deer Hill Road – Stanley Blvd./ Pleasant Hill Road	225.0	F	139.8	F
6	Mt. Diablo Boulevard –SR 24 EB On-ramp/ Pleasant Hill Road	17.3	B	17.6	B
7	SR 24 EB Off-Ramp – Old Tunnel Road/ Pleasant Hill Road	21.7	C	22.8	C
8	Deer Hill Road/Brown Avenue	**> 300**	**F**	**> 300**	**F**
	Mitigation - Signalize Intersection *Alternative Mitigation – Construct Roundabout*	13.6 *19.3*	B *C*	16.5 *11.0*	B B
9	Deer Hill Road/ First Street –Sierra Vista Way	19.2	B	25.2	C
10	Deer Hill Road/ SR 24 WB Ramps –Laurel Drive	**57.6**	**E**	**66.2**	**E**
11	Pleasant Hill Road/Project Driveway	12.2	B	9.6	A
12	Deer Hill Road/Soccer Dropoff Driveway	0.0	A	22.3	C
13	Deer Hill Road/Dog Park Driveway	12.1	B	10.7	B

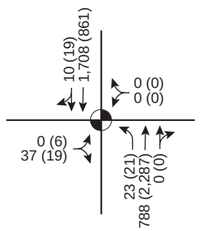
Notes: 1) LOS=Level of Service, Delay = Average control delay per vehicle in seconds
2) Signalized, all-way stop controlled, and roundabout intersections - Delay / LOS is for overall intersection
3) Unsignalized one- and two-way stop controlled intersections - Delay / LOS is for critical minor stop-controlled approach.
4) **Bold** indicates unacceptable operational conditions based on applicable City standards.
5) At intersections 1-5, intersection LOS standard does not apply; Delay Index is the applicable standard for Pleasant Hill Road north of SR 24 per Lafayette General Plan.

City of Lafayette - The Terraces of Lafayette EIR

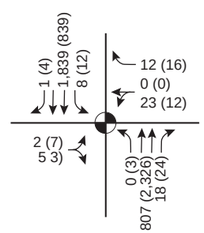
Cumulative plus Project Traffic Volumes, Lane Geometry, and Controls

Figure 9

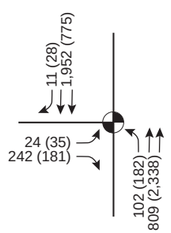
Intersection #1
Pleasant Hill Rd./Rancho View Dr.



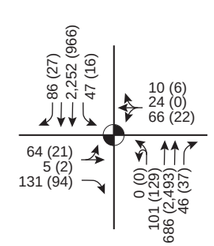
Intersection #2
Pleasant Hill Rd./Green Valley Dr.



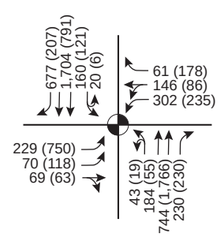
Intersection #3
Pleasant Hill Rd./Reliez Valley Rd.



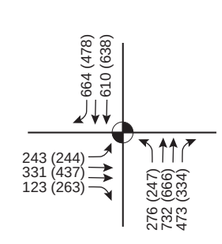
Intersection #4
Pleasant Hill Rd./Springhill Rd./ Quandt Rd.



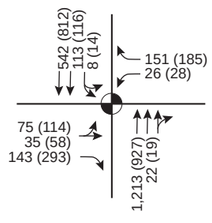
Intersection #5
Pleasant Hill Rd./Deer Hill Rd./ Stanley Blvd.



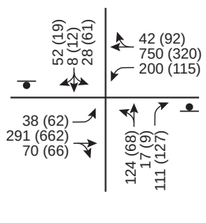
Intersection #6
Pleasant Hill Rd./Mt. Diablo Blvd./ SR 24 WB On Ramp



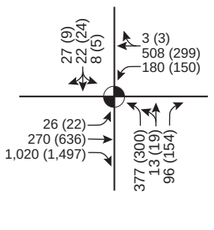
Intersection #7
Pleasant Hill Rd./Old Tunnel Rd./ SR 24 EB Off Ramp



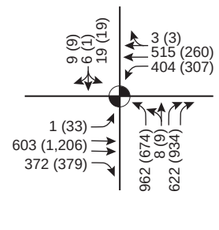
Intersection #8
Brown Ave./Deer Hill Rd.



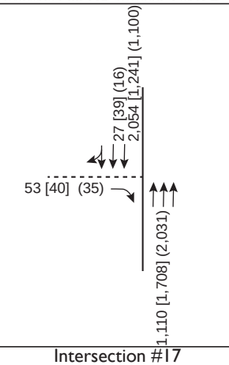
Intersection #9
First St./Sierra Vista Wy./Deer Hill Rd.



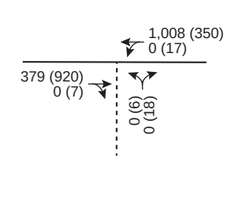
Intersection #10
SR 24 WB Ramps/ Laurel Dr./Deer Hill Rd.



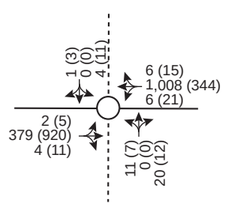
Intersection #11
Pleasant Hill Rd./Soccer Park Dwy.



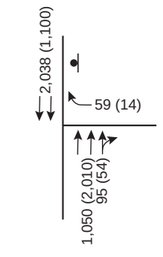
Intersection #12
Deer Hill Rd./Soccer Dropoff Dwy.



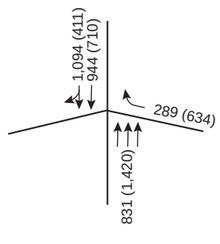
Intersection #13
Deer Hill Rd./Homes-Dog Park Dwy.



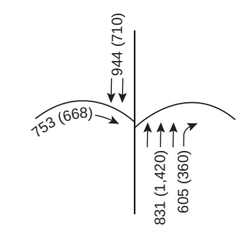
Intersection #14
Pleasant Hill Rd./Acalanes Ave.



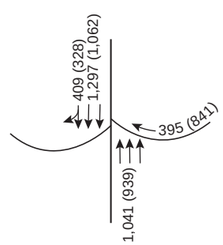
Intersection #15
Pleasant Hill Rd./ SR 24 WB Direct Ramps



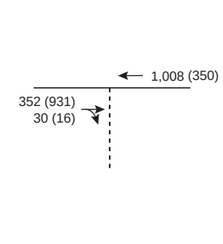
Intersection #16
Pleasant Hill Rd./ SR 24 WB Loop Ramps



Intersection #17
Pleasant Hill Rd./ SR 24 EB Loop Ramps



Intersection #18
Deer Hill Rd./ Soccer Park Dwy.



LEGEND

- ● Study Intersection
- --- Future Driveway
- XX AM Peak Hour Volume
- [XX] School PM Peak Hour Volume
- (XX) PM Peak Hour Volume

Pleasant Hill Road Corridor Traffic Simulation

SimTraffic simulation results for Cumulative Year 2030 No Project conditions prepared for the original EIR project, along with the new Cumulative Year 2030 No Project analysis presented previously in this report, were reviewed and compared with the Cumulative Year 2030 with Revised Project analysis presented above to supplement the intersection LOS results. During the a.m. peak hour under Cumulative Year 2030 No Project conditions, traffic on southbound Pleasant Hill Road would back up from the intersections at Deer Hill Road – Stanley Boulevard and Springhill Road – Quandt Road, with the queue extending past the junction at Taylor Boulevard. The addition of project traffic would result in a minor increase in this queue length. In effect, as described for Cumulative Year 2030 No Project conditions, the LOS F conditions at the Deer Hill Road – Stanley Boulevard intersection would also occur upstream at the Springhill Road/Quandt Road, Reliez Valley Road, Green Valley Drive, and Rancho View Drive intersections, which impacts southbound Pleasant Hill Road traffic and other traffic movements that conflict with southbound traffic at each intersection. However, the City's intersection LOS methods described in the previous Level of Service Analysis Methodology section are based on the LOS results calculated at each intersection individually, which are the results shown in Table XIII and described in the previous section.

During the commute p.m. peak hour, traffic on northbound Pleasant Hill Road would continue to back up from the intersection at Deer Hill Road – Stanley Boulevard and the queue would extend past the off-ramp from westbound SR 24 as well as onto that off-ramp toward the freeway mainline. (Note that, as stated above, this discussion is presented to supplement the intersection LOS results, but this analysis is not used to determine impact significance.)

Intersection Mitigation

TJKM considered potential mitigation measures for the intersection that would have significant traffic delay impacts as a result of the project under Cumulative Year 2030 with Revised Project conditions, as well as potential improvements at other intersections.

To mitigate the impact at the Deer Hill Road/Brown Avenue intersection, prior to project completion the project sponsor shall share with the City the cost to install one of the following mitigation measures at this intersection. One mitigation option is to install a traffic signal as part of the development project. The traffic signal equipment shall include an emergency vehicle preemption system (Opticom), which would allow emergency response vehicles approaching the signalized intersection to activate a green signal for their travel direction. The State Route 24 freeway overpass structures on Brown Avenue could obstruct the Opticom activation device on responding emergency vehicles headed northbound on Brown Avenue from Mount Diablo Boulevard toward Deer Hill Road, which could substantially reduce the effectiveness of the traffic signal preemption. To avoid this problem, the traffic signal equipment shall include advance detection devices for the Opticom system as needed to assure effective traffic signal preemption for responding emergency vehicles on northbound Brown Avenue. With signalization, the Deer Hill Road/Brown Avenue intersection would operate at LOS B during both the a.m. and p.m. peak hours under Cumulative Year 2030 with Revised Project conditions, reducing the project impact to *less-than-significant.*

An alternative mitigation to installing a traffic signal would be the redesign of the Deer Hill Road/Brown Avenue intersection as a roundabout, which would improve the approach LOS for the minor approach volumes at this intersection. A properly designed roundabout would adequately

accommodate emergency response vehicles. A roundabout would also benefit this location by: 1) creating consistency in traffic control devices on the Deer Hill Road corridor, given the proposed roundabout to the east at a project driveway; 2) providing effective traffic calming in a corridor with reported speed concerns; 3) enhancing the safety of pedestrian crossings at the intersection; and 4) being more compatible with the less-urban character of the area. With a roundabout, the Deer Hill Road/Brown Avenue intersection would operate at LOS C during the a.m. peak hour and LOS B during the p.m. peak hour under Cumulative with Revised Project Conditions, reducing the project impact to *less-than-significant.* TJKM recommends additional analysis of this alternative mitigation.

Although not required specifically as mitigation for intersection LOS, the LOS F delay at the Deer Hill Road – Stanley Blvd./Pleasant Hill Road intersection could be reduced somewhat with roadway widening to add a third lane for southbound through traffic on Pleasant Hill Road. A potential configuration would provide a third lane for southbound through traffic and a full-lane-width right-turn lane on southbound Pleasant Hill Road at the Deer Hill Road intersection, along with a standard Class II bike lane, replacing the existing southbound curb lane that is shared by right-turn-only traffic and bicycles approaching the intersection. The additional southbound lanes would start at least 150 feet north of Deer Hill Road and extend south along the entire project frontage on Pleasant Hill Road to become a right-turn-only lane for the on-ramp to westbound SR 24. However, widening for the potential lane configuration would also require dedication of additional property along the west side of Pleasant Hill Road to allow for a Class II bike lane and maintain existing curb parking and a future bus stop along the west curb (addressed in a previous section of this report.) The potential roadway widening would increase the pedestrian crossing distance on the Pleasant Hill Road crosswalk at the Deer Hill Road – Stanley Boulevard signal. The additional capacity would also be inconsistent with the Lamorinda Action Plan's Gateway Constraint Policy, which includes measures to maintain the existing number of travel lanes and to meter traffic flow on Pleasant Hill Road.

Left-Turn Queues

Left-turn queue lengths on northbound Pleasant Hill Road at Deer Hill Road, as well as on westbound Deer Hill Road at the Soccer Field Drop-off driveway, were also analyzed using Synchro results for Cumulative Year 2030 with Revised Project conditions in the a.m., and p.m. peak hours. The resulting 95th-percentile queue lengths were compared with the left-turn storage lane lengths that would be provided at these intersections to determine if that queue storage capacity would be adequate to avoid substantial new spillback into other lanes. The Cumulative Year 2030 with Revised Project results are summarized as follows:

- Northbound Pleasant Hill Road at Deer Hill Road – Stanley Blvd.: The addition of project traffic at this intersection would increase the peak estimated 95th-percentile left-turn queue length from 302 feet to approximately 326 feet (one additional car length) during the a.m. peak hour, and the queue would exceed the capacity of the existing 250-foot storage lane with or without the project. The additional project traffic used for this analysis includes U-turns from northbound to southbound Pleasant Hill Road to enter the Soccer/Park parking lot, and left turns to Deer Hill Road to access the Soccer Dropoff, Dog Park, and Homes driveways, as well as additional conflicting project traffic on southbound Pleasant Hill Road headed toward the recreation facilities and Homes. Because the additional queue length would only be approximately one car length where the queue would already exceed the storage lane capacity even without the Revised Project, which would not substantially increase traffic hazards, the impact is considered *less than significant.*

- Westbound Deer Hill Road at the Soccer Field Dropoff Driveway: The estimated 95th-percentile left-turn queue lengths during the a.m. and p.m. peak periods would be no more than one car length. Although a westbound left-turn storage lane is not proposed at this intersection, the expected peak-hour queue of one car is not expected to result in excessive queuing of westbound through vehicles on Deer Hill Road. Vehicles stopped in the travel lane waiting to make the left-turn should not pose a significant hazard for westbound through vehicles; the positive grade approaching the driveway will adequately limit westbound approach speeds, and adequate sight-distance between queuing vehicles and traffic approaching from both directions will be available. Therefore, the impact at the Soccer Dropoff driveway would be *less than significant*.

Although not required as mitigation at the Pleasant Hill Road/Deer Hill Road – Stanley Blvd intersection, TJKM recommends an extension of the northbound left-turn storage lane at Pleasant Hill Road/Deer Hill Road-Stanley Boulevard to accommodate the estimated a.m. peak hour queue. Extension of the storage lane by approximately 100 feet will adequately accommodate the estimated queue lengths at this intersection with and without traffic generated by the Revised Project. At the Soccer Dropoff driveway, TJKM also recommends the parking restrictions described previously in the Existing with Revised Project section on Left-Turn Queues.

Routes of Regional Significance Delay Index Results

Delay Indexes on Pleasant Hill Road north of State Route 24 during the a.m. and p.m. peak hours were determined for the Cumulative Year 2030 with Revised Project scenario. For this analysis of the CCTA-designated Routes of Regional Significance, the additional trips generated by the Revised Project are included in the traffic forecasts from the CCTA traffic model for Cumulative Year 2030 conditions, as described previously in this report.

The original certified EIR included Delay Index analysis for SR 24, which demonstrated that the original Project impacts on SR 24 would be less than significant. As shown in Table XIV, the Revised Project is expected to generate fewer peak hour, peak direction trips in both directions of State Route 24 than the original EIR project. Because the Revised Project would generate fewer peak hour trips on SR 24 than the original project, further Delay Index analysis is not needed to conclude that the Revised Project impacts would be less than significant on SR 24.

Table XIV: Original EIR and Revised Project Peak Hour Peak Direction Trips - State Route 24

Location	*Original EIR Project*		*Revised Project*	
	Peak Period			
	WB A.M.	*EB P.M.*	*WB A.M.*	*EB P.M.*
East of Pleasant Hill Road Interchange	7	16	5	11
West of Downtown Lafayette interchange	36	35	8	15

WB = Westbound, EB = Eastbound

For Pleasant Hill Road in both the northbound and southbound direction between State Route 24 and Rancho View Drive, the Delay Indexes in the Cumulative Year 2030 with Revised Project scenario were calculated during the a.m. and p.m. peak hours, and are summarized in Table XV. As noted in the table, Pleasant Hill Road will operate with an unacceptable peak hour peak direction Delay Index of over 2.0 for southbound traffic in the a.m. peak hour and northbound traffic in the p.m. peak hour under the Cumulative Year 2030 with Revised Project scenario. The addition of project trips to Pleasant Hill Road would increase the peak hour peak direction Delay Index by approximately 0.22 for southbound traffic in the a.m. peak hour and by approximately .02 for

northbound traffic in the p.m. peak hour under Cumulative Year 2030 plus Project conditions. Because the Delay Index would increase by more than 0.05 for a.m. peak hour peak direction traffic where the Delay Index exceeds 2.0 on Pleasant Hill Road, the result would be a *significant impact.*

Table XV: Cumulative Year 2030 with Revised Project Delay Index - Pleasant Hill Road

Scenario	*Travel Time (minutes)*		*Delay Index*	
	A.M. SB	*P.M. NB*	*A.M. SB*	*P.M. NB*
Cumulative Year 2030 No Project	8.18	9.71	3.12	3.70
Cumulative Year 2030 with Revised Project	8.77	9.77	3.34	3.72

SB = Southbound, NB = Northbound

The Lamorinda Action Plan proposes several measures to address traffic congestion and manage the Delay Index on Pleasant Hill Road. Provision of public transit service in the Pleasant Hill Road/Taylor Boulevard corridor with connections to other transit services in Lafayette is proposed. However, the potential number of peak-hour vehicle trips diverted to transit is not likely to reduce travel times significantly in the corridor, and funding for such service is uncertain. The Action Plan also suggests traffic management measures, including implementing a gateway constraint north of the project location to meter traffic flow on Pleasant Hill Road to discourage its use to bypass the I-680/SR 24 interchange. However, the potential number of peak-hour vehicle trips that could be metered without resulting in significant impacts at upstream locations outside of the City of Lafayette's jurisdiction is not likely to reduce travel times significantly in the corridor, and acceptance of such metering by other affected agencies is uncertain and would require a lengthy political process. Although these measures could reduce peak-hour traffic volumes and improve the Delay Index somewhat on Pleasant Hill Road, they are unlikely to cut the peak-direction travel times by about one-third to attain a Delay Index no higher than the 2.0 threshold, and the impact would remain significant. The implementation of transit service and traffic management measures requires coordination and cooperation of other agencies outside of Lafayette and beyond the control of the Revised Project. Therefore, these measures proposed in the Lamorinda Action Plan are considered infeasible for the purpose of the SEIR.

Another measure to manage the Delay Index on Pleasant Hill Road that is included in the Lamorinda Action Plan is to increase pedestrian and bicycle mobility between area schools and surrounding neighborhoods. The Revised Project could include improvements to increase pedestrian and bicycle mobility between area schools, the Revised Project itself, and surrounding neighborhoods. Facilities currently included in the Revised Project provide good connectivity to Acalanes High School. To improve connectivity to Springhill Elementary School, the Revised Project shall construct a pedestrian path along the west side of Pleasant Hill Road between Deer Hill Road and Springhill Road (described previously under Pedestrian Facilities in the Existing with Revised Project Conditions section) as mitigation of the project's impact on the cumulative Delay Index. This action would reduce the Revised Project's share of the cumulative Delay Index impacts and be consistent with Lafayette's Master Walkways Plan; however, it would not fully mitigate the cumulative Delay Index impacts to less than significant.

A mitigation option not included in the Lamorinda Action Plan is to construct additional capacity on Pleasant Hill Road north of Highway 24, such as an additional southbound lane starting north of Deer Hill Road/Stanley Boulevard and continuing to the Highway 24 westbound on-ramp. TJKM considered two widening alternatives of southbound Pleasant Hill Road approaching and south of Deer Hill Road. The first alternative considered the construction of a full-lane-width, shared through-right turn lane in addition to the two existing through lanes on the southbound approach of the intersection, with the additional southbound through travel lane extending southerly to the westbound SR-24 onramp. The second alternative considered the construction of a third exclusive through lane and a full-lane-width right turn lane on the southbound approach, in addition to the two existing through lanes, with the additional southbound travel lane extending south of the

intersection to the westbound SR 24 on-ramp. While the first alternative would not reduce the project's impact on the A.M. southbound Delay Index to a less-than-significant level, the second alternative is estimated to reduce the southbound Delay Index to 2.00, which would meet the 2.0 threshold for acceptable travel times on Pleasant Hill Road. However, in the Certified EIR for the original Terraces project, such additional capacity is determined to violate the Lamorinda Action Plan's Gateway Constraint Policy, which includes measures to meter traffic flow on Pleasant Hill Road, and to result in secondary impacts that are inconsistent with Lafayette General Plan goals and policies. No capacity expanding project is currently under consideration by the responsible regional transportation agencies. As such, this option is considered infeasible for the purpose of the Supplemental EIR.

Although the pedestrian path along the west side of Pleasant Hill Road between Deer Hill Road and Springhill Road required as mitigation would reduce the Revised Project's share of the cumulative Delay Index impacts, it would not fully mitigate the cumulative Delay Index impacts to less than significant. No other feasible mitigations are available to reduce this impact to less-than-significant levels. Therefore, this impact is considered *significant and unavoidable*.

As described in the previous Emergency Vehicle Access section, the emergency response route along Pleasant Hill Road would be northbound from Mount Diablo Boulevard, originating from Station 15. As under Existing with Revised Project conditions, under Cumulative Year 2030 with Revised Project conditions the Project's less-than-significant impact on p.m. peak-hour travel time and Delay Index for northbound Pleasant Hill Road north of State Route 24 would not significantly impact emergency access to other areas of Lafayette served by Pleasant Hill Road between State Route 24 and Rancho View Drive. The result would be a *less-than-significant* cumulative impact.

Alternatives

TJKM analyzed how the impacts on traffic, transit, pedestrian, and bicycle facilities with each of the alternatives to the Project would be different from the impacts of the proposed Revised Project. The alternatives considered are as follows:

- No Project Alternative: Project site remains in its existing condition.
- Mitigated Project Alternative:
  - 44 single-family homes on the same residential site area as the Revised Project. The street design in this portion of the project site would be adjusted as needed to provide adequate provisions for turning around CCCFPD equipment.
  - On-site dog park within the park area (instead of on parcel across Deer Hill Road).
  - Open space/passive uses on the remaining park area.
  - Parking lot at Deer Hill Rd./Pleasant Hill Rd. similar to Revised project.
  - Same driveway locations and access restrictions as Revised Project (except dog park driveway on north side of Deer Hill Road, which will not be included), including the drop-off/disabled access parking driveway on Deer Hill Road and both parking lot access driveways.
  - Instead of a roundabout on Deer Hill Road, a one-way stop sign on the residential driveway, along with the mitigation measures from the Certified EIR that were needed to ensure no significant impacts at the westernmost driveway on Deer Hill Road with the original project.

No Project Alternative

The No Project Alternative would generate no additional trips to or from the site, and no additional traffic volumes on adjacent streets. No new driveways would be constructed on Pleasant Hill Road or Deer Hill Road to access the site. Near-term transportation conditions would be the same as those described in the Existing Conditions section of this report, and future conditions would be similar to those described in the Cumulative Year 2030 No Project Conditions section. This No Project Alternative was evaluated in the original EIR, and no further analysis is required for the SEIR.

Mitigated Project Alternative

Without the soccer/sports field, and with open space/passive park instead of including more active-use recreation facilities on approximately six acres of the parkland as proposed in the Revised Project, the Mitigated Project Alternative would generate fewer vehicle trips, including approximately half as many trips during the p.m. peak hour. Table XVI summarizes the Mitigated Project Alternative trip generation results.

Table XVI: Mitigated Project Alternative Trip Generation

Land Use (ITE Code)	Size	Daily		A.M. Peak Hour					P.M. Peak Hour				
		Rate	Trips	Rate	In:Out %	In	Out	Total	Rate	In:Out %	In	Out	Total
Single-Family Detached Housing (210)[1,2]	44 DUs	11.22	493	0.93	25:75	10	31	41	1.16	63:37	32	19	51
Dog Park[3]	1 Park	265	265	13	60:40	8	5	13	34	59:41	20	14	34
Open Space/Passive Park (412)[1,4]	6 Acres	5.9	35	0.52	71:29	2	1	3	0.59	35:65	1	3	4
Total			**793**			**20**	**37**	**57**			**53**	**36**	**89**

Notes: DU = Dwelling Units
1. Source – *ITE Trip Generation*, 9th Edition
2. Rates for land use code 210 calculated based on Total trips (T) from regression equation divided by Size (DU): Daily: Ln(T) = 0.92Ln(DU)+2.72; A.M. Peak: T=0.70(DU) + 9.74; P.M. Peak: Ln(T)=0.90Ln(DU)+0.51
3. Source: TJKM trip generation surveys of dog parks (described in Technical Memo dated May 8, 2014).
4. The daily rate for land use code 412 is estimated based on a factor of the trip generation rate during the weekday p.m. peak hour of adjacent street traffic (0.59 x 10 = 5.9 daily trips per acre)

The expected directional distribution of the Mitigated Project Alternative trips would be the same as the proposed Revised Project. The Mitigated Project Alternative assumes the same driveway locations on Pleasant Hill Road and Deer Hill Road as the proposed Project, except the dog park driveway on the north side of Deer Hill Road would not be included, as the dog park would be relocated within the on-site park area with vehicle access via the two park parking lot driveways. Based on these assumptions, the Mitigated Project Alternative trip assignments to study intersection traffic movements would compare to the proposed Revised Project trip assignments (Figure 4) as follows:

- Residential component trip assignments would be identical.
- Dog park trips would be reassigned to the two park parking lot driveways along with the passive park trips, where the proposed Revised Project's soccer field and city park trips were assigned.
- The proportion of the combined dog park and passive park trip assignments compared to the proposed Revised Project's combined soccer field and city park trip assignments is approximately 57 percent for the a.m. peak hour and 42 percent for the p.m. peak hour.
- Assignment of high school pick-up and drop-off trips diverted to the park parking lot loading area by elimination of the existing passenger loading zone at the Pleasant Hill Road curb would be identical.

Impacts on traffic, transit, pedestrian, and bicycle facilities with the Mitigated Project Alternative in comparison to the impacts of the proposed Revised Project would be as follows:

- At the Deer Hill Road – Stanley Boulevard/Pleasant Hill Road intersection, the existing a.m. peak-hour traffic LOS F delay would increase by well over five seconds for the Mitigated Project Alternative as well as the proposed Revised Project. However, the increase in average delay during the a.m. peak hour with the Mitigated Project Alternative would be somewhat less than the delay increase with the proposed Revised Project. In either case, the intersection delay increase is not an impact based on the revised significance thresholds for this SEIR that eliminate consideration of intersection LOS on Pleasant Hill Road north of SR 24, in accordance with General Plan Policy C-1.2 of the Growth Management Chapter, the Lamorinda Action Plan, and CCTA guidelines, resulting in a less-than-significant impact.

- At the Deer Hill Road/Brown Avenue intersection, a significant impact on existing and Cumulative Year 2030 traffic delay during peak hours, which would require the Project sponsor to share with the City the cost of installing mitigation measures such as a traffic signal or a roundabout at the intersection, would occur with either the Mitigated Project Alternative or the proposed Revised Project.
- Significant impacts to traffic safety on Deer Hill Road at new driveway locations proposed with both the Mitigated Project Alternative and the Revised Project, which would be mitigated to less than significant by implementing specified design features and requirements, would occur with either the Mitigated Project Alternative or the proposed Revised Project. The exception would be the west driveway on Deer Hill Road serving the Homes, which would be controlled by a one-way stop sign for traffic exiting the Homes driveway with the Mitigated Project Alternative, rather than the roundabout that would also serve the Dog Park driveway on the north side of Deer Hill Road with the proposed Revised Project (the Dog Park is relocated in the Mitigated Project Alternative). The Homes driveway configuration assumed with this Mitigated Project Alternative would also incorporate the following mitigations for the original certified EIR Project's impacts on traffic safety at the west driveway:
    - Homes driveway located at least 100 feet further west than the original EIR project site plan (i.e. driveway location would be consistent with Revised Project site plan).
    - Widen Deer Hill Road as needed to add a striped westbound left-turn lane and appropriate taper lengths approaching the Homes driveway, and maintain appropriate widths for bike lanes and traffic lanes, as well as legal left-turn access at the adjacent driveway on the north side of the roadway.
    - Install a side road warning sign facing westbound Deer Hill Road traffic in advance of the Homes driveway.

However, the roundabout at this driveway in the proposed Revised Project along with the associated design features described in this report would reduce speeds relative to existing conditions on Deer Hill Road. This speed reduction would provide safe bicyclist access crossing Deer Hill Road immediately west of the driveway from the west end of the proposed multiuse trail on the site to continue westbound in the existing Class II bike lane, resulting in a less-than-significant impact with the roundabout. With the Mitigated Project Alternative, the one-way stop control on the Homes driveway and associated design features for Deer Hill Road described above would not provide adequate speed reduction to accommodate bicyclist safety crossing Deer Hill Road from the west end of the proposed multiuse trail, resulting in a significant impact. Mitigation of this impact with the Mitigated Project Alternative would require installation of traffic control devices that will provide adequate notice to reduce speed to drivers approaching the bicycle crossing on Deer Hill Road. Such traffic control devices may include a combination of advance warning signs, bicyclist-activated flashing warning signs and in-pavement lights at the crossing, and radar speed display signs that comply with the standards set forth in the California Manual on Uniform Traffic Control Devices (CA MUTCD) or as otherwise specified by the City Engineer. In addition, installation of street lights to provide adequate roadway illumination of the bicycle crossing as specified by the City Engineer would be required. Implementation of this measure would result in a *less-than-significant* impact with the Mitigated Project Alternative. This mitigation measure is similar in magnitude to the design features that would be required for the roundabout in the proposed Revised Project.

- Significant impacts to emergency vehicle access because of the proposed Revised Project's lack of provisions for turning around Fire District apparatus on dead-end emergency access

roadways on-site, would be mitigated to less than significant by implementing specified site plan revisions. These impacts would not occur with the Mitigated Project Alternative because the site plan would incorporate adequate provisions for turning around Fire District apparatus on dead-end emergency access roadways on-site.

- Significant impacts on traffic delay and safety for school pedestrians and vehicle traffic during construction of both the Mitigated Project Alternative and the proposed Revised Project, which would be mitigated to less than significant by implementing a Construction Staging Plan including specified restrictions on large trucks and site access, would occur with either the Mitigated Project Alternative or the proposed Revised Project.
- On Pleasant Hill Road, significant and unavoidable impacts on the peak-hour peak direction Delay Index under Cumulative Year 2030 conditions would occur with either the Mitigated Project Alternative or the proposed Revised Project. However, the increase in the Delay Index during the a.m. peak hour with the Mitigated Project Alternative would be somewhat less than the delay increase with the proposed Revised Project.
- Significant impacts on existing and planned pedestrian and bicycle facilities, which would be mitigated to less than significant by implementing specified design features and accommodation requirements for such facilities, would occur with either the Mitigated Project Alternative or the proposed Revised Project.
- Significant impacts of parking demand potentially exceeding capacity at the proposed Park parking lot because of potential diversion of existing parking demand from Acalanes High School and existing spaces on the west curb of Pleasant Hill Road, which would be mitigated to less than significant by implementing parking restrictions to avoid such parking in the lot, would occur with either the Mitigated Project Alternative or the proposed Revised Project. However, without the high parking demand of the soccer field and with open space/passive park instead of the higher parking demand of more active-use recreation facilities, the Mitigated Project Alternative would have lower parking demand at the Park parking lot than the proposed Revised Project. Because of the reduced parking demand with the Mitigated Project Alternative, the potential parking lot spillover on weekends and the recommended repeal of the weekend parking prohibition on Pleasant Hill Road to accommodate that spillover would be avoided.

Overall, the impacts of the Mitigated Project Alternative on traffic, transit, pedestrian, and bicycle facilities would be a *slight improvement* compared to the impacts of the proposed Revised Project.

Alternatives to Roundabout at Deer Hill Road/Homes Driveway

The EIR team of Placeworks and City staff requested that TJKM provide additional analysis of various traffic control alternatives to the roundabout at the Deer Hill Road/Homes Driveway intersection under the Mitigated Project Alternative scenario described above.

The analysis of the proposed Revised Project presented previously in this report included level of service (LOS) and safety evaluations assuming the roundabout intersection would include both the Homes driveway and the Dog Park driveway. The peak hour LOS results were as follows:

- Existing with Revised Project: LOS A in both the a.m. and p.m. peak hour
- Cumulative with Revised Project: LOS B in both the a.m. and p.m. peak hour

These LOS results are acceptable according to City standards. Note that with the elimination of the Dog Park driveway in the Mitigated Project Alternative, a roundabout at this location would have fewer conflicting traffic movements and operate with less delay and potentially improved LOS.

The same design features and additional traffic control devices to address Deer Hill Road approach speeds that would be included for the roundabout with the proposed Revised Project would apply with the elimination of the Dog Park driveway in the Mitigated Project Alternative for a roundabout at this location.

The roundabout at the Homes-Dog Park driveway in the proposed Revised Project along with the associated design features described in this report would reduce speeds relative to existing conditions on Deer Hill Road. This speed reduction would provide safe pedestrian and bicyclist access crossing Deer Hill Road immediately west of the roundabout, between the west end of the proposed multiuse trail on the south side and both the sidewalk connecting with the Dog Park and the existing westbound Class II bike lane on the north side. With the Mitigated Project Alternative, the sidewalk connecting to the Dog Park would be eliminated because the Dog Park would be relocated and no pedestrians would be expected to cross Deer Hill Road at this location, but the safety needs of bicyclists would remain. If a roundabout were constructed at the Homes driveway in the Mitigated Project Alternative along with the associated design features described in this report, speeds would decrease relative to existing conditions on Deer Hill Road and provide safe bicyclist access, resulting in a less-than-significant impact.

<u>One-Way Stop Sign on Homes Driveway</u>
This alternative assumes the driveway on Deer Hill Road serving the Homes would be controlled by a one-way stop sign for one lane of traffic exiting the Homes driveway and turning left or right, which is the baseline assumption for the Mitigated Project Alternative. The Homes driveway intersection configuration assumed with this Mitigated Project Alternative would also incorporate the following mitigations for the original certified EIR Project's impacts on traffic safety at the west driveway:

- Widen Deer Hill Road as needed to add a striped westbound left-turn lane and appropriate taper lengths approaching the Homes driveway, and maintain appropriate widths for bike lanes and traffic lanes, as well as legal left-turn access at the adjacent driveway on the north side of the roadway.
- Install a side road warning sign facing westbound Deer Hill Road traffic in advance of the Homes driveway.

As shown in Table XVII below, the one-way stop sign with the lane configuration described above would operate at LOS C for traffic exiting the Homes driveway during the a.m. and p.m. peak hours for both Existing and Cumulative with Mitigated Project Alternative conditions.

With the Mitigated Project Alternative, the one-way stop control on the Homes driveway and associated design features for Deer Hill Road described in the bullet points immediately above would not provide adequate speed reduction to accommodate bicyclist safety crossing Deer Hill Road from the west end of the proposed multiuse trail, resulting in a significant impact. Mitigation of this impact with the Mitigated Project Alternative would require installation of traffic control devices that will provide adequate notice to reduce speed to drivers approaching the bicycle crossing on Deer Hill Road. Such traffic control devices may include a combination of advance warning signs, bicyclist-activated flashing warning signs and in-pavement lights at the crossing, and radar speed display signs that comply with the standards set forth in the California Manual on Uniform Traffic Control Devices (CA MUTCD) or as otherwise specified by the City Engineer. In addition, installation of street lights to provide adequate roadway illumination of the bicycle crossing as specified by the City Engineer would be required. Implementation of this measure would result in a less-than-significant impact with one-way stop control of the driveway in the

Mitigated Project Alternative. However, the effectiveness of these traffic control devices on reducing approach speeds on Deer Hill Road is relatively uncertain. These devices would certainly serve to raise awareness of the bike crossing, but based on City staff's experiences elsewhere in the City, their effects on speed reduction and compliance with yield requirements are mixed. Compared to the roundabout, the traffic control devices alone would not offer the same level of safety enhancement to bicyclists (and pedestrians if the proposed Revised Project included two-way stop signs on the Homes and Dog Park driveways), because the roundabout involves a change to the roadway geometry to induce a change in driving behavior.

Table XVII: LOS for Alternatives to Roundabout at Homes Driveway Intersection

Traffic Control	*Existing + Mitigated Project Alternative*				*Cumulative + Mitigated Project Alternative*			
	AM		*PM*		*AM*		*PM*	
	Delay	*LOS*	*Delay*	*LOS*	*Delay*	*LOS*	*Delay*	*LOS*
One-Way Stop	15.6	C	19.7	C	20.5	C	23.9	C
All-Way Stops	79.6	F	57.6	F	181.8	F	110	F
Signalized	6.6	A	6.4	A	7.5	A	6.9	A

All-Way Stop Signs at Deer Hill Road/Homes Driveway

This alternative assumes all three approaches to the intersection of Deer Hill Road and the Homes driveway would be controlled by stop signs with the Mitigated Project Alternative scenario. The Homes driveway intersection lane configuration is assumed to be the same as described above for the one-way stop alternative, with one lane for traffic exiting the Homes driveway and turning left or right, and addition of a westbound left-turn lane on Deer Hill Road. With all-way stop signs, the westbound left-turn lane would no longer be required as safety mitigation because all westbound traffic would be required to stop, avoiding the primary factor for potential rear-end collisions in a single shared lane for left turns and through traffic. However, the separate westbound left-turn lane was assumed in order to enhance traffic-flow capacity at the intersection and provide a consistent basis for comparison with the other traffic control alternatives analyzed in this section.

As shown in Table XVII above, with all-way stop signs and the lane configuration described above, the Deer Hill Road/Homes driveway intersection would operate at LOS F during the a.m. and p.m. peak hours for both Existing and Cumulative with Mitigated Project Alternative conditions, resulting in a *significant impact*. The LOS F delays and long queues would occur for the peak direction of traffic flow on Deer Hill Road, westbound in the a.m. peak hour and eastbound in the p.m. peak hour.

All-way stop control at the Deer Hill Road/Homes driveway intersection could provide safe conditions for bicyclists crossing Deer Hill Road from the west end of the proposed multiuse trail on the site to the westbound bike lane on Deer Hill with the Mitigated Project Alternative. However, the crossing location would need to be incorporated into the stop-controlled intersection by relocating the end of the multiuse trail to intersect Deer Hill Road more easterly at the west corner of the driveway intersection. Installation of stop sign ahead warning signs would provide adequate notice to reduce speed to drivers approaching on Deer Hill Road.

If the proposed Revised Project included all-way stop signs at the Deer Hill Road/Homes-Dog Park driveway intersection, LOS F delays and queues would be longer than with the Mitigated Project Alternative because of the additional conflicting traffic movements with the Dog Park driveway.

All-way stop control would provide safe conditions for pedestrians crossing Deer Hill Road between the west end of the proposed multiuse trail and the sidewalk connecting to the Dog Park, as well as bicyclists crossing to the westbound bike lane, if the crossing location was also incorporated into the stop-controlled intersection (as described above) with the Revised project.

The subject driveway intersection would not come close to meeting all-way stop sign warrants with either the Mitigated Project Alternative or the proposed Revised Project. Where all-way stop signs are installed at such locations with relatively low conflicting side street volumes like these driveways and high main street volumes like Deer Hill Road, drivers tend to become increasingly disobedient to the stop signs. This creates an enforcement burden on the City, but more importantly, creates secondary impacts on pedestrians and bicyclists, whose safety presumes that motorists would obey the stop signs.

Traffic Signal at Deer Hill Road/Homes Driveway

This alternative assumes full traffic signal control at the intersection of Deer Hill Road and the Homes driveway with the Mitigated Project Alternative scenario. The Homes driveway intersection lane configuration is assumed to be the same as described above for the one-way and all-way stop alternatives, with one lane for traffic exiting the Homes driveway and turning left or right, and addition of a westbound left-turn lane on Deer Hill Road. With a traffic signal, the westbound left-turn lane would be required as safety mitigation because of the potential for rear-end collisions in a single shared lane for left turns and through traffic. The westbound left-turn lane was also assumed in order to enhance traffic-flow capacity at the intersection and provide a consistent basis for comparison with the other traffic control alternatives analyzed in this section.

As shown in Table XVII above, with traffic signal control and the lane configuration described above, the Deer Hill Road/Homes driveway intersection would operate at LOS A during the a.m. and p.m. peak hours for both Existing and Cumulative with Mitigated Project Alternative conditions. However, the intersection traffic volumes would not meet the warrants for traffic signal installation set forth in the CAMUTCD. Installation of new traffic signals is typically limited to locations that meet the warrants, because traffic signals tend to increase the number of rear-end accidents. This would be of particular concern for westbound Deer Hill Road traffic because of the steep downgrade approaching the Homes driveway intersection, which would increase the potential frequency and severity of rear-end accidents. A traffic signal at the Homes driveway intersection would also require installation of advance dynamic warning signs facing westbound traffic on Deer Hill Road to alert drivers approaching a red signal with a "Prepare to Stop" or comparable message, similar to the device on westbound Mt. Diablo Boulevard in advance of the Park Hotel driveway traffic signal. Additionally, a traffic signal would tend to encourage higher speeds, and might be considered inconsistent with "semi-rural" design, compared to roundabout or stop sign control.

Traffic signal control at the Deer Hill Road/Homes driveway intersection could provide safe conditions for bicyclists crossing Deer Hill Road from the west end of the proposed multiuse trail on the site to the westbound bike lane on Deer Hill with the Mitigated Project Alternative. However, the crossing location would need to be incorporated into the signalized intersection by relocating the end of the multiuse trail to intersect Deer Hill Road more easterly at the west corner of the driveway intersection.

If the proposed Revised Project included a traffic signal at the Deer Hill Road/Homes-Dog Park driveway intersection, it would operate at a very good LOS, with delays and queues somewhat longer than with the Mitigated Project Alternative because of the additional conflicting traffic

movements with the Dog Park driveway. Traffic signal control would provide safe conditions for pedestrians crossing Deer Hill Road between the west end of the proposed multiuse trail and the sidewalk connecting to the Dog Park, as well as bicyclists crossing to the westbound bike lane, if the crossing location was also incorporated into the signal-controlled intersection (as described above) with the Revised Project. However, the intersection traffic volumes would not meet the warrants for traffic signal installation; the increased potential for rear-end accidents on westbound Deer Hill Road, which would require installation of advance dynamic warning signs, as well as potential higher speeds and inconsistency with "semi-rural" design compared to roundabout or stop sign control, would be the same as described above for the Mitigated Project Alternative.

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6. *General Plan, City of Lafayette*
7. *Final Lamorinda Action Plan Update, DKS Associates, December 2009*
8. *Bikeways Master Plan, City of Lafayette*
9. *Master Walkways Plan, City of Lafayette*
10. *Downtown Lafayette Specific Plan EIR, City of Lafayette*
11. *2008 BART Station Profile Study, Bay Area Rapid Transit District*
12. *2008 Central Contra Costa County Transportation Authority Short Range Transit Plan (SRTP)*
13. *Municipal Code, Chapter 6-6, Off-Street Parking, City of Lafayette*

Appendix A – Level of Service Methodology

APPENDIX A
LEVEL OF SERVICE

The description and procedures for calculating capacity and level of service (LOS) are found in Transportation Research Board, *Highway Capacity Manual 2000*. *Highway Capacity Manual 2000* represents the latest research on capacity and quality of service for transportation facilities.

Quality of service requires quantitative measures to characterize operational conditions within a traffic stream. LOS is a quality measure describing operational conditions within a traffic stream, generally in terms of such service measures as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience.

Six levels of service are defined for each type of facility that has analysis procedures available. Letters designate each level, from A to F, with LOS A representing the best operating conditions and LOS F the worst. Each LOS represents a range of operating conditions and the driver's perception of these conditions. Safety is not included in the measures that establish service levels.

A general description of service levels for various types of facilities is shown in Table A-I

Table A-I: Level of Service Description

Facility Type	***Uninterrupted Flow***	***Interrupted Flow***
	Freeways Multi-lane Highways Two-lane Highways Urban Streets	Signalized Intersections Unsignalized Intersections Two-way Stop Control All-way Stop Control
LOS		
A	Free-flow	Very low delay.
B	Stable flow. Presence of other users noticeable.	Low delay.
C	Stable flow. Comfort and convenience starts to decline.	Acceptable delay.
D	High-density stable flow.	Tolerable delay.
E	Unstable flow.	Limit of acceptable delay.
F	Forced or breakdown flow.	Unacceptable delay

Source: *Highway Capacity Manual 2000*

Urban Streets

The term "urban streets" refers to urban arterials and collectors, including those in downtown areas.

Arterial streets are roads that primarily serve longer through trips. However, providing access to abutting commercial and residential land uses is also an important function of arterials.
Collector streets provide both land access and traffic circulation within residential, commercial and industrial areas. Their access function is more important than that of arterials, and unlike arterials their operation is not always dominated by traffic signals.

Downtown streets are signalized facilities that often resemble arterials. They not only move through traffic but also provide access to local businesses for passenger cars, transit buses, and trucks.

Pedestrian conflicts and lane obstructions created by stopping or standing buses, trucks and parking vehicles that cause turbulence in the traffic flow are typical of downtown streets.

The speed of vehicles on urban streets is influenced by three main factors, street environment, interaction among vehicles and traffic control. As a result, these factors also affect quality of service.

The street environment includes the geometric characteristics of the facility, the character of roadside activity and adjacent land uses. Thus, the environment reflects the number and width of lanes, type of median, driveway density, spacing between signalized intersections, existence of parking, level of pedestrian activity and speed limit.

The interaction among vehicles is determined by traffic density, the proportion of trucks and buses, and turning movements. This interaction affects the operation of vehicles at intersections and, to a lesser extent, between signals.

Traffic control (including signals and signs) forces a portion of all vehicles to slow or stop. The delays and speed changes caused by traffic control devices reduce vehicle speeds, however, such controls are needed to establish right-of-way.

The average travel speed for through vehicles along an urban street is the determinant of the operating LOS. The travel speed along a segment, section or entire length of an urban street is dependent on the running speed between signalized intersections and the amount of control delay incurred at signalized intersections.

LOS A describes primarily free-flow operations. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Control delay at signalized intersections is minimal.

LOS B describes reasonably unimpeded operations. The ability to maneuver within the traffic stream is only slightly restricted, and control delays at signalized intersections are not significant.

LOS C describes stable operations, however, ability to maneuver and change lanes in midblock location may be more restricted than at LOS B. Longer queues, adverse signal coordination, or both may contribute to lower travel speeds.

LOS D borders on a range in which in which small increases in flow may cause substantial increases in delay and decreases in travel speed. LOS D may be due to adverse signal progression, inappropriate signal timing, high volumes, or a combination of these factors.

LOS E is characterized by significant delays and lower travel speeds. Such operations are caused by a combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections, and inappropriate signal timing.

LOS F is characterized by urban street flow at extremely low speeds. Intersection congestion is likely at critical signalized locations, with high delays, high volumes, and extensive queuing.

The methodology to determine LOS stratifies urban streets into four classifications. The classifications are complex, and are related to functional and design categories. Table A-II describes the functional and design categories, while Table A-III relates these to the urban street classification.

Once classified, the urban street is divided into segments for analysis. An urban street segment is a one-way section of street encompassing a series of blocks or links terminating at a signalized intersection. Adjacent segments of urban streets may be combined to form larger street sections, provided that the segments have similar demand flows and characteristics.

Levels of service are related to the average travel speed of vehicles along the urban street segment or section.

Travel times for existing conditions are obtained by field measurements. The maximum-car technique is used. The vehicle is driven at the posted speed limit unless impeded by actual traffic conditions. In the maximum-car technique, a safe level of vehicular operation is maintained by observing proper following distances and by changing speeds at reasonable rates of acceleration and deceleration. The maximum-car technique provides the best base for measuring traffic performance.

An observer records the travel time and locations and duration of delay. The beginning and ending points are the centers of intersections. Delays include times waiting in queues at signalized intersections. The travel speed is determined by dividing the length of the segment by the travel time. Once the travel speed on the arterial is determined, the LOS is found by comparing the speed to the criteria in Table A-IV. LOS criteria vary for the different classifications of urban street, reflecting differences in driver expectations.

Table A-II: Functional and Design Categories for Urban Streets

Criterion	***Functional Category***			
	Principal Arterial		***Minor Arterial***	
Mobility function	Very important		Important	
Access function	Very minor		Substantial	
Points connected	Freeways, important activity centers, major traffic generators		Principal arterials	
Predominant trips served	Relatively long trips between major points and through trips entering, leaving, and passing through city		Trips of moderate length within relatively small geographical areas	
Criterion	***Design Category***			
	High-Speed	***Suburban***	***Intermediate***	***Urban***
Driveway access density	Very low density	Low density	Moderate density	High density
Arterial type	Multilane divided; undivided or two-lane with shoulders	Multilane divided: undivided or two-lane with shoulders	Multilane divided or undivided; one way, two lane	Undivided one way; two way, two or more lanes
Parking	No	No	Some	Usually
Separate left-turn lanes	Yes	Yes	Usually	Some
Signals per mile	0.5 to 2	1 to 5	4 to 10	6 to 12
Speed limits	45 to 55 mph	40 to 45 mph	30 to 40 mph	25 to 35 mph
Pedestrian activity	Very little	Little	Some	Usually
Roadside development	Low density	Low to medium density	Medium to moderate density	High density

Source: *Highway Capacity Manual 2000*

Table A-III: Urban Street Class based on Function and Design Categories

Design Category	*Functional Category*	
	Principal Arterial	***Minor Arterial***
High-Speed	I	Not applicable
Suburban	II	II
Intermediate	II	III or IV
Urban	III or IV	IV

Source: *Highway Capacity Manual 2000*

Table A-IV: Urban Street Levels of Service by Class

Urban Street Class	***I***	***II***	***III***	***IV***
Range of Free Flow Speeds (mph)	45 to 55	35 to 45	30 to 35	25 to 35
Typical Free Flow Speed (mph)	50	40	33	30
LOS	***Average Travel Speed (mph)***			
A	>42	>35	>30	>25
B	>34	>28	>24	>19
C	>27	>22	>18	>13
D	>21	>17	>14	>9
E	>16	>13	>10	>7
F	≤16	≤13	≤10	≤7

Source: *Highway Capacity Manual 2000*

Interrupted Flow

One of the more important elements limiting, and often interrupting the flow of traffic on a highway is the intersection. Flow on an interrupted facility is usually dominated by points of fixed operation such as traffic signals, stop and yield signs. These all operate quite differently and have differing impacts on overall flow.

Signalized Intersections

The capacity of a highway is related primarily to the geometric characteristics of the facility, as well as to the composition of the traffic stream on the facility. Geometrics are a fixed, or non-varying, characteristic of a facility.

At the signalized intersection, an additional element is introduced into the concept of capacity: time allocation. A traffic signal essentially allocates time among conflicting traffic movements seeking use of the same physical space. The way in which time is allocated has a significant impact on the operation of the intersection and on the capacity of the intersection and its approaches.

LOS for signalized intersections is defined in terms of control delay, which is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. The delay experienced by a motorist is made up of a number of factors that relate to control, traffic and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions, *i. e.,* in the absence of traffic control, geometric delay, any incidents, and any other vehicles. Specifically, LOS criteria for traffic signals are stated in terms of average control delay per vehicle, typically for a 15-minute analysis period. Delay is a complex measure and depends on a number of variables, including the quality of progression, the cycle length, the ratio of green time to cycle length and the volume to capacity ratio for the lane group.

For each intersection analyzed the average control delay per vehicle per approach is determined for the peak hour. A weighted average of control delay per vehicle is then determined for the intersection. A LOS designation is given to the control delay to better describe the level of operation. A description of levels of service for signalized intersections can be found in Table A-V

Table A-V: Description of Level of Service for Signalized Intersections

LOS	*Description*
A	Very low control delay, up to 10 seconds per vehicle. Progression is extremely favorable, and most vehicles arrive during the green phase. Many vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.
B	Control delay greater than 10 and up to 20 seconds per vehicle. There is good progression or short cycle lengths or both. More vehicles stop causing higher levels of delay.
C	Control delay greater than 20 and up to 35 seconds per vehicle. Higher delays are caused by fair progression or longer cycle lengths or both. Individual cycle failures may begin to appear. Cycle failure occurs when a given green phase doe not serve queued vehicles, and overflow occurs. The number of vehicles stopping is significant, though many still pass through the intersection without stopping.
D	Control delay greater than 35 and up to 55 seconds per vehicle. The influence of congestions becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volumes. Many vehicles stop, the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
E	Control delay greater than 55 and up to 80 seconds per vehicle. The limit of acceptable delay. High delays usually indicate poor progression, long cycle lengths, and high volumes. Individual cycle failures are frequent.
F	Control delay in excess of 80 seconds per vehicle. Unacceptable to most drivers. Oversaturation, arrival flow rates exceed the capacity of the intersection. Many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to higher delay.

Source: *Highway Capacity Manual 2000*

The use of control delay, which may also be referred to as signal delay, was introduced in the 1997 update to the *Highway Capacity Manual*, and represents a departure from previous updates. In the third edition, published in 1985 and the 1994 update to the third edition, delay only included stopped delay. Thus, the LOS criteria listed in Table A-V differs from earlier criteria.

Unsignalized Intersections

The current procedures on unsignalized intersections were first introduced in the 1997 update to the *Highway Capacity Manual* and represent a revision of the methodology published in the 1994 update to the 1985 *Highway Capacity Manual*. The revised procedures use control delay as a measure of effectiveness to determine LOS. Delay is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. The delay experienced by a motorist is made up of a number of factors that relate to control, traffic and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions, *i. e.,* in the absence of traffic control, geometric delay, any incidents, and any other vehicles. Control delay is the increased time of travel for a vehicle approaching and passing through an unsignalized intersection, compared with a free-flow vehicle if it were not required to slow or stop at the intersection.

Two-Way Stop Controlled Intersections

Two-way stop controlled intersections in which stop signs are used to assign the right-of-way, are the most prevalent type of intersection in the United States. At two-way stop-controlled intersections the stop-controlled approaches are referred as the minor street approaches and can be either public streets or private driveways. The approaches that are not controlled by stop signs are referred to as the major street approaches.

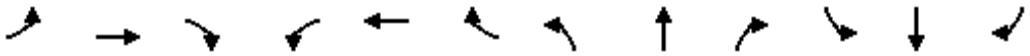
The capacity of movements subject to delay are determined using the "critical gap" method of capacity analysis. Expected average control delay based on movement volume and movement capacity is calculated. A LOS designation is given to the expected control delay for each minor movement. LOS is not defined for the intersection as a whole. Control delay is the increased time of travel for a vehicle approaching and passing through a stop-controlled intersection, compared with a free-flow vehicle if it were not required to slow or stop at the intersection. A description of levels of service for two-way stop-controlled intersections is found in Table A-VI.

Table A-VI: Description of Level of Service for Two-Way Stop Controlled Intersections

LOS	***Description***
A	Very low control delay less than 10 seconds per vehicle for each movement subject to delay.
B	Low control delay greater than 10 and up to 15 seconds per vehicle for each movement subject to delay.
C	Acceptable control delay greater than 15 and up to 25 seconds per vehicle for each movement subject to delay.
D	Tolerable control delay greater than 25 and up to 35 seconds per vehicle for each movement subject to delay.
E	Limit of tolerable control delay greater than 35 and up to 50 seconds per vehicle for each movement subject to delay.
F	Unacceptable control delay in excess of 50 seconds per vehicle for each movement subject to delay.

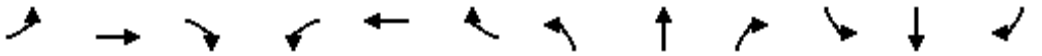
Source: *Highway Capacity Manual 2000*

Appendix B – Level of Service Worksheets: Existing Conditions



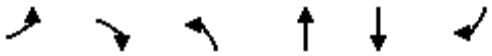
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	34	0	0	0	15	521	0	0	1331	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0					4.0	5.0			5.0	
Lane Util. Factor		1.00					1.00	0.95			0.95	
Frt		0.86					1.00	1.00			1.00	
Flt Protected		1.00					0.95	1.00			1.00	
Satd. Flow (prot)		1611					1770	3539			3536	
Flt Permitted		1.00					0.95	1.00			1.00	
Satd. Flow (perm)		1611					1770	3539			3536	
Peak-hour factor, PHF	0.65	0.65	0.65	0.92	0.92	0.92	0.79	0.79	0.79	0.66	0.66	0.66
Adj. Flow (vph)	0	0	52	0	0	0	19	659	0	0	2017	14
RTOR Reduction (vph)	0	49	0	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	3	0	0	0	0	19	659	0	0	2030	0
Turn Type	Perm			Perm			Prot					
Protected Phases		8			4		5	2			6	
Permitted Phases	8			4								
Actuated Green, G (s)		3.0					1.3	50.0			44.7	
Effective Green, g (s)		3.0					1.3	50.0			44.7	
Actuated g/C Ratio		0.05					0.02	0.81			0.72	
Clearance Time (s)		4.0					4.0	5.0			5.0	
Vehicle Extension (s)		2.5					2.0	4.0			4.0	
Lane Grp Cap (vph)		78					37	2854			2549	
v/s Ratio Prot		c0.00					c0.01	0.19			c0.57	
v/s Ratio Perm												
v/c Ratio		0.03					0.51	0.23			0.80	
Uniform Delay, d1		28.1					30.0	1.4			5.7	
Progression Factor		1.00					0.85	1.21			1.00	
Incremental Delay, d2		0.1					4.9	0.2			2.7	
Delay (s)		28.2					30.4	1.9			8.4	
Level of Service		C					C	A			A	
Approach Delay (s)		28.2			0.0			2.7			8.4	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM Average Control Delay	7.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
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)	2	0	5	17	0	9	0	586	12	7	1481	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			4.0	4.0		5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00			1.00	1.00		0.95	1.00	1.00	0.95	1.00
Frt		0.90			1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99			0.95	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1653			1770	1583		3539	1583	1770	3539	1583
Flt Permitted		0.91			1.00	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1531			1863	1583		3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.88	0.88	0.88	0.65	0.65	0.65	0.95	0.95	0.95	0.94	0.94	0.94
Adj. Flow (vph)	2	0	6	26	0	14	0	617	13	7	1576	1
RTOR Reduction (vph)	0	6	0	0	0	13	0	0	4	0	0	0
Lane Group Flow (vph)	0	2	0	0	26	1	0	617	9	7	1576	1
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4		4			2			6
Actuated Green, G (s)		3.7			2.7	2.7		45.2	45.2	1.1	50.3	50.3
Effective Green, g (s)		3.7			2.7	2.7		45.2	45.2	1.1	50.3	50.3
Actuated g/C Ratio		0.06			0.04	0.04		0.73	0.73	0.02	0.81	0.81
Clearance Time (s)		3.0			4.0	4.0		5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5			2.0	2.0		4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)		91			81	69		2580	1154	31	2871	1284
v/s Ratio Prot								0.17		0.00	c0.45	
v/s Ratio Perm		0.00			c0.01	0.00			0.01			0.00
v/c Ratio		0.03			0.32	0.01		0.24	0.01	0.23	0.55	0.00
Uniform Delay, d1		27.5			28.8	28.4		2.8	2.3	30.0	2.0	1.1
Progression Factor		1.00			1.00	1.00		1.97	2.49	0.95	2.26	1.18
Incremental Delay, d2		0.1			0.8	0.0		0.2	0.0	1.0	0.6	0.0
Delay (s)		27.5			29.6	28.4		5.7	5.7	29.5	5.0	1.3
Level of Service		C			C	C		A	A	C	A	A
Approach Delay (s)		27.5			29.2			5.7			5.2	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	5.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	22	224	94	587	1574	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3539	1583
Peak-hour factor, PHF	0.74	0.74	0.84	0.84	0.79	0.79
Adj. Flow (vph)	30	303	112	699	1992	13
RTOR Reduction (vph)	0	96	0	0	0	2
Lane Group Flow (vph)	30	207	112	699	1992	11
Turn Type		Perm	Prot			Perm
Protected Phases	8		5	2	6	
Permitted Phases		8				6
Actuated Green, G (s)	19.5	19.5	10.4	95.5	81.1	81.1
Effective Green, g (s)	19.5	19.5	10.4	95.5	81.1	81.1
Actuated g/C Ratio	0.16	0.16	0.08	0.77	0.65	0.65
Clearance Time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Vehicle Extension (s)	2.5	2.5	2.0	4.0	4.0	4.0
Lane Grp Cap (vph)	278	249	148	2726	2315	1035
v/s Ratio Prot	0.02		c0.06	0.20	c0.56	
v/s Ratio Perm		c0.13				0.01
v/c Ratio	0.11	0.83	0.76	0.26	0.86	0.01
Uniform Delay, d1	44.8	50.7	55.6	4.1	17.0	7.5
Progression Factor	1.00	1.00	0.93	1.11	1.03	1.16
Incremental Delay, d2	0.1	20.1	17.5	0.2	4.2	0.0
Delay (s)	44.9	70.7	69.2	4.8	21.7	8.7
Level of Service	D	E	E	A	C	A
Approach Delay (s)	68.4			13.7	21.6	
Approach LOS	E			B	C	

Intersection Summary			
HCM Average Control Delay	24.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	58	5	119	66	24	10	26	75	498	46	39	1864
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1550	1550
Total Lost time (s)		3.5	3.5		3.5			3.5	4.1	4.1	3.5	4.1
Lane Util. Factor		1.00	1.00		1.00			*0.92	0.95	1.00	1.00	0.95
Frt		1.00	0.85		0.99			1.00	1.00	0.85	1.00	1.00
Flt Protected		0.96	1.00		0.97			0.95	1.00	1.00	0.95	1.00
Satd. Flow (prot)		1781	1583		1779			1628	3539	1583	1444	2887
Flt Permitted		0.68	1.00		0.71			0.95	1.00	1.00	0.95	1.00
Satd. Flow (perm)		1260	1583		1302			1628	3539	1583	1444	2887
Peak-hour factor, PHF	0.88	0.88	0.88	0.75	0.75	0.75	0.92	0.94	0.94	0.94	0.97	0.97
Adj. Flow (vph)	66	6	135	88	32	13	28	80	530	49	40	1922
RTOR Reduction (vph)	0	0	93	0	3	0	0	0	0	13	0	0
Lane Group Flow (vph)	0	72	42	0	130	0	0	108	530	36	40	1922
Turn Type	Perm		Perm	Perm			Prot	Prot		Perm	Prot	
Protected Phases		8			4		5	5	2		1	6
Permitted Phases	8		8	4						2		
Actuated Green, G (s)		15.7	15.7		15.7			11.7	90.6	90.6	6.6	85.5
Effective Green, g (s)		15.7	15.7		15.7			11.7	90.6	90.6	6.6	85.5
Actuated g/C Ratio		0.13	0.13		0.13			0.09	0.73	0.73	0.05	0.69
Clearance Time (s)		3.5	3.5		3.5			3.5	4.1	4.1	3.5	4.1
Vehicle Extension (s)		2.0	2.0		2.0			1.0	4.0	4.0	1.5	4.0
Lane Grp Cap (vph)		160	200		165			154	2586	1157	77	1991
v/s Ratio Prot								c0.07	0.15		0.03	c0.67
v/s Ratio Perm		0.06	0.03		c0.10					0.02		
v/c Ratio		0.45	0.21		0.78			0.70	0.20	0.03	0.52	0.97
Uniform Delay, d1		50.2	48.6		52.5			54.5	5.3	4.6	57.2	17.9
Progression Factor		1.00	1.00		1.00			0.87	1.50	2.98	1.20	0.44
Incremental Delay, d2		0.7	0.2		19.8			10.1	0.2	0.0	1.2	8.3
Delay (s)		50.9	48.8		72.3			57.6	8.1	13.7	70.1	16.1
Level of Service		D	D		E			E	A	B	E	B
Approach Delay (s)		49.5			72.3				16.3			16.6
Approach LOS		D			E				B			B

Intersection Summary			
HCM Average Control Delay	21.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	11.1
Intersection Capacity Utilization	95.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR
Lane Configurations	
Volume (vph)	71
Ideal Flow (vphpl)	1550
Total Lost time (s)	4.1
Lane Util. Factor	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1292
Flt Permitted	1.00
Satd. Flow (perm)	1292
Peak-hour factor, PHF	0.97
Adj. Flow (vph)	73
RTOR Reduction (vph)	6
Lane Group Flow (vph)	67
Turn Type	Perm
Protected Phases	
Permitted Phases	6
Actuated Green, G (s)	85.5
Effective Green, g (s)	85.5
Actuated g/C Ratio	0.69
Clearance Time (s)	4.1
Vehicle Extension (s)	4.0
Lane Grp Cap (vph)	891
v/s Ratio Prot	
v/s Ratio Perm	0.05
v/c Ratio	0.08
Uniform Delay, d1	6.3
Progression Factor	0.28
Incremental Delay, d2	0.1
Delay (s)	1.8
Level of Service	A
Approach Delay (s)	
Approach LOS	

Intersection Summary

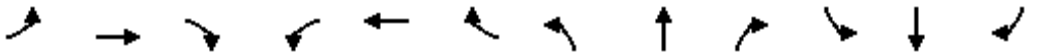
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	157	48	55	235	100	42	41	100	569	181	49	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1500	1500
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	5.0		4.0
Lane Util. Factor	0.97	1.00		0.95	0.95	1.00		1.00	0.95	1.00		1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00	1.00	0.76		1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
Frt	1.00	0.92		1.00	1.00	0.85		1.00	1.00	0.85		1.00
Flt Protected	0.95	1.00		0.95	0.98	1.00		0.95	1.00	1.00		0.95
Satd. Flow (prot)	3433	1714		1681	1734	1559		1770	3539	1196		1397
Flt Permitted	0.95	1.00		0.95	0.98	1.00		0.95	1.00	1.00		0.95
Satd. Flow (perm)	3433	1714		1681	1734	1559		1770	3539	1196		1397
Peak-hour factor, PHF	0.54	0.54	0.54	0.67	0.67	0.67	0.64	0.64	0.64	0.64	0.78	0.78
Adj. Flow (vph)	291	89	102	351	149	63	64	156	889	283	63	95
RTOR Reduction (vph)	0	37	0	0	0	52	0	0	0	166	0	0
Lane Group Flow (vph)	291	154	0	246	254	11	0	220	889	117	0	158
Confl. Peds. (#/hr)	2					2				74		74
Turn Type	Split			Split		Perm	Prot	Prot		Perm	Prot	Prot
Protected Phases	8	8		4	4		5	5	2		1	1
Permitted Phases						4				2		
Actuated Green, G (s)	16.1	16.1		21.6	21.6	21.6		23.0	51.1	51.1		18.2
Effective Green, g (s)	16.1	16.1		21.6	21.6	21.6		23.0	51.1	51.1		18.2
Actuated g/C Ratio	0.13	0.13		0.17	0.17	0.17		0.19	0.41	0.41		0.15
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	5.0		4.0
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0		2.0	3.0	3.0		2.0
Lane Grp Cap (vph)	446	223		293	302	272		328	1458	493		205
v/s Ratio Prot	0.08	c0.09		0.15	c0.15			c0.12	0.25			c0.11
v/s Ratio Perm						0.01				0.10		
v/c Ratio	0.65	0.69		0.84	0.84	0.04		0.67	0.61	0.24		0.77
Uniform Delay, d1	51.3	51.6		49.5	49.5	42.6		47.0	28.6	23.8		50.9
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		0.85
Incremental Delay, d2	2.6	7.3		17.9	18.0	0.0		4.2	1.9	1.1		10.5
Delay (s)	53.9	58.9		67.4	67.5	42.6		51.2	30.5	24.9		53.7
Level of Service	D	E		E	E	D		D	C	C		D
Approach Delay (s)		55.9			64.7				32.6			
Approach LOS		E			E				C			

Intersection Summary			
HCM Average Control Delay	189.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	84.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

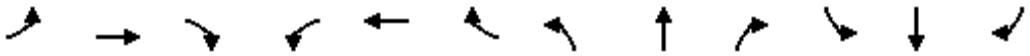
Movement	SBT	SBR
Lane Configurations		
Volume (vph)	1417	550
Ideal Flow (vphpl)	1500	1500
Total Lost time (s)	5.0	5.0
Lane Util. Factor	0.95	1.00
Frpb, ped/bikes	1.00	1.00
Flpb, ped/bikes	1.00	1.00
Frt	1.00	0.85
Flt Protected	1.00	1.00
Satd. Flow (prot)	2794	1250
Flt Permitted	1.00	1.00
Satd. Flow (perm)	2794	1250
Peak-hour factor, PHF	0.78	0.78
Adj. Flow (vph)	1817	705
RTOR Reduction (vph)	0	61
Lane Group Flow (vph)	1817	644
Confl. Peds. (#/hr)		
Turn Type		Perm
Protected Phases	6	
Permitted Phases		6
Actuated Green, G (s)	46.3	46.3
Effective Green, g (s)	46.3	46.3
Actuated g/C Ratio	0.37	0.37
Clearance Time (s)	5.0	5.0
Vehicle Extension (s)	4.0	4.0
Lane Grp Cap (vph)	1043	467
v/s Ratio Prot	c0.65	
v/s Ratio Perm		0.51
v/c Ratio	1.74	1.38
Uniform Delay, d1	38.9	38.9
Progression Factor	1.17	1.22
Incremental Delay, d2	336.7	179.2
Delay (s)	381.9	226.5
Level of Service	F	F
Approach Delay (s)	321.7	
Approach LOS	F	

Intersection Summary



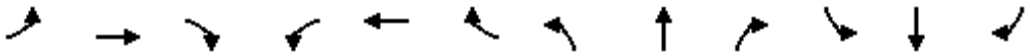
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	212	216	60	0	0	0	224	688	396	0	492	528
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5				4.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	1.00				1.00	0.95	1.00		0.95	1.00
Frt	1.00	1.00	0.85				1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00				0.95	1.00	1.00		1.00	1.00
Satd. Flow (prot)	1770	3539	1583				1770	3539	1583		3539	1583
Flt Permitted	0.95	1.00	1.00				0.95	1.00	1.00		1.00	1.00
Satd. Flow (perm)	1770	3539	1583				1770	3539	1583		3539	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.92	0.92	0.92	0.96	0.96	0.96	0.94	0.94	0.94
Adj. Flow (vph)	236	240	67	0	0	0	233	717	412	0	523	562
RTOR Reduction (vph)	0	0	53	0	0	0	0	0	115	0	0	332
Lane Group Flow (vph)	236	240	14	0	0	0	233	717	297	0	523	230
Turn Type	Perm		Perm				Prot		Perm			Perm
Protected Phases		4					5	2			6	
Permitted Phases	4		4						2			6
Actuated Green, G (s)	14.3	14.3	14.3				13.5	46.2	46.2		28.7	28.7
Effective Green, g (s)	14.3	14.3	14.3				13.5	46.2	46.2		28.7	28.7
Actuated g/C Ratio	0.20	0.20	0.20				0.19	0.66	0.66		0.41	0.41
Clearance Time (s)	4.5	4.5	4.5				4.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	2.0	2.0	2.0				2.0	4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	362	723	323				341	2336	1045		1451	649
v/s Ratio Prot		0.07					c0.13	0.20			c0.15	
v/s Ratio Perm	c0.13		0.01						0.19			0.15
v/c Ratio	0.65	0.33	0.04				0.68	0.31	0.28		0.36	0.36
Uniform Delay, d1	25.6	23.8	22.4				26.3	5.1	5.0		14.3	14.3
Progression Factor	1.00	1.00	1.00				1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	3.2	0.1	0.0				4.5	0.3	0.7		0.7	1.5
Delay (s)	28.8	23.9	22.4				30.7	5.4	5.7		15.0	15.8
Level of Service	C	C	C				C	A	A		B	B
Approach Delay (s)		25.8			0.0			9.8			15.4	
Approach LOS		C			A			A			B	

Intersection Summary			
HCM Average Control Delay	14.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	52.6%	ICU Level of Service	A
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)	16	32	132	12	0	136	0	1020	20	80	448	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	1.00	1.00		1.00		0.91		1.00	0.95	
Frt		1.00	0.85	1.00		0.85		1.00		1.00	1.00	
Flt Protected		0.98	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1833	1583	1770		1583		5070		1770	3539	
Flt Permitted		0.98	1.00	0.74		1.00		1.00		0.95	1.00	
Satd. Flow (perm)		1833	1583	1380		1583		5070		1770	3539	
Peak-hour factor, PHF	0.87	0.87	0.87	0.86	0.86	0.86	0.97	0.97	0.97	0.96	0.96	0.96
Adj. Flow (vph)	18	37	152	14	0	158	0	1052	21	83	467	0
RTOR Reduction (vph)	0	0	136	0	0	142	0	2	0	0	0	0
Lane Group Flow (vph)	0	55	16	14	0	16	0	1071	0	83	467	0
Turn Type	Split		Perm	custom		custom				Prot		
Protected Phases	4	4						2		1	6	
Permitted Phases			4	8		8						
Actuated Green, G (s)		5.9	5.9	5.4		5.4		23.2		4.1	31.3	
Effective Green, g (s)		5.9	5.9	5.4		5.4		23.2		4.1	31.3	
Actuated g/C Ratio		0.11	0.11	0.10		0.10		0.42		0.08	0.57	
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)		198	171	136		157		2154		133	2029	
v/s Ratio Prot		c0.03						c0.21		c0.05	0.13	
v/s Ratio Perm			0.01	c0.01		0.01						
v/c Ratio		0.28	0.10	0.10		0.10		0.50		0.62	0.23	
Uniform Delay, d1		22.4	21.9	22.4		22.4		11.4		24.5	5.7	
Progression Factor		1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2		0.8	0.2	0.3		0.3		0.2		8.8	0.1	
Delay (s)		23.2	22.2	22.7		22.7		11.6		33.3	5.8	
Level of Service		C	C	C		C		B		C	A	
Approach Delay (s)		22.4			22.7			11.6			9.9	
Approach LOS		C			C			B			A	

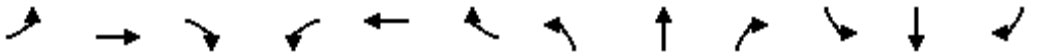
Intersection Summary			
HCM Average Control Delay	13.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	54.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	43.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	26	200	48	172	645	36	85	12	76	28	8	52
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.94	0.94	0.94	0.98	0.98	0.98	0.85	0.85	0.85
Hourly flow rate (vph)	29	222	53	183	686	38	87	12	78	33	9	61
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	724			276			1425	1397	249	1435	1405	705
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	724			276			1425	1397	249	1435	1405	705
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			86			0	90	90	59	92	86
cM capacity (veh/h)	878			1287			80	117	790	81	116	436

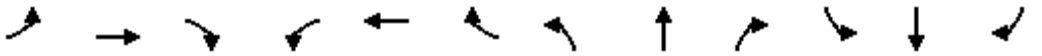
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1
Volume Total	29	276	183	724	99	78	104
Volume Left	29	0	183	0	87	0	33
Volume Right	0	53	0	38	0	78	61
cSH	878	1700	1287	1700	83	790	164
Volume to Capacity	0.03	0.16	0.14	0.43	1.20	0.10	0.63
Queue Length 95th (ft)	3	0	12	0	180	8	88
Control Delay (s)	9.2	0.0	8.3	0.0	251.6	10.1	58.4
Lane LOS	A		A		F	B	F
Approach Delay (s)	0.9		1.7		145.5		58.4
Approach LOS					F		F

Intersection Summary				
Average Delay	22.5			
Intersection Capacity Utilization	61.5%	ICU Level of Service	B	
Analysis Period (min)	15			



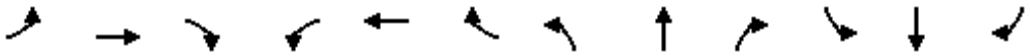
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	240	900	140	445	3	261	13	81	8	21	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.95	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)	1770	1863	1583	1770	1861		1681	1693	1583		1732	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)	1770	1863	1583	1770	1861		1681	1693	1583		1732	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	261	978	152	484	3	284	14	88	9	23	28
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	71	0	25	0
Lane Group Flow (vph)	27	261	978	152	487	0	148	150	17	0	36	0
Turn Type	Prot		Free	Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			Free						2			
Actuated Green, G (s)	1.4	15.1	54.4	6.1	19.8		10.4	10.4	10.4		6.8	
Effective Green, g (s)	1.4	15.1	54.4	6.1	19.8		10.4	10.4	10.4		6.8	
Actuated g/C Ratio	0.03	0.28	1.00	0.11	0.36		0.19	0.19	0.19		0.12	
Clearance Time (s)	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	
Lane Grp Cap (vph)	46	517	1583	198	677		321	324	303		217	
v/s Ratio Prot	0.02	0.14		0.09	c0.26		0.09	0.09			0.02	
v/s Ratio Perm			c0.62						0.01			
v/c Ratio	0.59	0.50	0.62	0.77	0.72		0.46	0.46	0.06		0.16	
Uniform Delay, d1	26.2	16.5	0.0	23.5	14.9		19.5	19.5	18.0		21.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	17.7	0.8	1.8	16.2	3.7		1.1	1.0	0.1		0.4	
Delay (s)	43.9	17.3	1.8	39.7	18.6		20.6	20.6	18.1		21.6	
Level of Service	D	B	A	D	B		C	C	B		C	
Approach Delay (s)		5.9			23.6			20.0			21.6	
Approach LOS		A			C			B			C	

Intersection Summary			
HCM Average Control Delay	13.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	54.4	Sum of lost time (s)	0.0
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



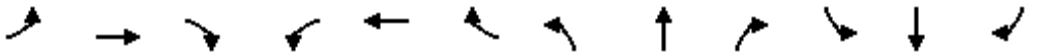
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	540	284	288	480	3	882	8	537	18	6	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	0.88		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (prot)	1770	3539	1583	1770	3536		1681	1687	2787		1747	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (perm)	1770	3539	1583	1770	3536		1681	1687	2787		1747	
Peak-hour factor, PHF	0.91	0.91	0.91	0.88	0.88	0.88	0.95	0.95	0.95	0.69	0.69	0.69
Adj. Flow (vph)	1	593	312	327	545	3	928	8	565	26	9	13
RTOR Reduction (vph)	0	0	248	0	1	0	0	0	407	0	11	0
Lane Group Flow (vph)	1	593	64	327	547	0	464	472	158	0	37	0
Turn Type	Prot		Perm	Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4						2			
Actuated Green, G (s)	0.8	19.2	19.2	16.0	34.4		26.0	26.0	26.0		16.0	
Effective Green, g (s)	0.8	19.2	19.2	16.0	34.4		26.0	26.0	26.0		16.0	
Actuated g/C Ratio	0.01	0.21	0.21	0.17	0.37		0.28	0.28	0.28		0.17	
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)	15	729	326	304	1305		469	471	777		300	
v/s Ratio Prot	0.00	c0.17		c0.18	0.15		0.28	c0.28			c0.02	
v/s Ratio Perm			0.04						0.06			
v/c Ratio	0.07	0.81	0.20	1.08	0.42		0.99	1.00	0.20		0.12	
Uniform Delay, d1	45.8	35.3	30.6	38.6	21.9		33.5	33.6	25.7		32.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	1.9	6.9	0.3	73.2	0.2		39.0	42.0	0.6		0.8	
Delay (s)	47.7	42.2	30.9	111.8	22.2		72.5	75.6	26.3		33.5	
Level of Service	D	D	C	F	C		E	E	C		C	
Approach Delay (s)		38.3			55.7			56.1			33.5	
Approach LOS		D			E			E			C	

Intersection Summary			
HCM Average Control Delay	50.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	93.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



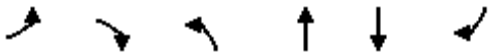
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	6	0	19	0	0	0	18	1898	0	0	724	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0					4.0	5.0			5.0	
Lane Util. Factor		1.00					1.00	0.95			0.95	
Frt		0.90					1.00	1.00			1.00	
Flt Protected		0.99					0.95	1.00			1.00	
Satd. Flow (prot)		1653					1770	3539			3527	
Flt Permitted		0.96					0.95	1.00			1.00	
Satd. Flow (perm)		1610					1770	3539			3527	
Peak-hour factor, PHF	0.79	0.79	0.79	0.92	0.92	0.92	0.98	0.98	0.98	0.95	0.95	0.95
Adj. Flow (vph)	8	0	24	0	0	0	18	1937	0	0	762	18
RTOR Reduction (vph)	0	23	0	0	0	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	9	0	0	0	0	18	1937	0	0	778	0
Turn Type	Perm			Perm			Prot					
Protected Phases		8			4		5	2			6	
Permitted Phases	8			4								
Actuated Green, G (s)		2.6					2.5	50.4			43.9	
Effective Green, g (s)		2.6					2.5	50.4			43.9	
Actuated g/C Ratio		0.04					0.04	0.81			0.71	
Clearance Time (s)		4.0					4.0	5.0			5.0	
Vehicle Extension (s)		2.5					2.0	4.0			4.0	
Lane Grp Cap (vph)		68					71	2877			2497	
v/s Ratio Prot							0.01	c0.55			0.22	
v/s Ratio Perm		c0.01										
v/c Ratio		0.13					0.25	0.67			0.31	
Uniform Delay, d1		28.6					28.8	2.4			3.4	
Progression Factor		1.00					1.25	1.76			1.00	
Incremental Delay, d2		0.6					0.6	1.0			0.3	
Delay (s)		29.3					36.6	5.3			3.7	
Level of Service		C					D	A			A	
Approach Delay (s)		29.3			0.0			5.5			3.7	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



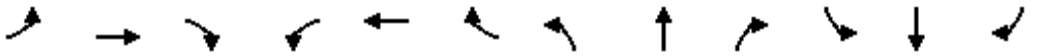
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	7	0	3	12	0	16	3	1854	21	11	706	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			4.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00			1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.96			1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.97			0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1725			1770	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.96			1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1720			1863	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.63	0.63	0.63	0.88	0.88	0.88	0.98	0.98	0.98	0.97	0.97	0.97
Adj. Flow (vph)	11	0	5	14	0	18	3	1892	21	11	728	4
RTOR Reduction (vph)	0	5	0	0	0	17	0	0	6	0	0	1
Lane Group Flow (vph)	0	11	0	0	14	1	3	1892	15	11	728	3
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4		4			2			6
Actuated Green, G (s)		3.5			2.5	2.5	1.0	45.3	45.3	1.2	45.5	45.5
Effective Green, g (s)		3.5			2.5	2.5	1.0	45.3	45.3	1.2	45.5	45.5
Actuated g/C Ratio		0.06			0.04	0.04	0.02	0.73	0.73	0.02	0.73	0.73
Clearance Time (s)		3.0			4.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5			2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)		97			75	64	29	2586	1157	34	2597	1162
v/s Ratio Prot							0.00	c0.53		c0.01	0.21	
v/s Ratio Perm		0.01			c0.01	0.00			0.01			0.00
v/c Ratio		0.12			0.19	0.01	0.10	0.73	0.01	0.32	0.28	0.00
Uniform Delay, d1		27.8			28.8	28.6	30.1	4.8	2.3	30.0	2.8	2.2
Progression Factor		1.00			1.00	1.00	1.24	0.42	0.20	0.72	2.42	2.30
Incremental Delay, d2		0.4			0.4	0.0	0.4	1.3	0.0	2.0	0.3	0.0
Delay (s)		28.2			29.2	28.6	37.7	3.4	0.5	23.7	7.0	5.1
Level of Service		C			C	C	D	A	A	C	A	A
Approach Delay (s)		28.2			28.9			3.4			7.2	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	4.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	68.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	20	103	182	1864	718	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3539	1583
Peak-hour factor, PHF	0.88	0.88	0.95	0.95	0.90	0.90
Adj. Flow (vph)	23	117	192	1962	798	29
RTOR Reduction (vph)	0	107	0	0	0	14
Lane Group Flow (vph)	23	10	192	1962	798	15
Turn Type		Perm	Prot			Perm
Protected Phases	8		5	2	6	
Permitted Phases		8				6
Actuated Green, G (s)	5.4	5.4	11.0	47.6	32.6	32.6
Effective Green, g (s)	5.4	5.4	11.0	47.6	32.6	32.6
Actuated g/C Ratio	0.09	0.09	0.18	0.77	0.53	0.53
Clearance Time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Vehicle Extension (s)	2.5	2.5	2.0	4.0	4.0	4.0
Lane Grp Cap (vph)	154	138	314	2717	1861	832
v/s Ratio Prot	c0.01		0.11	c0.55	0.23	
v/s Ratio Perm		0.01				0.01
v/c Ratio	0.15	0.07	0.61	0.72	0.43	0.02
Uniform Delay, d1	26.2	26.0	23.5	3.8	9.0	7.0
Progression Factor	1.00	1.00	0.84	1.83	0.89	0.64
Incremental Delay, d2	0.3	0.2	1.6	1.1	0.7	0.0
Delay (s)	26.5	26.2	21.4	8.0	8.8	4.5
Level of Service	C	C	C	A	A	A
Approach Delay (s)	26.2			9.2	8.6	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	9.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
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)	19	2	87	22	0	6	123	2017	33	14	846	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1550	1550	1550
Total Lost time (s)		3.5	3.5		3.5		3.5	4.1	4.1	3.5	4.1	4.1
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.96		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1781	1583		1739		1770	3539	1583	1444	2887	1292
Flt Permitted		0.77	1.00		0.76		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1431	1583		1368		1770	3539	1583	1444	2887	1292
Peak-hour factor, PHF	0.81	0.81	0.81	0.78	0.78	0.78	0.96	0.96	0.96	0.94	0.94	0.94
Adj. Flow (vph)	23	2	107	28	0	8	128	2101	34	15	900	26
RTOR Reduction (vph)	0	0	98	0	7	0	0	0	3	0	0	7
Lane Group Flow (vph)	0	25	9	0	29	0	128	2101	31	15	900	19
Turn Type	Perm		Perm	Perm			Prot		Perm	Prot		Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8		8	4					2			6
Actuated Green, G (s)		5.0	5.0		5.0		7.0	44.7	44.7	1.2	38.9	38.9
Effective Green, g (s)		5.0	5.0		5.0		7.0	44.7	44.7	1.2	38.9	38.9
Actuated g/C Ratio		0.08	0.08		0.08		0.11	0.72	0.72	0.02	0.63	0.63
Clearance Time (s)		3.5	3.5		3.5		3.5	4.1	4.1	3.5	4.1	4.1
Vehicle Extension (s)		2.0	2.0		2.0		1.0	4.0	4.0	1.5	4.0	4.0
Lane Grp Cap (vph)		115	128		110		200	2552	1141	28	1811	811
v/s Ratio Prot							c0.07	c0.59		0.01	0.31	
v/s Ratio Perm		0.02	0.01		c0.02				0.02			0.01
v/c Ratio		0.22	0.07		0.26		0.64	0.82	0.03	0.54	0.50	0.02
Uniform Delay, d1		26.7	26.3		26.8		26.3	5.9	2.5	30.1	6.3	4.4
Progression Factor		1.00	1.00		1.00		0.72	2.34	1.73	1.44	0.42	0.03
Incremental Delay, d2		0.3	0.1		0.5		2.2	1.3	0.0	9.0	0.9	0.1
Delay (s)		27.0	26.4		27.2		21.0	15.3	4.3	52.4	3.5	0.2
Level of Service		C	C		C		C	B	A	D	A	A
Approach Delay (s)		26.5			27.2			15.4			4.2	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM Average Control Delay	12.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	77.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

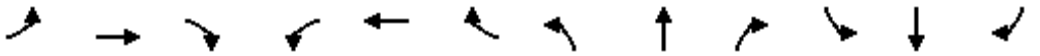
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	646	89	51	184	67	150	22	18	1408	183	8	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1500	1500
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	5.0		4.0
Lane Util. Factor	0.97	1.00		0.95	0.95	1.00		1.00	*0.92	1.00		1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00	1.00	0.76		1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
Frt	1.00	0.95		1.00	1.00	0.85		1.00	1.00	0.85		1.00
Flt Protected	0.95	1.00		0.95	0.98	1.00		0.95	1.00	1.00		0.95
Satd. Flow (prot)	3433	1761		1681	1729	1557		1770	3427	1196		1397
Flt Permitted	0.95	1.00		0.95	0.98	1.00		0.95	1.00	1.00		0.95
Satd. Flow (perm)	3433	1761		1681	1729	1557		1770	3427	1196		1397
Peak-hour factor, PHF	0.95	0.95	0.95	0.84	0.84	0.84	0.97	0.97	0.97	0.97	0.90	0.90
Adj. Flow (vph)	680	94	54	219	80	179	23	19	1452	189	9	109
RTOR Reduction (vph)	0	16	0	0	0	51	0	0	0	69	0	0
Lane Group Flow (vph)	680	132	0	147	152	128	0	42	1452	120	0	118
Confl. Peds. (#/hr)	2					2				74		74
Turn Type	Split			Split		Perm	Prot	Prot		Perm	Prot	Prot
Protected Phases	8	8		4	4		5	5	2		1	1
Permitted Phases						4				2		
Actuated Green, G (s)	29.1	29.1		15.9	15.9	15.9		6.4	48.4	48.4		13.6
Effective Green, g (s)	29.1	29.1		15.9	15.9	15.9		6.4	48.4	48.4		13.6
Actuated g/C Ratio	0.23	0.23		0.13	0.13	0.13		0.05	0.39	0.39		0.11
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	5.0		4.0
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0		2.0	3.0	3.0		2.0
Lane Grp Cap (vph)	806	413		216	222	200		91	1338	467		153
v/s Ratio Prot	c0.20	0.07		0.09	c0.09			0.02	c0.42			c0.08
v/s Ratio Perm						0.08				0.10		
v/c Ratio	0.84	0.32		0.68	0.68	0.64		0.46	1.09	0.26		0.77
Uniform Delay, d1	45.3	39.3		51.6	51.7	51.3		57.1	37.8	25.6		53.7
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.08
Incremental Delay, d2	7.7	0.2		6.8	6.8	4.8		1.3	51.2	1.3		18.1
Delay (s)	53.0	39.4		58.5	58.4	56.1		58.5	89.0	26.9		75.8
Level of Service	D	D		E	E	E		E	F	C		E
Approach Delay (s)		50.6			57.6				81.3			
Approach LOS		D			E				F			

Intersection Summary			
HCM Average Control Delay	58.5	HCM Level of Service	E
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	88.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

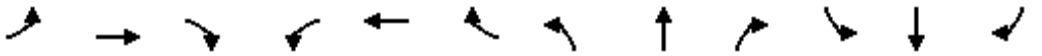
Movement	SBT	SBR
Lane Configurations		
Volume (vph)	640	181
Ideal Flow (vphpl)	1500	1500
Total Lost time (s)	5.0	5.0
Lane Util. Factor	0.95	1.00
Frpb, ped/bikes	1.00	1.00
Flpb, ped/bikes	1.00	1.00
Frt	1.00	0.85
Flt Protected	1.00	1.00
Satd. Flow (prot)	2794	1250
Flt Permitted	1.00	1.00
Satd. Flow (perm)	2794	1250
Peak-hour factor, PHF	0.90	0.90
Adj. Flow (vph)	711	201
RTOR Reduction (vph)	0	41
Lane Group Flow (vph)	711	160
Confl. Peds. (#/hr)		
Turn Type		Perm
Protected Phases	6	
Permitted Phases		6
Actuated Green, G (s)	55.6	55.6
Effective Green, g (s)	55.6	55.6
Actuated g/C Ratio	0.45	0.45
Clearance Time (s)	5.0	5.0
Vehicle Extension (s)	4.0	4.0
Lane Grp Cap (vph)	1253	560
v/s Ratio Prot	0.25	
v/s Ratio Perm		0.13
v/c Ratio	0.57	0.29
Uniform Delay, d1	25.3	21.6
Progression Factor	0.82	0.85
Incremental Delay, d2	1.7	1.2
Delay (s)	22.4	19.6
Level of Service	C	B
Approach Delay (s)	28.0	
Approach LOS	C	

Intersection Summary



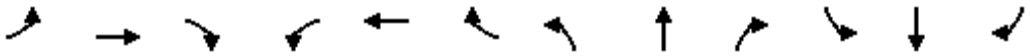
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	197	430	234	0	0	0	207	488	232	0	536	402
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5				4.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	1.00				1.00	0.95	1.00		0.95	1.00
Frt	1.00	1.00	0.85				1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00				0.95	1.00	1.00		1.00	1.00
Satd. Flow (prot)	1770	3539	1583				1770	3539	1583		3539	1583
Flt Permitted	0.95	1.00	1.00				0.95	1.00	1.00		1.00	1.00
Satd. Flow (perm)	1770	3539	1583				1770	3539	1583		3539	1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.92	0.92	0.92	0.96	0.96	0.96	0.94	0.94	0.94
Adj. Flow (vph)	216	473	257	0	0	0	216	508	242	0	570	428
RTOR Reduction (vph)	0	0	167	0	0	0	0	0	72	0	0	256
Lane Group Flow (vph)	216	473	90	0	0	0	216	508	170	0	570	172
Turn Type	Perm		Perm				Prot		Perm			Perm
Protected Phases		4					5	2			6	
Permitted Phases	4		4						2			6
Actuated Green, G (s)	16.0	16.0	16.0				12.4	44.5	44.5		28.1	28.1
Effective Green, g (s)	16.0	16.0	16.0				12.4	44.5	44.5		28.1	28.1
Actuated g/C Ratio	0.23	0.23	0.23				0.18	0.64	0.64		0.40	0.40
Clearance Time (s)	4.5	4.5	4.5				4.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	2.0	2.0	2.0				2.0	4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	405	809	362				314	2250	1006		1421	635
v/s Ratio Prot		c0.13					c0.12	0.14			c0.16	
v/s Ratio Perm	0.12		0.06						0.11			0.11
v/c Ratio	0.53	0.58	0.25				0.69	0.23	0.17		0.40	0.27
Uniform Delay, d1	23.7	24.0	22.1				27.0	5.4	5.2		14.9	14.1
Progression Factor	1.00	1.00	1.00				1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.7	0.7	0.1				4.9	0.2	0.4		0.8	1.0
Delay (s)	24.4	24.7	22.2				31.9	5.7	5.6		15.8	15.1
Level of Service	C	C	C				C	A	A		B	B
Approach Delay (s)		24.0			0.0			11.5			15.5	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM Average Control Delay	16.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	49.4%	ICU Level of Service	A
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)	54	49	265	26	0	160	0	739	15	106	664	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	1.00	1.00		1.00		0.91		1.00	0.95	
Frt		1.00	0.85	1.00		0.85		1.00		1.00	1.00	
Flt Protected		0.97	1.00	0.95		1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1815	1583	1770		1583		5070		1770	3539	
Flt Permitted		0.97	1.00	0.68		1.00		1.00		0.95	1.00	
Satd. Flow (perm)		1815	1583	1275		1583		5070		1770	3539	
Peak-hour factor, PHF	0.91	0.91	0.91	0.86	0.86	0.86	0.98	0.98	0.98	0.91	0.91	0.91
Adj. Flow (vph)	59	54	291	30	0	186	0	754	15	116	730	0
RTOR Reduction (vph)	0	0	238	0	0	159	0	3	0	0	0	0
Lane Group Flow (vph)	0	113	53	30	0	27	0	766	0	116	730	0
Turn Type	Split		Perm	custom		custom				Prot		
Protected Phases	4	4						2		1	6	
Permitted Phases			4	8		8						
Actuated Green, G (s)		9.3	9.3	7.3		7.3		14.0		4.5	22.5	
Effective Green, g (s)		9.3	9.3	7.3		7.3		14.0		4.5	22.5	
Actuated g/C Ratio		0.18	0.18	0.14		0.14		0.27		0.09	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)		330	288	182		226		1389		156	1558	
v/s Ratio Prot		c0.06						0.15		c0.07	c0.21	
v/s Ratio Perm			0.03	c0.02		0.02						
v/c Ratio		0.34	0.18	0.16		0.12		0.55		0.74	0.47	
Uniform Delay, d1		18.2	17.7	19.2		19.1		15.9		22.7	10.1	
Progression Factor		1.00	1.00	1.00		1.00		1.00		1.00	1.00	
Incremental Delay, d2		0.6	0.3	0.4		0.2		0.5		17.3	0.2	
Delay (s)		18.9	18.0	19.7		19.3		16.3		40.1	10.3	
Level of Service		B	B	B		B		B		D	B	
Approach Delay (s)		18.2			19.4			16.3			14.4	
Approach LOS		B			B			B			B	

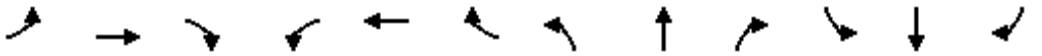
Intersection Summary			
HCM Average Control Delay	16.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	51.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	46	612	49	104	292	85	57	8	107	61	12	19
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.94	0.94	0.94	0.98	0.98	0.98	0.85	0.85	0.85
Hourly flow rate (vph)	51	680	54	111	311	90	58	8	109	72	14	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	401			734			1371	1432	707	1473	1414	356
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	401			734			1371	1432	707	1473	1414	356
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			87			39	93	75	0	88	97
cM capacity (veh/h)	1158			871			95	112	435	65	115	688

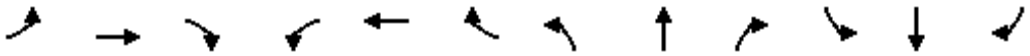
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1
Volume Total	51	734	111	401	66	109	108
Volume Left	51	0	111	0	58	0	72
Volume Right	0	54	0	90	0	109	22
cSH	1158	1700	871	1700	97	435	86
Volume to Capacity	0.04	0.43	0.13	0.24	0.69	0.25	1.26
Queue Length 95th (ft)	3	0	11	0	86	25	198
Control Delay (s)	8.3	0.0	9.7	0.0	100.3	16.0	271.1
Lane LOS	A		A		F	C	F
Approach Delay (s)	0.5		2.1		47.9		271.1
Approach LOS					E		F

Intersection Summary				
Average Delay	24.8			
Intersection Capacity Utilization	62.8%	ICU Level of Service		B
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	21	560	1296	84	234	2	166	14	116	5	24	9
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	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.95	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)	1770	1863	1583	1770	1861		1681	1698	1583		1790	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)	1770	1863	1583	1770	1861		1681	1698	1583		1790	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	23	609	1409	91	254	2	180	15	126	5	26	10
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	108	0	9	0
Lane Group Flow (vph)	23	609	1409	91	255	0	97	98	18	0	32	0
Turn Type	Prot		Free	Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			Free						2			
Actuated Green, G (s)	1.9	28.7	65.5	5.0	31.8		9.1	9.1	9.1		6.7	
Effective Green, g (s)	1.9	28.7	65.5	5.0	31.8		9.1	9.1	9.1		6.7	
Actuated g/C Ratio	0.03	0.44	1.00	0.08	0.49		0.14	0.14	0.14		0.10	
Clearance Time (s)	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	
Lane Grp Cap (vph)	51	816	1583	135	904		234	236	220		183	
v/s Ratio Prot	0.01	0.33		0.05	0.14		0.06	0.06			0.02	
v/s Ratio Perm			c0.89						0.01			
v/c Ratio	0.45	0.75	0.89	0.67	0.28		0.41	0.42	0.08		0.17	
Uniform Delay, d1	31.3	15.4	0.0	29.5	10.0		25.8	25.8	24.6		26.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	6.2	3.7	7.9	12.5	0.2		1.2	1.2	0.2		0.5	
Delay (s)	37.5	19.1	7.9	42.0	10.2		27.0	27.0	24.7		27.3	
Level of Service	D	B	A	D	B		C	C	C		C	
Approach Delay (s)		11.6			18.5			26.1			27.3	
Approach LOS		B			B			C			C	

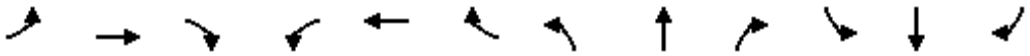
Intersection Summary			
HCM Average Control Delay	14.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	65.5	Sum of lost time (s)	0.0
Intersection Capacity Utilization	55.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	17	1109	248	176	224	3	510	6	783	19	1	9
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	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	0.88		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (prot)	1770	3539	1583	1770	3533		1681	1687	2787		1727	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (perm)	1770	3539	1583	1770	3533		1681	1687	2787		1727	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	18	1205	270	191	243	3	554	7	851	21	1	10
RTOR Reduction (vph)	0	0	110	0	1	0	0	0	592	0	8	0
Lane Group Flow (vph)	18	1205	160	191	245	0	283	278	259	0	24	0
Turn Type	Prot		Perm	Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4						2			
Actuated Green, G (s)	1.6	33.4	33.4	10.0	41.8		17.0	17.0	17.0		16.0	
Effective Green, g (s)	1.6	33.4	33.4	10.0	41.8		17.0	17.0	17.0		16.0	
Actuated g/C Ratio	0.02	0.36	0.36	0.11	0.45		0.18	0.18	0.18		0.17	
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)	31	1279	572	192	1598		309	310	513		299	
v/s Ratio Prot	0.01	c0.34		c0.11	0.07		c0.17	0.16			c0.01	
v/s Ratio Perm			0.10						0.09			
v/c Ratio	0.58	0.94	0.28	0.99	0.15		0.92	0.90	0.50		0.08	
Uniform Delay, d1	45.1	28.6	21.0	41.2	14.9		37.0	36.8	33.9		32.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	24.7	13.6	0.3	63.1	0.0		33.6	30.5	3.5		0.5	
Delay (s)	69.8	42.2	21.2	104.3	14.9		70.6	67.3	37.4		32.5	
Level of Service	E	D	C	F	B		E	E	D		C	
Approach Delay (s)		38.7			54.0			50.0			32.5	
Approach LOS		D			D			D			C	

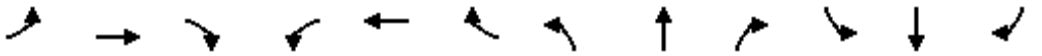
Intersection Summary			
HCM Average Control Delay	45.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	92.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Appendix C – Level of Service Worksheets: Existing plus Project Conditions



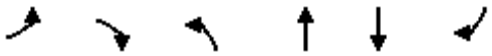
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	34	0	0	0	15	528	0	0	1338	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0					4.0	5.0			5.0	
Lane Util. Factor		1.00					1.00	0.95			0.95	
Frt		0.86					1.00	1.00			1.00	
Flt Protected		1.00					0.95	1.00			1.00	
Satd. Flow (prot)		1611					1770	3539			3536	
Flt Permitted		1.00					0.95	1.00			1.00	
Satd. Flow (perm)		1611					1770	3539			3536	
Peak-hour factor, PHF	0.65	0.65	0.65	0.92	0.92	0.92	0.79	0.79	0.79	0.66	0.66	0.66
Adj. Flow (vph)	0	0	52	0	0	0	19	668	0	0	2027	14
RTOR Reduction (vph)	0	49	0	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	3	0	0	0	0	19	668	0	0	2040	0
Turn Type	Perm			Perm			Prot					
Protected Phases		8			4		5	2			6	
Permitted Phases	8			4								
Actuated Green, G (s)		3.0					1.3	50.0			44.7	
Effective Green, g (s)		3.0					1.3	50.0			44.7	
Actuated g/C Ratio		0.05					0.02	0.81			0.72	
Clearance Time (s)		4.0					4.0	5.0			5.0	
Vehicle Extension (s)		2.5					2.0	4.0			4.0	
Lane Grp Cap (vph)		78					37	2854			2549	
v/s Ratio Prot		c0.00					c0.01	0.19			c0.58	
v/s Ratio Perm												
v/c Ratio		0.03					0.51	0.23			0.80	
Uniform Delay, d1		28.1					30.0	1.4			5.7	
Progression Factor		1.00					0.84	1.21			1.00	
Incremental Delay, d2		0.1					4.9	0.2			2.7	
Delay (s)		28.2					30.2	1.9			8.5	
Level of Service		C					C	A			A	
Approach Delay (s)		28.2			0.0			2.7			8.5	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM Average Control Delay	7.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
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)	2	0	5	17	0	9	0	593	12	7	1488	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			4.0	4.0		5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00			1.00	1.00		0.95	1.00	1.00	0.95	1.00
Frt		0.90			1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99			0.95	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1653			1770	1583		3539	1583	1770	3539	1583
Flt Permitted		0.91			1.00	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1531			1863	1583		3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.88	0.88	0.88	0.65	0.65	0.65	0.95	0.95	0.95	0.94	0.94	0.94
Adj. Flow (vph)	2	0	6	26	0	14	0	624	13	7	1583	1
RTOR Reduction (vph)	0	6	0	0	0	13	0	0	4	0	0	0
Lane Group Flow (vph)	0	2	0	0	26	1	0	624	9	7	1583	1
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4		4			2			6
Actuated Green, G (s)		3.7			2.7	2.7		45.2	45.2	1.1	50.3	50.3
Effective Green, g (s)		3.7			2.7	2.7		45.2	45.2	1.1	50.3	50.3
Actuated g/C Ratio		0.06			0.04	0.04		0.73	0.73	0.02	0.81	0.81
Clearance Time (s)		3.0			4.0	4.0		5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5			2.0	2.0		4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)		91			81	69		2580	1154	31	2871	1284
v/s Ratio Prot								0.18		0.00	c0.45	
v/s Ratio Perm		0.00			c0.01	0.00			0.01			0.00
v/c Ratio		0.03			0.32	0.01		0.24	0.01	0.23	0.55	0.00
Uniform Delay, d1		27.5			28.8	28.4		2.8	2.3	30.0	2.0	1.1
Progression Factor		1.00			1.00	1.00		1.98	2.50	0.95	2.26	1.18
Incremental Delay, d2		0.1			0.8	0.0		0.2	0.0	1.0	0.6	0.0
Delay (s)		27.5			29.6	28.4		5.7	5.7	29.4	5.1	1.3
Level of Service		C			C	C		A	A	C	A	A
Approach Delay (s)		27.5			29.2			5.7			5.2	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	5.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	52.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	22	224	94	594	1581	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3539	1583
Peak-hour factor, PHF	0.74	0.74	0.84	0.84	0.79	0.79
Adj. Flow (vph)	30	303	112	707	2001	13
RTOR Reduction (vph)	0	96	0	0	0	2
Lane Group Flow (vph)	30	207	112	707	2001	11
Turn Type		Perm	Prot			Perm
Protected Phases	8		5	2	6	
Permitted Phases		8				6
Actuated Green, G (s)	19.5	19.5	10.4	95.5	81.1	81.1
Effective Green, g (s)	19.5	19.5	10.4	95.5	81.1	81.1
Actuated g/C Ratio	0.16	0.16	0.08	0.77	0.65	0.65
Clearance Time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Vehicle Extension (s)	2.5	2.5	2.0	4.0	4.0	4.0
Lane Grp Cap (vph)	278	249	148	2726	2315	1035
v/s Ratio Prot	0.02		c0.06	0.20	c0.57	
v/s Ratio Perm		c0.13				0.01
v/c Ratio	0.11	0.83	0.76	0.26	0.86	0.01
Uniform Delay, d1	44.8	50.7	55.6	4.1	17.1	7.5
Progression Factor	1.00	1.00	0.93	1.11	1.03	1.15
Incremental Delay, d2	0.1	20.1	17.5	0.2	4.3	0.0
Delay (s)	44.9	70.7	69.0	4.8	21.9	8.6
Level of Service	D	E	E	A	C	A
Approach Delay (s)	68.4			13.6	21.8	
Approach LOS	E			B	C	

Intersection Summary			
HCM Average Control Delay	24.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	65.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	58	5	119	66	24	10	26	75	505	46	39	1871
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1550	1550
Total Lost time (s)		3.5	3.5		3.5			3.5	4.1	4.1	3.5	4.1
Lane Util. Factor		1.00	1.00		1.00			*0.92	0.95	1.00	1.00	0.95
Frt		1.00	0.85		0.99			1.00	1.00	0.85	1.00	1.00
Flt Protected		0.96	1.00		0.97			0.95	1.00	1.00	0.95	1.00
Satd. Flow (prot)		1781	1583		1779			1628	3539	1583	1444	2887
Flt Permitted		0.68	1.00		0.71			0.95	1.00	1.00	0.95	1.00
Satd. Flow (perm)		1260	1583		1302			1628	3539	1583	1444	2887
Peak-hour factor, PHF	0.88	0.88	0.88	0.75	0.75	0.75	0.92	0.94	0.94	0.94	0.97	0.97
Adj. Flow (vph)	66	6	135	88	32	13	28	80	537	49	40	1929
RTOR Reduction (vph)	0	0	93	0	3	0	0	0	0	13	0	0
Lane Group Flow (vph)	0	72	42	0	130	0	0	108	537	36	40	1929
Turn Type	Perm		Perm	Perm			Prot	Prot		Perm	Prot	
Protected Phases		8			4		5	5	2		1	6
Permitted Phases	8		8	4						2		
Actuated Green, G (s)		15.7	15.7		15.7			11.7	90.6	90.6	6.6	85.5
Effective Green, g (s)		15.7	15.7		15.7			11.7	90.6	90.6	6.6	85.5
Actuated g/C Ratio		0.13	0.13		0.13			0.09	0.73	0.73	0.05	0.69
Clearance Time (s)		3.5	3.5		3.5			3.5	4.1	4.1	3.5	4.1
Vehicle Extension (s)		2.0	2.0		2.0			1.0	4.0	4.0	1.5	4.0
Lane Grp Cap (vph)		160	200		165			154	2586	1157	77	1991
v/s Ratio Prot								c0.07	0.15		0.03	c0.67
v/s Ratio Perm		0.06	0.03		c0.10					0.02		
v/c Ratio		0.45	0.21		0.78			0.70	0.21	0.03	0.52	0.97
Uniform Delay, d1		50.2	48.6		52.5			54.5	5.3	4.6	57.2	18.0
Progression Factor		1.00	1.00		1.00			0.88	1.48	2.92	1.19	0.43
Incremental Delay, d2		0.7	0.2		19.8			10.1	0.2	0.0	1.2	8.6
Delay (s)		50.9	48.8		72.3			57.8	8.0	13.5	69.4	16.4
Level of Service		D	D		E			E	A	B	E	B
Approach Delay (s)		49.5			72.3				16.2			16.9
Approach LOS		D			E				B			B

Intersection Summary			
HCM Average Control Delay	21.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	11.1
Intersection Capacity Utilization	95.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR
Lane Configurations	
Volume (vph)	71
Ideal Flow (vphpl)	1550
Total Lost time (s)	4.1
Lane Util. Factor	1.00
Frt	0.85
Flt Protected	1.00
Satd. Flow (prot)	1292
Flt Permitted	1.00
Satd. Flow (perm)	1292
Peak-hour factor, PHF	0.97
Adj. Flow (vph)	73
RTOR Reduction (vph)	6
Lane Group Flow (vph)	67
Turn Type	Perm
Protected Phases	
Permitted Phases	6
Actuated Green, G (s)	85.5
Effective Green, g (s)	85.5
Actuated g/C Ratio	0.69
Clearance Time (s)	4.1
Vehicle Extension (s)	4.0
Lane Grp Cap (vph)	891
v/s Ratio Prot	
v/s Ratio Perm	0.05
v/c Ratio	0.08
Uniform Delay, d1	6.3
Progression Factor	0.27
Incremental Delay, d2	0.1
Delay (s)	1.8
Level of Service	A
Approach Delay (s)	
Approach LOS	

Intersection Summary

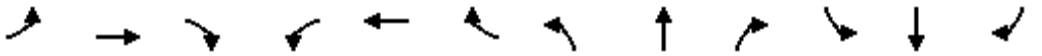
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	162	51	44	236	102	42	49	107	571	182	49	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1500	1500
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	5.0		4.0
Lane Util. Factor	0.97	1.00		0.95	0.95	1.00		1.00	0.95	1.00		1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00	1.00	0.76		1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
Frt	1.00	0.93		1.00	1.00	0.85		1.00	1.00	0.85		1.00
Flt Protected	0.95	1.00		0.95	0.98	1.00		0.95	1.00	1.00		0.95
Satd. Flow (prot)	3433	1733		1681	1735	1559		1770	3539	1196		1397
Flt Permitted	0.95	1.00		0.95	0.98	1.00		0.95	1.00	1.00		0.95
Satd. Flow (perm)	3433	1733		1681	1735	1559		1770	3539	1196		1397
Peak-hour factor, PHF	0.54	0.54	0.54	0.67	0.67	0.67	0.64	0.64	0.64	0.64	0.78	0.78
Adj. Flow (vph)	300	94	81	352	152	63	77	167	892	284	63	95
RTOR Reduction (vph)	0	28	0	0	0	52	0	0	0	166	0	0
Lane Group Flow (vph)	300	147	0	250	254	11	0	244	892	118	0	158
Confl. Peds. (#/hr)	2					2				74		74
Turn Type	Split			Split		Perm	Prot	Prot		Perm	Prot	Prot
Protected Phases	8	8		4	4		5	5	2		1	1
Permitted Phases						4				2		
Actuated Green, G (s)	15.9	15.9		21.8	21.8	21.8		26.0	50.9	50.9		18.4
Effective Green, g (s)	15.9	15.9		21.8	21.8	21.8		26.0	50.9	50.9		18.4
Actuated g/C Ratio	0.13	0.13		0.18	0.18	0.18		0.21	0.41	0.41		0.15
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	5.0		4.0
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0		2.0	3.0	3.0		2.0
Lane Grp Cap (vph)	440	222		296	305	274		371	1453	491		207
v/s Ratio Prot	c0.09	0.08		c0.15	0.15			c0.14	0.25			c0.11
v/s Ratio Perm						0.01				0.10		
v/c Ratio	0.68	0.66		0.84	0.83	0.04		0.66	0.61	0.24		0.76
Uniform Delay, d1	51.6	51.5		49.5	49.3	42.4		44.9	28.8	23.9		50.7
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		0.85
Incremental Delay, d2	3.5	5.7		18.6	16.7	0.0		3.2	1.9	1.2		9.7
Delay (s)	55.1	57.1		68.1	66.0	42.4		48.1	30.8	25.1		52.7
Level of Service	E	E		E	E	D		D	C	C		D
Approach Delay (s)		55.8			64.3				32.6			
Approach LOS		E			E				C			

Intersection Summary			
HCM Average Control Delay	215.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	85.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations		
Volume (vph)	1421	553
Ideal Flow (vphpl)	1500	1500
Total Lost time (s)	5.0	5.0
Lane Util. Factor	0.95	1.00
Frpb, ped/bikes	1.00	1.00
Flpb, ped/bikes	1.00	1.00
Frt	1.00	0.85
Flt Protected	1.00	1.00
Satd. Flow (prot)	2794	1250
Flt Permitted	1.00	1.00
Satd. Flow (perm)	2794	1250
Peak-hour factor, PHF	0.78	0.78
Adj. Flow (vph)	1822	709
RTOR Reduction (vph)	0	64
Lane Group Flow (vph)	1822	645
Confl. Peds. (#/hr)		
Turn Type		Perm
Protected Phases	6	
Permitted Phases		6
Actuated Green, G (s)	43.3	43.3
Effective Green, g (s)	43.3	43.3
Actuated g/C Ratio	0.35	0.35
Clearance Time (s)	5.0	5.0
Vehicle Extension (s)	4.0	4.0
Lane Grp Cap (vph)	976	436
v/s Ratio Prot	c0.65	
v/s Ratio Perm		0.52
v/c Ratio	1.87	1.48
Uniform Delay, d1	40.4	40.4
Progression Factor	1.17	1.21
Incremental Delay, d2	392.7	223.6
Delay (s)	439.8	272.3
Level of Service	F	F
Approach Delay (s)	372.9	
Approach LOS	F	

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	212	216	60	0	0	0	224	700	396	0	505	584
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5				4.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	1.00				1.00	0.95	1.00		0.95	1.00
Frt	1.00	1.00	0.85				1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00				0.95	1.00	1.00		1.00	1.00
Satd. Flow (prot)	1770	3539	1583				1770	3539	1583		3539	1583
Flt Permitted	0.95	1.00	1.00				0.95	1.00	1.00		1.00	1.00
Satd. Flow (perm)	1770	3539	1583				1770	3539	1583		3539	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.92	0.92	0.92	0.96	0.96	0.96	0.94	0.94	0.94
Adj. Flow (vph)	236	240	67	0	0	0	233	729	412	0	537	621
RTOR Reduction (vph)	0	0	53	0	0	0	0	0	113	0	0	366
Lane Group Flow (vph)	236	240	14	0	0	0	233	729	299	0	537	255
Turn Type	Perm		Perm				Prot		Perm			Perm
Protected Phases		4					5	2			6	
Permitted Phases	4		4						2			6
Actuated Green, G (s)	14.3	14.3	14.3				13.5	46.2	46.2		28.7	28.7
Effective Green, g (s)	14.3	14.3	14.3				13.5	46.2	46.2		28.7	28.7
Actuated g/C Ratio	0.20	0.20	0.20				0.19	0.66	0.66		0.41	0.41
Clearance Time (s)	4.5	4.5	4.5				4.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	2.0	2.0	2.0				2.0	4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	362	723	323				341	2336	1045		1451	649
v/s Ratio Prot		0.07					c0.13	0.21			0.15	
v/s Ratio Perm	c0.13		0.01						0.19			c0.16
v/c Ratio	0.65	0.33	0.04				0.68	0.31	0.29		0.37	0.39
Uniform Delay, d1	25.6	23.8	22.4				26.3	5.1	5.0		14.4	14.5
Progression Factor	1.00	1.00	1.00				1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	3.2	0.1	0.0				4.5	0.3	0.7		0.7	1.8
Delay (s)	28.8	23.9	22.4				30.7	5.4	5.7		15.1	16.3
Level of Service	C	C	C				C	A	A		B	B
Approach Delay (s)		25.8			0.0			9.8			15.7	
Approach LOS		C			A			A			B	

Intersection Summary			
HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Volume (vph)	16	32	132	12	0	137	0	1028	20	8	76	457
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	1.00	1.00		1.00		0.91			1.00	0.95
Frt		1.00	0.85	1.00		0.85		1.00			1.00	1.00
Flt Protected		0.98	1.00	0.95		1.00		1.00			0.95	1.00
Satd. Flow (prot)		1833	1583	1770		1583		5070			1770	3539
Flt Permitted		0.98	1.00	0.74		1.00		1.00			0.98	1.00
Satd. Flow (perm)		1833	1583	1380		1583		5070			1817	3539
Peak-hour factor, PHF	0.87	0.87	0.87	0.86	0.86	0.86	0.97	0.97	0.97	0.92	0.96	0.96
Adj. Flow (vph)	18	37	152	14	0	159	0	1060	21	9	79	476
RTOR Reduction (vph)	0	0	136	0	0	143	0	2	0	0	0	0
Lane Group Flow (vph)	0	55	16	14	0	16	0	1079	0	0	88	476
Turn Type	Split		Perm	custom		custom				custom	Prot	
Protected Phases	4	4						2			1	6
Permitted Phases			4	8		8				1		
Actuated Green, G (s)		5.8	5.8	5.4		5.4		23.2			4.1	31.3
Effective Green, g (s)		5.8	5.8	5.4		5.4		23.2			4.1	31.3
Actuated g/C Ratio		0.11	0.11	0.10		0.10		0.43			0.08	0.57
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)		195	168	137		157		2158			137	2032
v/s Ratio Prot		c0.03						c0.21				0.13
v/s Ratio Perm			0.01	c0.01		0.01					c0.05	
v/c Ratio		0.28	0.10	0.10		0.10		0.50			0.64	0.23
Uniform Delay, d1		22.4	22.0	22.3		22.3		11.4			24.5	5.7
Progression Factor		1.00	1.00	1.00		1.00		1.00			1.00	1.00
Incremental Delay, d2		0.8	0.3	0.3		0.3		0.2			9.9	0.1
Delay (s)		23.2	22.2	22.7		22.6		11.6			34.4	5.8
Level of Service		C	C	C		C		B			C	A
Approach Delay (s)		22.5			22.6			11.6				10.2
Approach LOS		C			C			B				B

Intersection Summary			
HCM Average Control Delay	13.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	54.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	50.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

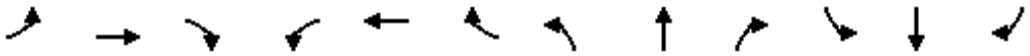
Movement	SBR
Lane Configurations	
Volume (vph)	0
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.96
Adj. Flow (vph)	0
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	26	209	48	172	657	36	85	12	76	28	8	52
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.94	0.94	0.94	0.98	0.98	0.98	0.85	0.85	0.85
Hourly flow rate (vph)	29	232	53	183	699	38	87	12	78	33	9	61
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	737			286			1447	1420	259	1458	1427	718
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	737			286			1447	1420	259	1458	1427	718
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			86			0	89	90	57	92	86
cM capacity (veh/h)	869			1277			76	113	780	77	112	429

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1
Volume Total	29	286	183	737	99	78	104
Volume Left	29	0	183	0	87	0	33
Volume Right	0	53	0	38	0	78	61
cSH	869	1700	1277	1700	79	780	158
Volume to Capacity	0.03	0.17	0.14	0.43	1.25	0.10	0.65
Queue Length 95th (ft)	3	0	13	0	186	8	92
Control Delay (s)	9.3	0.0	8.3	0.0	274.7	10.1	62.7
Lane LOS	A		A		F	B	F
Approach Delay (s)	0.9		1.6		158.5		62.7
Approach LOS					F		F

Intersection Summary				
Average Delay	23.9			
Intersection Capacity Utilization	62.1%	ICU Level of Service	B	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	26	209	48	172	657	36	85	12	76	28	8	52
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	1.00		1.00	1.00			1.00	1.00		1.00	
Frt	1.00	0.97		1.00	0.99			1.00	0.85		0.92	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.98	
Satd. Flow (prot)	1770	1811		1770	1848			1784	1583		1687	
Flt Permitted	0.17	1.00		0.56	1.00			0.73	1.00		0.91	
Satd. Flow (perm)	325	1811		1043	1848			1358	1583		1557	
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.98	0.98	0.98	0.85	0.85	0.85
Adj. Flow (vph)	29	232	53	183	699	38	87	12	78	33	9	61
RTOR Reduction (vph)	0	17	0	0	4	0	0	0	50	0	39	0
Lane Group Flow (vph)	29	268	0	183	733	0	0	99	28	0	64	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	27.5	27.5		27.5	27.5			19.5	19.5		19.5	
Effective Green, g (s)	27.5	27.5		27.5	27.5			19.5	19.5		19.5	
Actuated g/C Ratio	0.50	0.50		0.50	0.50			0.35	0.35		0.35	
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)	162	905		521	924			481	561		552	
v/s Ratio Prot		0.15			c0.40							
v/s Ratio Perm	0.09			0.18				c0.07	0.02		0.04	
v/c Ratio	0.18	0.30		0.35	0.79			0.21	0.05		0.12	
Uniform Delay, d1	7.6	8.1		8.3	11.4			12.4	11.7		11.9	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.5	0.2		0.4	4.7			1.0	0.2		0.4	
Delay (s)	8.1	8.3		8.8	16.1			13.3	11.8		12.4	
Level of Service	A	A		A	B			B	B		B	
Approach Delay (s)		8.2			14.7			12.7			12.4	
Approach LOS		A			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

INTERSECTION SUMMARY

Site: Int #8 Ex Plus Proj AM

Roundabout with 5 legs, and 1-lane approaches and circulating road

Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	30.9	mph	30.9	mph
Travel Distance (Total)	961.3	veh-mi/h	1153.5	pers-mi/h
Travel Time (Total)	31.1	veh-h/h	37.4	pers-h/h
Demand Flows (Total)	1534	veh/h	1840	pers/h
Percent Heavy Vehicles (Demand)	0.3	%		
Degree of Saturation	0.748			
Practical Spare Capacity	13.6	%		
Effective Intersection Capacity	2049	veh/h		
Control Delay (Total)	4.77	veh-h/h	5.72	pers-h/h
Control Delay (Average)	11.2	sec	11.2	sec
Control Delay (Worst Lane)	14.6	sec		
Control Delay (Worst Movement)	14.6	sec	14.6	sec
Geometric Delay (Average)	0.0	sec		
Stop-Line Delay (Average)	11.2	sec		
Idling Time (Average)	8.1	sec		
Intersection Level of Service (LOS)	LOS B			
95% Back of Queue - Vehicles (Worst Lane)	8.9	veh		
95% Back of Queue - Distance (Worst Lane)	223.6	ft		
Queue Storage Ratio (Worst Lane)	0.18			
Total Effective Stops	657	veh/h	789	pers/h
Effective Stop Rate	0.43	per veh	0.43	per pers
Proportion Queued	0.63		0.63	
Performance Index	55.6		55.6	
Cost (Total)	465.51	$/h	465.51	$/h
Fuel Consumption (Total)	36.3	gal/h		
Carbon Dioxide (Total)	322.7	kg/h		
Hydrocarbons (Total)	0.124	kg/h		
Carbon Monoxide (Total)	1.720	kg/h		
NOx (Total)	0.315	kg/h		

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	736,174	veh/y	883,409	pers/y
Delay	2,290	veh-h/y	2,748	pers-h/y
Effective Stops	315,508	veh/y	378,609	pers/y
Travel Distance	461,417	veh-mi/y	553,700	pers-mi/y
Travel Time	14,942	veh-h/y	17,930	pers-h/y
Cost	223,443	$/y	223,443	$/y
Fuel Consumption	17,400	gal/y		
Carbon Dioxide	154,907	kg/y		
Hydrocarbons	60	kg/y		
Carbon Monoxide	826	kg/y		
NOx	151	kg/y		

MOVEMENT SUMMARY

Site: Int #8 Ex Plus Proj AM

Roundabout with 5 legs, and 1-lane approaches and circulating road

Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Brown Ave											
7	L2	92	0.0	0.173	4.9	LOS A	0.8	20.2	0.44	0.32	33.2
7a	L1	11	0.0	0.173	4.9	LOS A	0.8	20.2	0.44	0.32	32.9
14a	R1	2	0.0	0.173	4.9	LOS A	0.8	20.2	0.44	0.32	33.0
14	R2	83	0.0	0.173	4.9	LOS A	0.8	20.2	0.44	0.32	32.5
Approach		188	0.0	0.173	4.9	LOS A	0.8	20.2	0.44	0.32	32.8
East: Deer Hill Road											
5	L2	187	0.0	0.748	14.6	LOS B	8.9	223.6	0.73	0.47	29.6
2	T1	714	0.5	0.748	14.6	LOS B	8.9	223.6	0.73	0.47	29.7
12a	R1	32	0.0	0.748	14.6	LOS B	8.9	223.6	0.73	0.47	29.5
12b	R3	8	0.0	0.748	14.6	LOS B	8.9	223.6	0.73	0.47	28.9
Approach		940	0.3	0.748	14.6	LOS B	8.9	223.6	0.73	0.47	29.7
NorthEast: Brown Ave											
5bx	L3	7	0.0	0.040	7.5	LOS A	0.1	3.7	0.66	0.64	32.4
5ax	L1	2	0.0	0.040	7.5	LOS A	0.1	3.7	0.66	0.64	31.9
12ax	R1	11	0.0	0.040	7.5	LOS A	0.1	3.7	0.66	0.64	32.0
12x	R2	1	0.0	0.040	7.5	LOS A	0.1	3.7	0.66	0.64	31.5
Approach		21	0.0	0.040	7.5	LOS A	0.1	3.7	0.66	0.64	32.1
NorthWest: Miller Dr											
3x	L2	1	0.0	0.146	8.7	LOS A	0.6	14.0	0.68	0.68	31.9
3ax	L1	24	0.0	0.146	8.7	LOS A	0.6	14.0	0.68	0.68	31.6
18ax	R1	7	0.0	0.146	8.7	LOS A	0.6	14.0	0.68	0.68	31.7
18bx	R3	46	0.0	0.146	8.7	LOS A	0.6	14.0	0.68	0.68	31.0
Approach		77	0.0	0.146	8.7	LOS A	0.6	14.0	0.68	0.68	31.3
West: Deer Hill Road											
1b	L3	8	0.0	0.268	5.6	LOS A	1.4	34.9	0.43	0.30	34.1
1a	L1	21	0.0	0.268	5.6	LOS A	1.4	34.9	0.43	0.30	33.5
6	T1	227	0.5	0.268	5.6	LOS A	1.4	34.9	0.43	0.30	33.9
16	R2	52	0.0	0.268	5.6	LOS A	1.4	34.9	0.43	0.30	33.1
Approach		308	0.4	0.268	5.6	LOS A	1.4	34.9	0.43	0.30	33.7
All Vehicles		1534	0.3	0.748	11.2	LOS B	8.9	223.6	0.63	0.43	30.9

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

LEVEL OF SERVICE

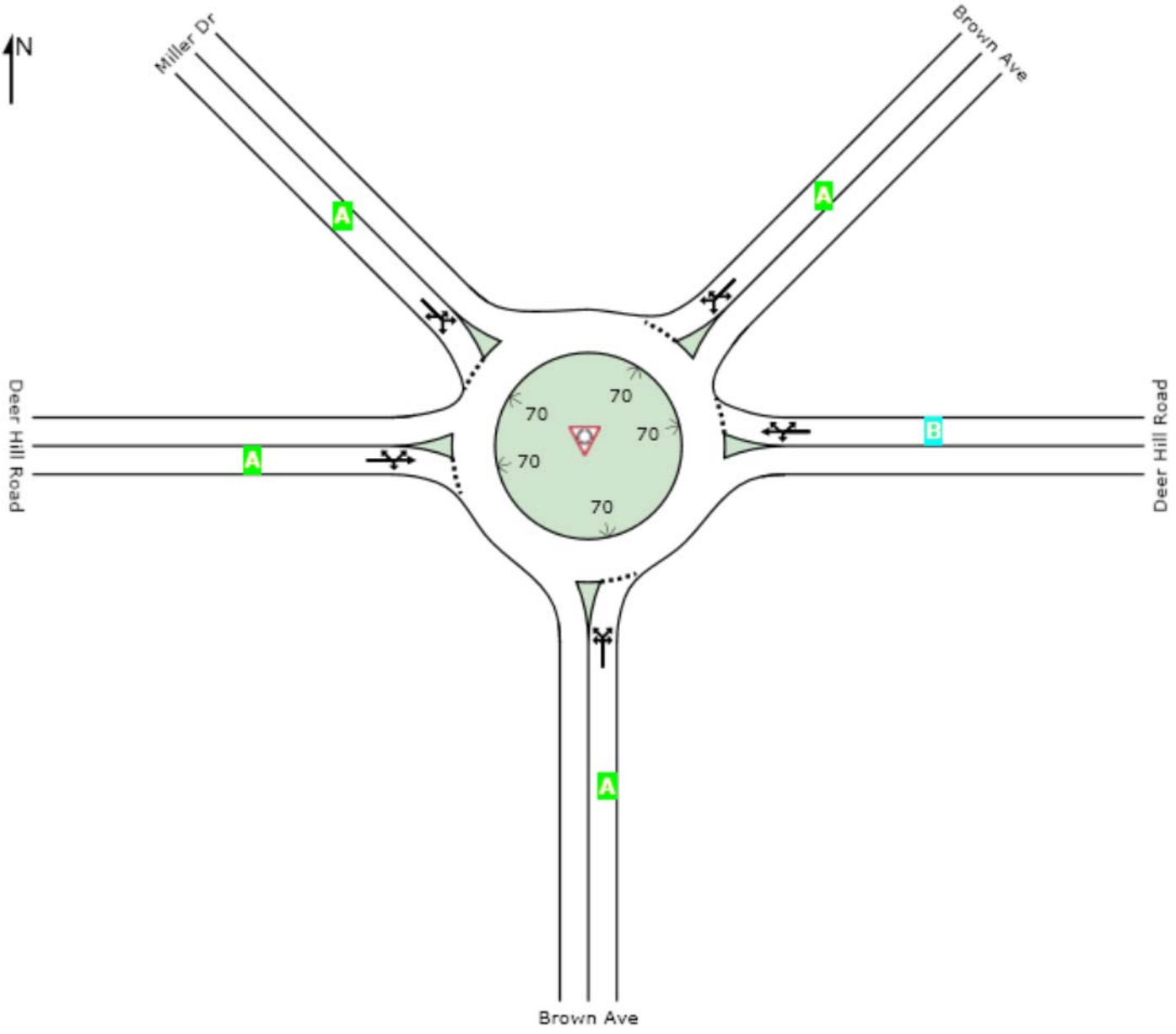
Site: Int #8 Ex Plus Proj AM

Roundabout with 5 legs, and 1-lane approaches and circulating road

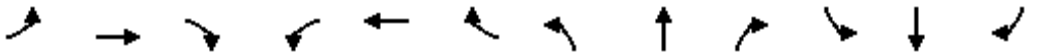
Roundabout

All Movement Classes

	South	East	Northeast	Northwest	West	Intersection
LOS	A	B	A	A	A	B

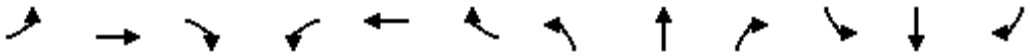


Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.



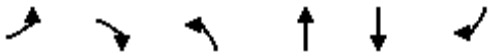
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	248	900	141	456	3	261	13	82	8	21	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.95	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)	1770	1863	1583	1770	1861		1681	1693	1583		1732	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)	1770	1863	1583	1770	1861		1681	1693	1583		1732	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	270	978	153	496	3	284	14	89	9	23	28
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	72	0	25	0
Lane Group Flow (vph)	27	270	978	153	499	0	148	150	17	0	35	0
Turn Type	Prot		Free	Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			Free						2			
Actuated Green, G (s)	1.4	15.2	54.5	6.1	19.9		10.4	10.4	10.4		6.8	
Effective Green, g (s)	1.4	15.2	54.5	6.1	19.9		10.4	10.4	10.4		6.8	
Actuated g/C Ratio	0.03	0.28	1.00	0.11	0.37		0.19	0.19	0.19		0.12	
Clearance Time (s)	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	
Lane Grp Cap (vph)	45	520	1583	198	680		321	323	302		216	
v/s Ratio Prot	0.02	0.14		0.09	c0.27		0.09	0.09			0.02	
v/s Ratio Perm			c0.62						0.01			
v/c Ratio	0.60	0.52	0.62	0.77	0.73		0.46	0.46	0.06		0.16	
Uniform Delay, d1	26.3	16.6	0.0	23.5	15.0		19.6	19.6	18.0		21.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	19.7	0.9	1.8	16.9	4.1		1.1	1.1	0.1		0.4	
Delay (s)	46.0	17.4	1.8	40.4	19.1		20.6	20.6	18.1		21.7	
Level of Service	D	B	A	D	B		C	C	B		C	
Approach Delay (s)		6.1			24.1			20.0			21.7	
Approach LOS		A			C			C			C	

Intersection Summary			
HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	54.5	Sum of lost time (s)	0.0
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
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)	1	548	284	292	487	3	882	8	537	18	6	9
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	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	0.88		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (prot)	1770	3539	1583	1770	3536		1681	1687	2787		1747	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (perm)	1770	3539	1583	1770	3536		1681	1687	2787		1747	
Peak-hour factor, PHF	0.91	0.91	0.91	0.88	0.88	0.88	0.95	0.95	0.95	0.69	0.69	0.69
Adj. Flow (vph)	1	602	312	332	553	3	928	8	565	26	9	13
RTOR Reduction (vph)	0	0	248	0	1	0	0	0	407	0	11	0
Lane Group Flow (vph)	1	602	64	332	555	0	464	472	158	0	37	0
Turn Type	Prot		Perm	Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4						2			
Actuated Green, G (s)	0.8	19.2	19.2	16.0	34.4		26.0	26.0	26.0		16.0	
Effective Green, g (s)	0.8	19.2	19.2	16.0	34.4		26.0	26.0	26.0		16.0	
Actuated g/C Ratio	0.01	0.21	0.21	0.17	0.37		0.28	0.28	0.28		0.17	
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)	15	729	326	304	1305		469	471	777		300	
v/s Ratio Prot	0.00	c0.17		c0.19	0.16		0.28	c0.28			c0.02	
v/s Ratio Perm			0.04						0.06			
v/c Ratio	0.07	0.83	0.20	1.09	0.43		0.99	1.00	0.20		0.12	
Uniform Delay, d1	45.8	35.4	30.6	38.6	22.0		33.5	33.6	25.7		32.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	1.9	7.6	0.3	78.5	0.2		39.0	42.0	0.6		0.8	
Delay (s)	47.7	43.0	30.9	117.1	22.2		72.5	75.6	26.3		33.5	
Level of Service	D	D	C	F	C		E	E	C		C	
Approach Delay (s)		38.9			57.7			56.1			33.5	
Approach LOS		D			E			E			C	

Intersection Summary			
HCM Average Control Delay	51.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	93.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	53	0	966	1682	27
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	58	0	1050	1828	29
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					244	
pX, platoon unblocked	0.67	0.67	0.67			
vC, conflicting volume	2193	929	1858			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1788	0	1285			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	92	100			
cM capacity (veh/h)	48	722	357			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	58	350	350	350	1219	639
Volume Left	0	0	0	0	0	0
Volume Right	58	0	0	0	0	29
cSH	722	1700	1700	1700	1700	1700
Volume to Capacity	0.08	0.21	0.21	0.21	0.72	0.38
Queue Length 95th (ft)	6	0	0	0	0	0
Control Delay (s)	10.4	0.0	0.0	0.0	0.0	0.0
Lane LOS	B					
Approach Delay (s)	10.4	0.0			0.0	
Approach LOS	B					

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	331	0	0	803	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	360	0	0	873	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				652		
pX, platoon unblocked						
vC, conflicting volume			360		1233	360
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			360		1233	360
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1199		195	685

Direction, Lane #	EB 1	WB 1	NW 1
Volume Total	360	873	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1199	1700
Volume to Capacity	0.21	0.00	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	0.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	45.6%	ICU Level of Service	A
Analysis Period (min)	15		

INTERSECTION SUMMARY

Site: Int #13 - Existing Plus Project AM

Roundabout with 1-lane approaches and circulating road
MUTCD (FHWA 2009) example number: 2B-22
Roundabout Guide (TRB 2010) example number: A-1
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	31.8	mph	31.8	mph
Travel Distance (Total)	778.1	veh-mi/h	933.7	pers-mi/h
Travel Time (Total)	24.4	veh-h/h	29.3	pers-h/h
Demand Flows (Total)	1254	veh/h	1505	pers/h
Percent Heavy Vehicles (Demand)	0.4	%		
Degree of Saturation	0.618			
Practical Spare Capacity	37.5	%		
Effective Intersection Capacity	2029	veh/h		
Control Delay (Total)	2.82	veh-h/h	3.39	pers-h/h
Control Delay (Average)	8.1	sec	8.1	sec
Control Delay (Worst Lane)	9.7	sec		
Control Delay (Worst Movement)	9.7	sec	9.7	sec
Geometric Delay (Average)	0.0	sec		
Stop-Line Delay (Average)	8.1	sec		
Idling Time (Average)	7.3	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	6.6	veh		
95% Back of Queue - Distance (Worst Lane)	165.7	ft		
Queue Storage Ratio (Worst Lane)	0.14			
Total Effective Stops	61	veh/h	74	pers/h
Effective Stop Rate	0.05	per veh	0.05	per pers
Proportion Queued	0.16		0.16	
Performance Index	35.6		35.6	
Cost (Total)	355.00	$/h	355.00	$/h
Fuel Consumption (Total)	28.6	gal/h		
Carbon Dioxide (Total)	254.9	kg/h		
Hydrocarbons (Total)	0.095	kg/h		
Carbon Monoxide (Total)	1.365	kg/h		
NOx (Total)	0.263	kg/h		

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	602,087	veh/y	722,504	pers/y
Delay	1,355	veh-h/y	1,626	pers-h/y
Effective Stops	29,406	veh/y	35,288	pers/y
Travel Distance	373,489	veh-mi/y	448,186	pers-mi/y
Travel Time	11,733	veh-h/y	14,080	pers-h/y
Cost	170,401	$/y	170,401	$/y
Fuel Consumption	13,737	gal/y		
Carbon Dioxide	122,350	kg/y		
Hydrocarbons	46	kg/y		
Carbon Monoxide	655	kg/y		
NOx	126	kg/y		

MOVEMENT SUMMARY

Site: Int #13 - Existing Plus Project AM

Roundabout with 1-lane approaches and circulating road
MUTCD (FHWA 2009) example number: 2B-22
Roundabout Guide (TRB 2010) example number: A-1
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Homes Dwy.											
3	L2	12	0.0	0.034	3.8	LOS A	0.1	3.5	0.42	0.28	33.2
8	T1	1	0.0	0.034	3.8	LOS A	0.1	3.5	0.42	0.28	33.5
18	R2	22	0.0	0.034	3.8	LOS A	0.1	3.5	0.42	0.28	32.8
Approach		35	0.0	0.034	3.8	LOS A	0.1	3.5	0.42	0.28	33.0
East: Deer Hill Rd.											
1	L2	7	0.0	0.618	9.7	LOS A	6.6	165.7	0.18	0.05	30.9
6	T1	860	0.5	0.618	9.7	LOS A	6.6	165.7	0.18	0.05	31.2
16	R2	7	0.0	0.618	9.7	LOS A	6.6	165.7	0.18	0.05	30.6
Approach		873	0.5	0.618	9.7	LOS A	6.6	165.7	0.18	0.05	31.2
North: Dog Park Dwy.											
7	L2	4	0.0	0.011	6.1	LOS A	0.0	1.0	0.62	0.50	31.6
4	T1	1	0.0	0.011	6.1	LOS A	0.0	1.0	0.62	0.50	31.9
14	R2	1	0.0	0.011	6.1	LOS A	0.0	1.0	0.62	0.50	31.3
Approach		7	0.0	0.011	6.1	LOS A	0.0	1.0	0.62	0.50	31.6
West: Deer Hill Rd.											
5	L2	2	0.0	0.240	4.5	LOS A	1.3	33.2	0.08	0.02	33.3
2	T1	334	0.3	0.240	4.5	LOS A	1.3	33.2	0.08	0.02	33.6
12	R2	4	0.0	0.240	4.5	LOS A	1.3	33.2	0.08	0.02	33.0
Approach		340	0.3	0.240	4.5	LOS A	1.3	33.2	0.08	0.02	33.6
All Vehicles		1254	0.4	0.618	8.1	LOS A	6.6	165.7	0.16	0.05	31.8

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

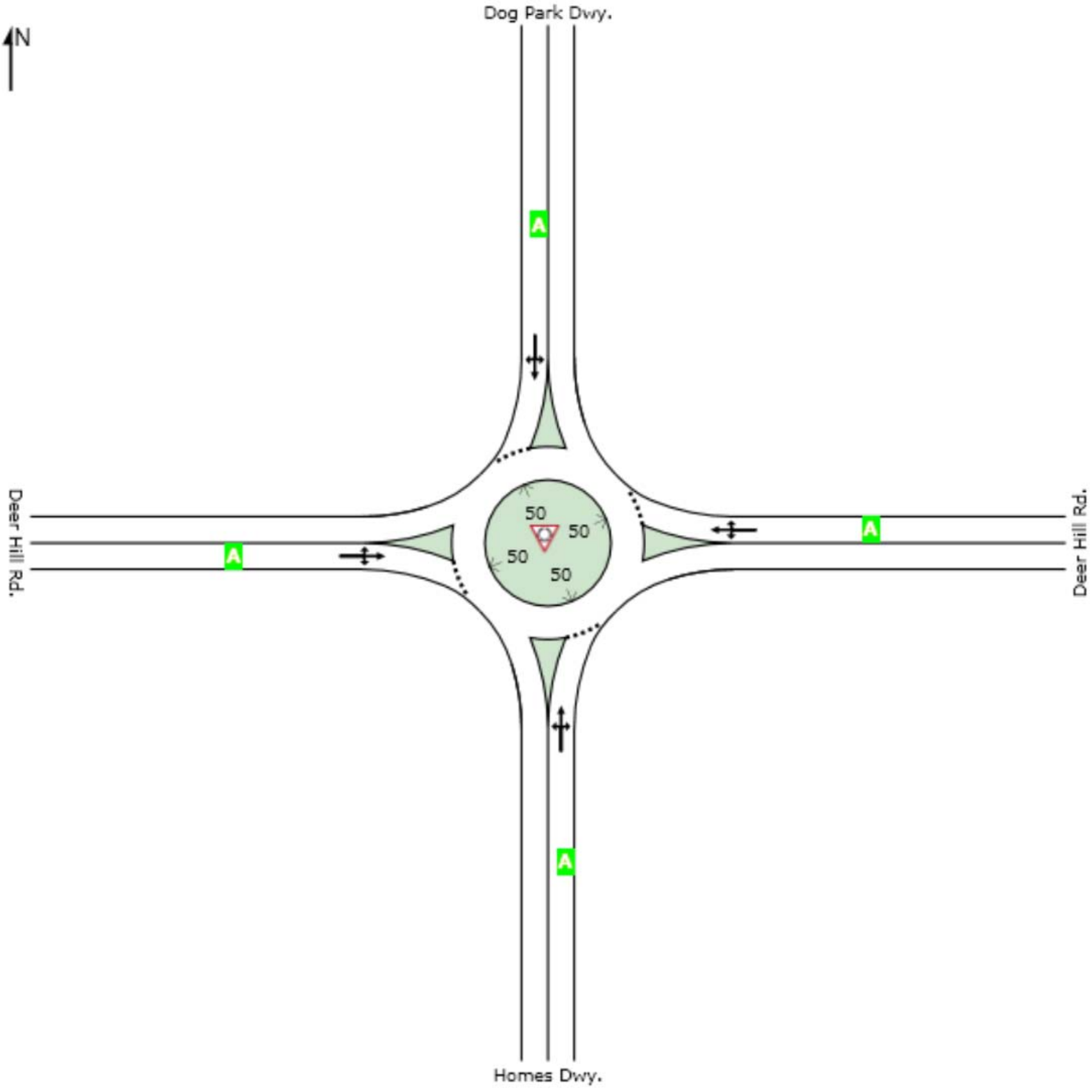
LEVEL OF SERVICE

Site: Int #13 - Existing Plus Project AM

Roundabout with 1-lane approaches and circulating road
MUTCD (FHWA 2009) example number: 2B-22
Roundabout Guide (TRB 2010) example number: A-1
Roundabout

All Movement Classes

	South	East	North	West	Intersection
LOS	A	A	A	A	A

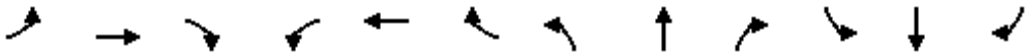


Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	301	30	0	803	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	327	33	0	873	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				372		
pX, platoon unblocked						
vC, conflicting volume			360		1216	343
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			360		1216	343
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1199		200	699

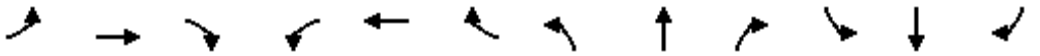
Direction, Lane #	EB 1	WB 1
Volume Total	360	873
Volume Left	0	0
Volume Right	33	0
cSH	1700	1700
Volume to Capacity	0.21	0.51
Queue Length 95th (ft)	0	0
Control Delay (s)	0.0	0.0
Lane LOS		
Approach Delay (s)	0.0	0.0
Approach LOS		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	45.6%	ICU Level of Service	A
Analysis Period (min)	15		



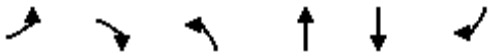
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	6	0	19	0	0	0	18	1914	0	0	744	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0					4.0	5.0			5.0	
Lane Util. Factor		1.00					1.00	0.95			0.95	
Frt		0.90					1.00	1.00			1.00	
Flt Protected		0.99					0.95	1.00			1.00	
Satd. Flow (prot)		1653					1770	3539			3527	
Flt Permitted		0.96					0.95	1.00			1.00	
Satd. Flow (perm)		1610					1770	3539			3527	
Peak-hour factor, PHF	0.79	0.79	0.79	0.92	0.92	0.92	0.98	0.98	0.98	0.95	0.95	0.95
Adj. Flow (vph)	8	0	24	0	0	0	18	1953	0	0	783	18
RTOR Reduction (vph)	0	23	0	0	0	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	9	0	0	0	0	18	1953	0	0	799	0
Turn Type	Perm			Perm			Prot					
Protected Phases		8			4		5	2			6	
Permitted Phases	8			4								
Actuated Green, G (s)		2.6					2.4	50.4			44.0	
Effective Green, g (s)		2.6					2.4	50.4			44.0	
Actuated g/C Ratio		0.04					0.04	0.81			0.71	
Clearance Time (s)		4.0					4.0	5.0			5.0	
Vehicle Extension (s)		2.5					2.0	4.0			4.0	
Lane Grp Cap (vph)		68					69	2877			2503	
v/s Ratio Prot							0.01	c0.55			0.23	
v/s Ratio Perm		c0.01										
v/c Ratio		0.13					0.26	0.68			0.32	
Uniform Delay, d1		28.6					28.9	2.4			3.4	
Progression Factor		1.00					1.24	1.76			1.00	
Incremental Delay, d2		0.6					0.6	1.1			0.3	
Delay (s)		29.3					36.4	5.3			3.7	
Level of Service		C					D	A			A	
Approach Delay (s)		29.3			0.0			5.6			3.7	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	63.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



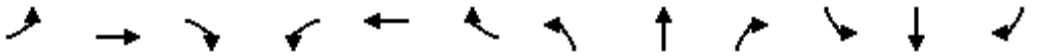
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	7	0	3	12	0	16	3	1870	21	11	726	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			4.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00			1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.96			1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.97			0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1725			1770	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.96			1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1720			1863	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.63	0.63	0.63	0.88	0.88	0.88	0.98	0.98	0.98	0.97	0.97	0.97
Adj. Flow (vph)	11	0	5	14	0	18	3	1908	21	11	748	4
RTOR Reduction (vph)	0	5	0	0	0	17	0	0	6	0	0	1
Lane Group Flow (vph)	0	11	0	0	14	1	3	1908	15	11	748	3
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4		4			2			6
Actuated Green, G (s)		3.5			2.5	2.5	1.0	45.3	45.3	1.2	45.5	45.5
Effective Green, g (s)		3.5			2.5	2.5	1.0	45.3	45.3	1.2	45.5	45.5
Actuated g/C Ratio		0.06			0.04	0.04	0.02	0.73	0.73	0.02	0.73	0.73
Clearance Time (s)		3.0			4.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5			2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)		97			75	64	29	2586	1157	34	2597	1162
v/s Ratio Prot							0.00	c0.54		c0.01	0.21	
v/s Ratio Perm		0.01			c0.01	0.00			0.01			0.00
v/c Ratio		0.12			0.19	0.01	0.10	0.74	0.01	0.32	0.29	0.00
Uniform Delay, d1		27.8			28.8	28.6	30.1	4.9	2.3	30.0	2.8	2.2
Progression Factor		1.00			1.00	1.00	1.24	0.41	0.20	0.72	2.41	2.26
Incremental Delay, d2		0.4			0.4	0.0	0.4	1.4	0.0	2.0	0.3	0.0
Delay (s)		28.2			29.2	28.6	37.8	3.4	0.5	23.7	7.0	5.0
Level of Service		C			C	C	D	A	A	C	A	A
Approach Delay (s)		28.2			28.9			3.4			7.2	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	4.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	69.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	20	103	182	1880	738	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3539	1583
Peak-hour factor, PHF	0.88	0.88	0.95	0.95	0.90	0.90
Adj. Flow (vph)	23	117	192	1979	820	29
RTOR Reduction (vph)	0	107	0	0	0	14
Lane Group Flow (vph)	23	10	192	1979	820	15
Turn Type		Perm	Prot			Perm
Protected Phases	8		5	2	6	
Permitted Phases		8				6
Actuated Green, G (s)	5.4	5.4	11.0	47.6	32.6	32.6
Effective Green, g (s)	5.4	5.4	11.0	47.6	32.6	32.6
Actuated g/C Ratio	0.09	0.09	0.18	0.77	0.53	0.53
Clearance Time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Vehicle Extension (s)	2.5	2.5	2.0	4.0	4.0	4.0
Lane Grp Cap (vph)	154	138	314	2717	1861	832
v/s Ratio Prot	c0.01		0.11	c0.56	0.23	
v/s Ratio Perm		0.01				0.01
v/c Ratio	0.15	0.07	0.61	0.73	0.44	0.02
Uniform Delay, d1	26.2	26.0	23.5	3.8	9.1	7.0
Progression Factor	1.00	1.00	0.84	1.84	0.89	0.62
Incremental Delay, d2	0.3	0.2	1.6	1.1	0.8	0.0
Delay (s)	26.5	26.2	21.3	8.1	8.8	4.4
Level of Service	C	C	C	A	A	A
Approach Delay (s)	26.2			9.3	8.7	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	9.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	62.8%	ICU Level of Service	B
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)	19	2	87	22	0	6	123	2033	33	14	866	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1550	1550	1550
Total Lost time (s)		3.5	3.5		3.5		3.5	4.1	4.1	3.5	4.1	4.1
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.96		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1781	1583		1739		1770	3539	1583	1444	2887	1292
Flt Permitted		0.77	1.00		0.76		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1431	1583		1368		1770	3539	1583	1444	2887	1292
Peak-hour factor, PHF	0.81	0.81	0.81	0.78	0.78	0.78	0.96	0.96	0.96	0.94	0.94	0.94
Adj. Flow (vph)	23	2	107	28	0	8	128	2118	34	15	921	26
RTOR Reduction (vph)	0	0	98	0	7	0	0	0	3	0	0	7
Lane Group Flow (vph)	0	25	9	0	29	0	128	2118	31	15	921	19
Turn Type	Perm		Perm	Perm			Prot		Perm	Prot		Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8		8	4					2			6
Actuated Green, G (s)		5.0	5.0		5.0		7.0	44.7	44.7	1.2	38.9	38.9
Effective Green, g (s)		5.0	5.0		5.0		7.0	44.7	44.7	1.2	38.9	38.9
Actuated g/C Ratio		0.08	0.08		0.08		0.11	0.72	0.72	0.02	0.63	0.63
Clearance Time (s)		3.5	3.5		3.5		3.5	4.1	4.1	3.5	4.1	4.1
Vehicle Extension (s)		2.0	2.0		2.0		1.0	4.0	4.0	1.5	4.0	4.0
Lane Grp Cap (vph)		115	128		110		200	2552	1141	28	1811	811
v/s Ratio Prot							c0.07	c0.60		0.01	0.32	
v/s Ratio Perm		0.02	0.01		c0.02				0.02			0.01
v/c Ratio		0.22	0.07		0.26		0.64	0.83	0.03	0.54	0.51	0.02
Uniform Delay, d1		26.7	26.3		26.8		26.3	6.0	2.5	30.1	6.3	4.4
Progression Factor		1.00	1.00		1.00		0.71	2.39	1.74	1.43	0.42	0.03
Incremental Delay, d2		0.3	0.1		0.5		2.0	1.3	0.0	8.9	1.0	0.1
Delay (s)		27.0	26.4		27.2		20.7	15.6	4.3	52.1	3.6	0.2
Level of Service		C	C		C		C	B	A	D	A	A
Approach Delay (s)		26.5			27.2			15.7			4.3	
Approach LOS		C			C			B			A	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	77.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

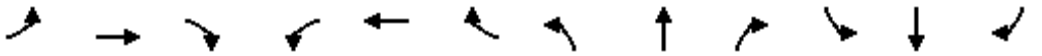
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	654	93	68	187	70	150	32	51	1416	184	8	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1500	1500
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	5.0		4.0
Lane Util. Factor	0.97	1.00		0.95	0.95	1.00		1.00	*0.92	1.00		1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00	1.00	0.76		1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
Frt	1.00	0.94		1.00	1.00	0.85		1.00	1.00	0.85		1.00
Flt Protected	0.95	1.00		0.95	0.98	1.00		0.95	1.00	1.00		0.95
Satd. Flow (prot)	3433	1744		1681	1730	1557		1770	3427	1196		1397
Flt Permitted	0.95	1.00		0.95	0.98	1.00		0.95	1.00	1.00		0.95
Satd. Flow (perm)	3433	1744		1681	1730	1557		1770	3427	1196		1397
Peak-hour factor, PHF	0.95	0.95	0.95	0.84	0.84	0.84	0.97	0.97	0.97	0.97	0.90	0.90
Adj. Flow (vph)	688	98	72	223	83	179	33	53	1460	190	9	109
RTOR Reduction (vph)	0	21	0	0	0	51	0	0	0	70	0	0
Lane Group Flow (vph)	688	149	0	152	154	128	0	86	1460	120	0	118
Confl. Peds. (#/hr)	2					2				74		74
Turn Type	Split			Split		Perm	Prot	Prot		Perm	Prot	Prot
Protected Phases	8	8		4	4		5	5	2		1	1
Permitted Phases						4				2		
Actuated Green, G (s)	29.6	29.6		16.1	16.1	16.1		9.1	47.7	47.7		13.6
Effective Green, g (s)	29.6	29.6		16.1	16.1	16.1		9.1	47.7	47.7		13.6
Actuated g/C Ratio	0.24	0.24		0.13	0.13	0.13		0.07	0.38	0.38		0.11
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	5.0		4.0
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0		2.0	3.0	3.0		2.0
Lane Grp Cap (vph)	819	416		218	225	202		130	1318	460		153
v/s Ratio Prot	c0.20	0.09		c0.09	0.09			0.05	c0.43			c0.08
v/s Ratio Perm						0.08				0.10		
v/c Ratio	0.84	0.36		0.70	0.68	0.63		0.66	1.11	0.26		0.77
Uniform Delay, d1	44.9	39.3		51.6	51.5	51.1		56.0	38.1	26.1		53.7
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.08
Incremental Delay, d2	7.4	0.2		7.6	6.7	4.7		9.4	59.9	1.4		18.0
Delay (s)	52.4	39.5		59.2	58.2	55.8		65.3	98.0	27.5		75.9
Level of Service	D	D		E	E	E		E	F	C		E
Approach Delay (s)		49.8			57.6				88.7			
Approach LOS		D			E				F			

Intersection Summary			
HCM Average Control Delay	62.1	HCM Level of Service	E
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	89.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

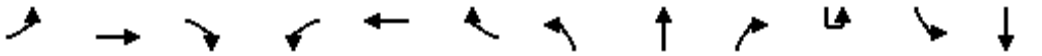
Movement	SBT	SBR
Lane Configurations		
Volume (vph)	643	198
Ideal Flow (vphpl)	1500	1500
Total Lost time (s)	5.0	5.0
Lane Util. Factor	0.95	1.00
Frpb, ped/bikes	1.00	1.00
Flpb, ped/bikes	1.00	1.00
Frt	1.00	0.85
Flt Protected	1.00	1.00
Satd. Flow (prot)	2794	1250
Flt Permitted	1.00	1.00
Satd. Flow (perm)	2794	1250
Peak-hour factor, PHF	0.90	0.90
Adj. Flow (vph)	714	220
RTOR Reduction (vph)	0	47
Lane Group Flow (vph)	714	173
Confl. Peds. (#/hr)		
Turn Type		Perm
Protected Phases	6	
Permitted Phases		6
Actuated Green, G (s)	52.2	52.2
Effective Green, g (s)	52.2	52.2
Actuated g/C Ratio	0.42	0.42
Clearance Time (s)	5.0	5.0
Vehicle Extension (s)	4.0	4.0
Lane Grp Cap (vph)	1176	526
v/s Ratio Prot	0.26	
v/s Ratio Perm		0.14
v/c Ratio	0.61	0.33
Uniform Delay, d1	27.9	24.1
Progression Factor	0.83	0.84
Incremental Delay, d2	2.2	1.5
Delay (s)	25.3	21.9
Level of Service	C	C
Approach Delay (s)	30.2	
Approach LOS	C	

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	197	430	234	0	0	0	207	522	232	0	566	407
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5				4.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	1.00				1.00	0.95	1.00		0.95	1.00
Frt	1.00	1.00	0.85				1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00				0.95	1.00	1.00		1.00	1.00
Satd. Flow (prot)	1770	3539	1583				1770	3539	1583		3539	1583
Flt Permitted	0.95	1.00	1.00				0.95	1.00	1.00		1.00	1.00
Satd. Flow (perm)	1770	3539	1583				1770	3539	1583		3539	1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.92	0.92	0.92	0.96	0.96	0.96	0.94	0.94	0.94
Adj. Flow (vph)	216	473	257	0	0	0	216	544	242	0	602	433
RTOR Reduction (vph)	0	0	167	0	0	0	0	0	72	0	0	259
Lane Group Flow (vph)	216	473	90	0	0	0	216	544	170	0	602	174
Turn Type	Perm		Perm				Prot		Perm			Perm
Protected Phases		4					5	2			6	
Permitted Phases	4		4						2			6
Actuated Green, G (s)	16.0	16.0	16.0				12.4	44.5	44.5		28.1	28.1
Effective Green, g (s)	16.0	16.0	16.0				12.4	44.5	44.5		28.1	28.1
Actuated g/C Ratio	0.23	0.23	0.23				0.18	0.64	0.64		0.40	0.40
Clearance Time (s)	4.5	4.5	4.5				4.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	2.0	2.0	2.0				2.0	4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	405	809	362				314	2250	1006		1421	635
v/s Ratio Prot		c0.13					c0.12	0.15			c0.17	
v/s Ratio Perm	0.12		0.06						0.11			0.11
v/c Ratio	0.53	0.58	0.25				0.69	0.24	0.17		0.42	0.27
Uniform Delay, d1	23.7	24.0	22.1				27.0	5.5	5.2		15.1	14.1
Progression Factor	1.00	1.00	1.00				1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.7	0.7	0.1				4.9	0.3	0.4		0.9	1.1
Delay (s)	24.4	24.7	22.2				31.9	5.7	5.6		16.0	15.2
Level of Service	C	C	C				C	A	A		B	B
Approach Delay (s)		24.0			0.0			11.3			15.7	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	50.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Volume (vph)	54	49	265	26	0	164	0	760	15	14	104	682
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	1.00	1.00		1.00		0.91			1.00	0.95
Frt		1.00	0.85	1.00		0.85		1.00			1.00	1.00
Flt Protected		0.97	1.00	0.95		1.00		1.00			0.95	1.00
Satd. Flow (prot)		1815	1583	1770		1583		5071			1770	3539
Flt Permitted		0.97	1.00	0.68		1.00		1.00			0.66	1.00
Satd. Flow (perm)		1815	1583	1275		1583		5071			1221	3539
Peak-hour factor, PHF	0.91	0.91	0.91	0.86	0.86	0.86	0.98	0.98	0.98	0.92	0.91	0.91
Adj. Flow (vph)	59	54	291	30	0	191	0	776	15	15	114	749
RTOR Reduction (vph)	0	0	240	0	0	165	0	3	0	0	0	0
Lane Group Flow (vph)	0	113	51	30	0	26	0	788	0	0	129	749
Turn Type	Split		Perm	custom		custom				custom	Prot	
Protected Phases	4	4						2			1	6
Permitted Phases			4	8		8				1		
Actuated Green, G (s)		9.2	9.2	7.2		7.2		14.0			6.1	24.1
Effective Green, g (s)		9.2	9.2	7.2		7.2		14.0			6.1	24.1
Actuated g/C Ratio		0.18	0.18	0.14		0.14		0.27			0.12	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)		318	277	175		217		1352			142	1625
v/s Ratio Prot		c0.06						c0.16				0.21
v/s Ratio Perm			0.03	c0.02		0.02					c0.11	
v/c Ratio		0.36	0.18	0.17		0.12		0.58			0.91	0.46
Uniform Delay, d1		19.0	18.5	20.0		19.9		16.7			22.9	9.7
Progression Factor		1.00	1.00	1.00		1.00		1.00			1.00	1.00
Incremental Delay, d2		0.7	0.3	0.5		0.3		0.6			48.5	0.2
Delay (s)		19.7	18.8	20.5		20.1		17.4			71.4	10.0
Level of Service		B	B	C		C		B			E	A
Approach Delay (s)		19.0			20.2			17.4				19.0
Approach LOS		B			C			B				B

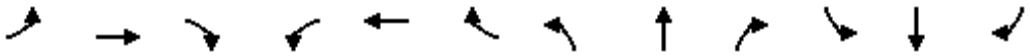
Intersection Summary			
HCM Average Control Delay	18.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	52.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	50.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR
Lane Configurations	
Volume (vph)	0
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.91
Adj. Flow (vph)	0
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	46	638	49	104	308	85	57	8	107	61	12	19
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.94	0.94	0.94	0.98	0.98	0.98	0.85	0.85	0.85
Hourly flow rate (vph)	51	709	54	111	328	90	58	8	109	72	14	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	418			763			1417	1478	736	1519	1460	373
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	418			763			1417	1478	736	1519	1460	373
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			87			33	92	74	0	87	97
cM capacity (veh/h)	1141			849			87	105	419	59	107	673

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1
Volume Total	51	763	111	418	66	109	108
Volume Left	51	0	111	0	58	0	72
Volume Right	0	54	0	90	0	109	22
cSH	1141	1700	849	1700	89	419	78
Volume to Capacity	0.04	0.45	0.13	0.25	0.75	0.26	1.38
Queue Length 95th (ft)	4	0	11	0	94	26	213
Control Delay (s)	8.3	0.0	9.9	0.0	118.3	16.6	325.7
Lane LOS	A		A		F	C	F
Approach Delay (s)	0.5		2.1		55.0		325.7
Approach LOS					F		F

Intersection Summary				
Average Delay	28.5			
Intersection Capacity Utilization	64.1%	ICU Level of Service	C	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	46	638	49	104	308	85	57	8	107	61	12	19
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	1.00		1.00	1.00			1.00	1.00		1.00	
Frt	1.00	0.99		1.00	0.97			1.00	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	
Satd. Flow (prot)	1770	1843		1770	1803			1784	1583		1753	
Flt Permitted	0.44	1.00		0.16	1.00			0.76	1.00		0.81	
Satd. Flow (perm)	818	1843		297	1803			1407	1583		1459	
Peak-hour factor, PHF	0.90	0.90	0.90	0.94	0.94	0.94	0.98	0.98	0.98	0.85	0.85	0.85
Adj. Flow (vph)	51	709	54	111	328	90	58	8	109	72	14	22
RTOR Reduction (vph)	0	5	0	0	20	0	0	0	71	0	14	0
Lane Group Flow (vph)	51	758	0	111	398	0	0	66	38	0	94	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	27.8	27.8		27.8	27.8			19.2	19.2		19.2	
Effective Green, g (s)	27.8	27.8		27.8	27.8			19.2	19.2		19.2	
Actuated g/C Ratio	0.51	0.51		0.51	0.51			0.35	0.35		0.35	
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)	413	931		150	911			491	552		509	
v/s Ratio Prot		c0.41			0.22							
v/s Ratio Perm	0.06			0.37				0.05	0.02		c0.06	
v/c Ratio	0.12	0.81		0.74	0.44			0.13	0.07		0.18	
Uniform Delay, d1	7.2	11.4		10.7	8.6			12.2	11.9		12.5	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.1	5.5		17.3	0.3			0.6	0.2		0.8	
Delay (s)	7.3	16.9		28.1	9.0			12.8	12.2		13.2	
Level of Service	A	B		C	A			B	B		B	
Approach Delay (s)		16.3			13.0			12.4			13.2	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	14.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

INTERSECTION SUMMARY

Site: Int #8 Ex Plus Proj PM

Roundabout with 5 legs, and 1-lane approaches and circulating road

Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	31.6	mph	31.6	mph
Travel Distance (Total)	1017.9	veh-mi/h	1221.5	pers-mi/h
Travel Time (Total)	32.2	veh-h/h	38.7	pers-h/h
Demand Flows (Total)	1626	veh/h	1951	pers/h
Percent Heavy Vehicles (Demand)	0.3	%		
Degree of Saturation	0.672			
Practical Spare Capacity	26.4	%		
Effective Intersection Capacity	2419	veh/h		
Control Delay (Total)	4.42	veh-h/h	5.30	pers-h/h
Control Delay (Average)	9.8	sec	9.8	sec
Control Delay (Worst Lane)	12.4	sec		
Control Delay (Worst Movement)	12.4	sec	12.4	sec
Geometric Delay (Average)	0.0	sec		
Stop-Line Delay (Average)	9.8	sec		
Idling Time (Average)	6.7	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	6.6	veh		
95% Back of Queue - Distance (Worst Lane)	165.5	ft		
Queue Storage Ratio (Worst Lane)	0.14			
Total Effective Stops	705	veh/h	846	pers/h
Effective Stop Rate	0.43	per veh	0.43	per pers
Proportion Queued	0.58		0.58	
Performance Index	55.5		55.5	
Cost (Total)	478.19	$/h	478.19	$/h
Fuel Consumption (Total)	37.8	gal/h		
Carbon Dioxide (Total)	336.5	kg/h		
Hydrocarbons (Total)	0.128	kg/h		
Carbon Monoxide (Total)	1.803	kg/h		
NOx (Total)	0.326	kg/h		

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	780,522	veh/y	936,626	pers/y
Delay	2,121	veh-h/y	2,546	pers-h/y
Effective Stops	338,378	veh/y	406,053	pers/y
Travel Distance	488,612	veh-mi/y	586,335	pers-mi/y
Travel Time	15,469	veh-h/y	18,563	pers-h/y
Cost	229,530	$/y	229,530	$/y
Fuel Consumption	18,144	gal/y		
Carbon Dioxide	161,520	kg/y		
Hydrocarbons	62	kg/y		
Carbon Monoxide	865	kg/y		
NOx	157	kg/y		

SIDRA INTERSECTION 6

MOVEMENT SUMMARY

Site: Int #8 Ex Plus Proj PM

Roundabout with 5 legs, and 1-lane approaches and circulating road

Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Brown Ave											
7	L2	62	0.0	0.290	9.3	LOS A	1.2	31.1	0.69	0.69	31.5
7a	L1	7	0.0	0.290	9.3	LOS A	1.2	31.1	0.69	0.69	31.2
14a	R1	2	0.0	0.290	9.3	LOS A	1.2	31.1	0.69	0.69	31.4
14	R2	116	0.0	0.290	9.3	LOS A	1.2	31.1	0.69	0.69	30.9
Approach		187	0.0	0.290	9.3	LOS A	1.2	31.1	0.69	0.69	31.1
East: Deer Hill Road											
5	L2	113	0.0	0.424	7.0	LOS A	2.8	70.5	0.39	0.22	32.9
2	T1	335	0.3	0.424	7.0	LOS A	2.8	70.5	0.39	0.22	32.9
12a	R1	75	0.0	0.424	7.0	LOS A	2.8	70.5	0.39	0.22	32.7
12b	R3	17	0.0	0.424	7.0	LOS A	2.8	70.5	0.39	0.22	32.0
Approach		540	0.2	0.424	7.0	LOS A	2.8	70.5	0.39	0.22	32.9
NorthEast: Brown Ave											
5bx	L3	13	0.0	0.026	4.8	LOS A	0.1	2.6	0.54	0.42	32.8
5ax	L1	2	0.0	0.026	4.8	LOS A	0.1	2.6	0.54	0.42	32.3
12ax	R1	4	0.0	0.026	4.8	LOS A	0.1	2.6	0.54	0.42	32.4
12x	R2	1	0.0	0.026	4.8	LOS A	0.1	2.6	0.54	0.42	31.9
Approach		21	0.0	0.026	4.8	LOS A	0.1	2.6	0.54	0.42	32.6
NorthWest: Miller Dr											
3x	L2	1	0.0	0.096	5.1	LOS A	0.4	9.9	0.54	0.46	33.0
3ax	L1	53	0.0	0.096	5.1	LOS A	0.4	9.9	0.54	0.46	32.8
18ax	R1	11	0.0	0.096	5.1	LOS A	0.4	9.9	0.54	0.46	32.9
18bx	R3	16	0.0	0.096	5.1	LOS A	0.4	9.9	0.54	0.46	32.1
Approach		82	0.0	0.096	5.1	LOS A	0.4	9.9	0.54	0.46	32.7
West: Deer Hill Road											
1b	L3	13	0.0	0.672	12.4	LOS B	6.6	165.5	0.69	0.51	31.0
1a	L1	37	0.0	0.672	12.4	LOS B	6.6	165.5	0.69	0.51	30.5
6	T1	693	0.5	0.672	12.4	LOS B	6.6	165.5	0.69	0.51	30.8
16	R2	53	0.0	0.672	12.4	LOS B	6.6	165.5	0.69	0.51	30.2
Approach		797	0.4	0.672	12.4	LOS B	6.6	165.5	0.69	0.51	30.8
All Vehicles		1626	0.3	0.672	9.8	LOS A	6.6	165.5	0.58	0.43	31.6

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

LEVEL OF SERVICE

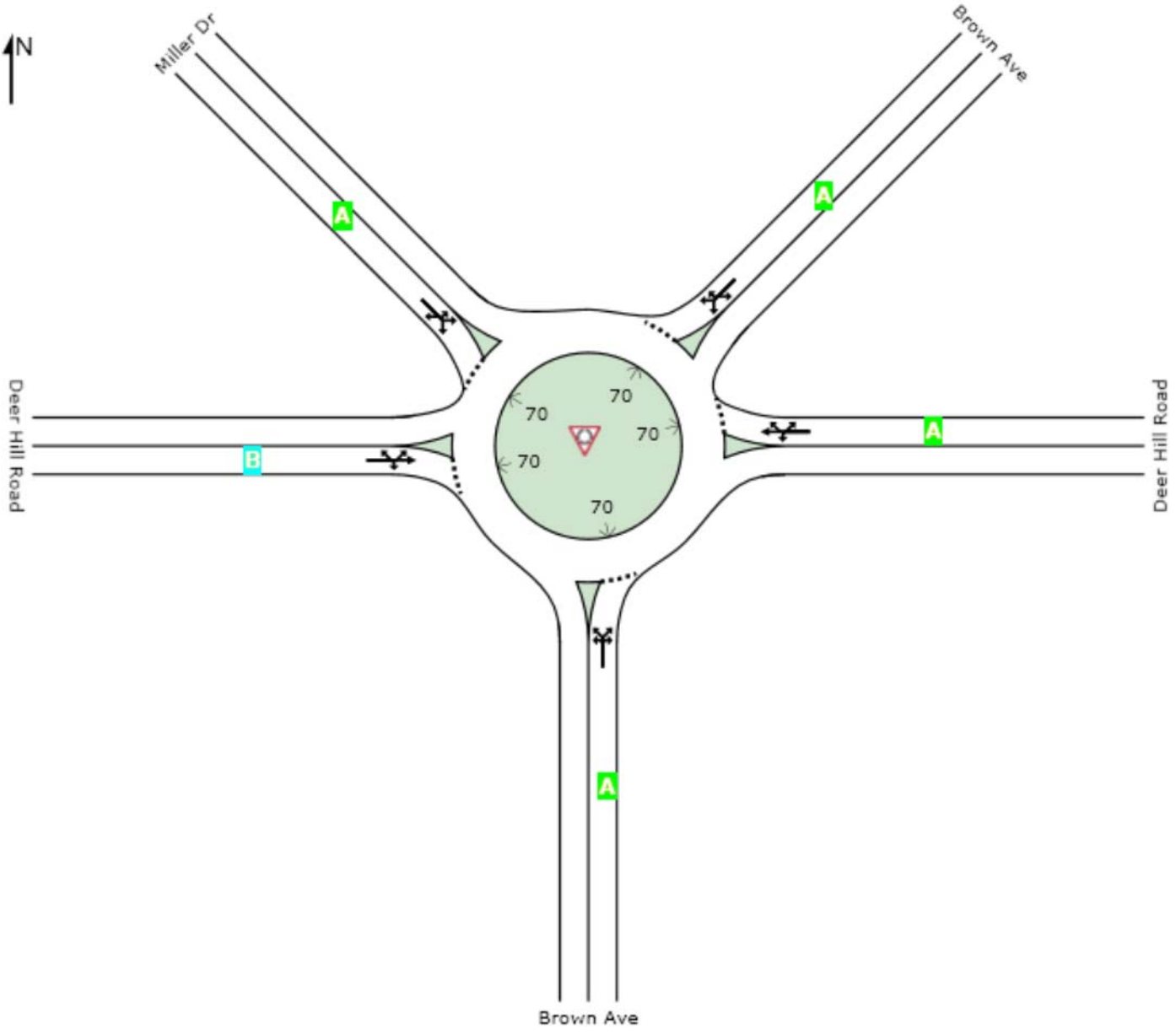
Site: Int #8 Ex Plus Proj PM

Roundabout with 5 legs, and 1-lane approaches and circulating road

Roundabout

All Movement Classes

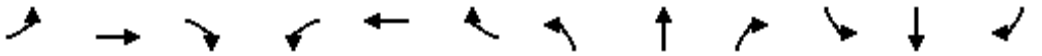
	South	East	Northeast	Northwest	West	Intersection
LOS	A	A	A	A	B	A



Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

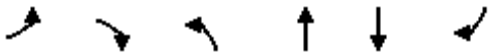
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	21	584	1296	88	246	2	166	14	118	5	24	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.95	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)	1770	1863	1583	1770	1861		1681	1698	1583		1790	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)	1770	1863	1583	1770	1861		1681	1698	1583		1790	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	23	635	1409	96	267	2	180	15	128	5	26	10
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	110	0	9	0
Lane Group Flow (vph)	23	635	1409	96	268	0	97	98	18	0	32	0
Turn Type	Prot		Free	Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			Free						2			
Actuated Green, G (s)	1.9	29.6	66.5	5.0	32.7		9.2	9.2	9.2		6.7	
Effective Green, g (s)	1.9	29.6	66.5	5.0	32.7		9.2	9.2	9.2		6.7	
Actuated g/C Ratio	0.03	0.45	1.00	0.08	0.49		0.14	0.14	0.14		0.10	
Clearance Time (s)	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	
Lane Grp Cap (vph)	51	829	1583	133	915		233	235	219		180	
v/s Ratio Prot	0.01	0.34		0.05	0.14		0.06	0.06			0.02	
v/s Ratio Perm			c0.89						0.01			
v/c Ratio	0.45	0.77	0.89	0.72	0.29		0.42	0.42	0.08		0.18	
Uniform Delay, d1	31.8	15.5	0.0	30.1	10.0		26.2	26.2	25.0		27.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	6.2	4.3	7.9	17.5	0.2		1.2	1.2	0.2		0.5	
Delay (s)	38.0	19.8	7.9	47.6	10.2		27.4	27.4	25.1		27.9	
Level of Service	D	B	A	D	B		C	C	C		C	
Approach Delay (s)		11.9			20.0			26.5			27.9	
Approach LOS		B			C			C			C	

Intersection Summary			
HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	66.5	Sum of lost time (s)	0.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
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)	17	1133	248	176	236	3	510	6	783	19	1	9
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	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	0.88		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (prot)	1770	3539	1583	1770	3533		1681	1687	2787		1727	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (perm)	1770	3539	1583	1770	3533		1681	1687	2787		1727	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	18	1232	270	191	257	3	554	7	851	21	1	10
RTOR Reduction (vph)	0	0	107	0	1	0	0	0	592	0	8	0
Lane Group Flow (vph)	18	1232	163	191	259	0	283	278	259	0	24	0
Turn Type	Prot		Perm	Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4						2			
Actuated Green, G (s)	1.6	33.4	33.4	10.0	41.8		17.0	17.0	17.0		16.0	
Effective Green, g (s)	1.6	33.4	33.4	10.0	41.8		17.0	17.0	17.0		16.0	
Actuated g/C Ratio	0.02	0.36	0.36	0.11	0.45		0.18	0.18	0.18		0.17	
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)	31	1279	572	192	1598		309	310	513		299	
v/s Ratio Prot	0.01	c0.35		c0.11	0.07		c0.17	0.16			c0.01	
v/s Ratio Perm			0.10						0.09			
v/c Ratio	0.58	0.96	0.28	0.99	0.16		0.92	0.90	0.51		0.08	
Uniform Delay, d1	45.1	28.9	21.0	41.2	15.0		37.0	36.8	33.9		32.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	24.7	17.0	0.3	63.1	0.0		33.6	30.5	3.5		0.5	
Delay (s)	69.8	45.9	21.3	104.3	15.0		70.6	67.3	37.5		32.5	
Level of Service	E	D	C	F	B		E	E	D		C	
Approach Delay (s)		41.8			52.8			50.0			32.5	
Approach LOS		D			D			D			C	

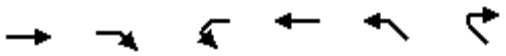
Intersection Summary			
HCM Average Control Delay	46.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	92.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	35	0	1791	910	16
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	38	0	1947	989	17
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					244	
pX, platoon unblocked	0.82	0.82	0.82			
vC, conflicting volume	1647	503	1007			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1343	0	559			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	96	100			
cM capacity (veh/h)	117	885	823			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	38	649	649	649	659	347
Volume Left	0	0	0	0	0	0
Volume Right	38	0	0	0	0	17
cSH	885	1700	1700	1700	1700	1700
Volume to Capacity	0.04	0.38	0.38	0.38	0.39	0.20
Queue Length 95th (ft)	3	0	0	0	0	0
Control Delay (s)	9.2	0.0	0.0	0.0	0.0	0.0
Lane LOS	A					
Approach Delay (s)	9.2	0.0			0.0	
Approach LOS	A					

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	37.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	806	7	17	337	6	18
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	876	8	18	366	7	20
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				650		
pX, platoon unblocked						
vC, conflicting volume			884		1283	880
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			884		1283	880
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		96	94
cM capacity (veh/h)			766		178	346

Direction, Lane #	EB 1	WB 1	NW 1
Volume Total	884	385	26
Volume Left	0	18	7
Volume Right	8	0	20
cSH	1700	766	280
Volume to Capacity	0.52	0.02	0.09
Queue Length 95th (ft)	0	2	8
Control Delay (s)	0.0	0.8	19.2
Lane LOS		A	C
Approach Delay (s)	0.0	0.8	19.2
Approach LOS			C

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	52.8%	ICU Level of Service	A
Analysis Period (min)	15		

INTERSECTION SUMMARY

Site: Int #13 - Existing Plus Project PM

Roundabout with 1-lane approaches and circulating road
MUTCD (FHWA 2009) example number: 2B-22
Roundabout Guide (TRB 2010) example number: A-1
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	31.6	mph	31.6	mph
Travel Distance (Total)	798.4	veh-mi/h	958.0	pers-mi/h
Travel Time (Total)	25.2	veh-h/h	30.3	pers-h/h
Demand Flows (Total)	1287	veh/h	1544	pers/h
Percent Heavy Vehicles (Demand)	0.5	%		
Degree of Saturation	0.633			
Practical Spare Capacity	34.2	%		
Effective Intersection Capacity	2032	veh/h		
Control Delay (Total)	3.02	veh-h/h	3.63	pers-h/h
Control Delay (Average)	8.5	sec	8.5	sec
Control Delay (Worst Lane)	10.2	sec		
Control Delay (Worst Movement)	10.2	sec	10.2	sec
Geometric Delay (Average)	0.0	sec		
Stop-Line Delay (Average)	8.5	sec		
Idling Time (Average)	7.2	sec		
Intersection Level of Service (LOS)	LOS A			
95% Back of Queue - Vehicles (Worst Lane)	6.8	veh		
95% Back of Queue - Distance (Worst Lane)	170.2	ft		
Queue Storage Ratio (Worst Lane)	0.14			
Total Effective Stops	125	veh/h	150	pers/h
Effective Stop Rate	0.10	per veh	0.10	per pers
Proportion Queued	0.25		0.25	
Performance Index	37.2		37.2	
Cost (Total)	368.32	$/h	368.32	$/h
Fuel Consumption (Total)	29.7	gal/h		
Carbon Dioxide (Total)	264.3	kg/h		
Hydrocarbons (Total)	0.099	kg/h		
Carbon Monoxide (Total)	1.407	kg/h		
NOx (Total)	0.281	kg/h		

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	617,739	veh/y	741,287	pers/y
Delay	1,450	veh-h/y	1,740	pers-h/y
Effective Stops	59,804	veh/y	71,765	pers/y
Travel Distance	383,214	veh-mi/y	459,857	pers-mi/y
Travel Time	12,112	veh-h/y	14,534	pers-h/y
Cost	176,791	$/y	176,791	$/y
Fuel Consumption	14,240	gal/y		
Carbon Dioxide	126,849	kg/y		
Hydrocarbons	47	kg/y		
Carbon Monoxide	675	kg/y		
NOx	135	kg/y		

MOVEMENT SUMMARY

Site: Int #13 - Existing Plus Project PM

Roundabout with 1-lane approaches and circulating road
MUTCD (FHWA 2009) example number: 2B-22
Roundabout Guide (TRB 2010) example number: A-1
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Homes Dwy.											
3	L2	8	0.0	0.036	6.4	LOS A	0.1	3.4	0.62	0.57	32.0
8	T1	1	0.0	0.036	6.4	LOS A	0.1	3.4	0.62	0.57	32.2
18	R2	13	0.0	0.036	6.4	LOS A	0.1	3.4	0.62	0.57	31.6
Approach		22	0.0	0.036	6.4	LOS A	0.1	3.4	0.62	0.57	31.8
East: Deer Hill Rd.											
1	L2	23	0.0	0.264	4.8	LOS A	1.5	37.6	0.09	0.02	33.1
6	T1	334	0.7	0.264	4.8	LOS A	1.5	37.6	0.09	0.02	33.4
16	R2	16	0.0	0.264	4.8	LOS A	1.5	37.6	0.09	0.02	32.8
Approach		373	0.6	0.264	4.8	LOS A	1.5	37.6	0.09	0.02	33.3
North: Dog Park Dwy.											
7	L2	12	0.0	0.016	3.7	LOS A	0.1	1.6	0.43	0.27	32.6
4	T1	1	0.0	0.016	3.7	LOS A	0.1	1.6	0.43	0.27	32.9
14	R2	3	0.0	0.016	3.7	LOS A	0.1	1.6	0.43	0.27	32.3
Approach		16	0.0	0.016	3.7	LOS A	0.1	1.6	0.43	0.27	32.6
West: Deer Hill Rd.											
5	L2	5	0.0	0.633	10.2	LOS B	6.8	170.2	0.30	0.11	30.7
2	T1	859	0.5	0.633	10.2	LOS B	6.8	170.2	0.30	0.11	31.0
12	R2	12	0.0	0.633	10.2	LOS B	6.8	170.2	0.30	0.11	30.4
Approach		876	0.5	0.633	10.2	LOS B	6.8	170.2	0.30	0.11	31.0
All Vehicles		1287	0.5	0.633	8.5	LOS A	6.8	170.2	0.25	0.10	31.6

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

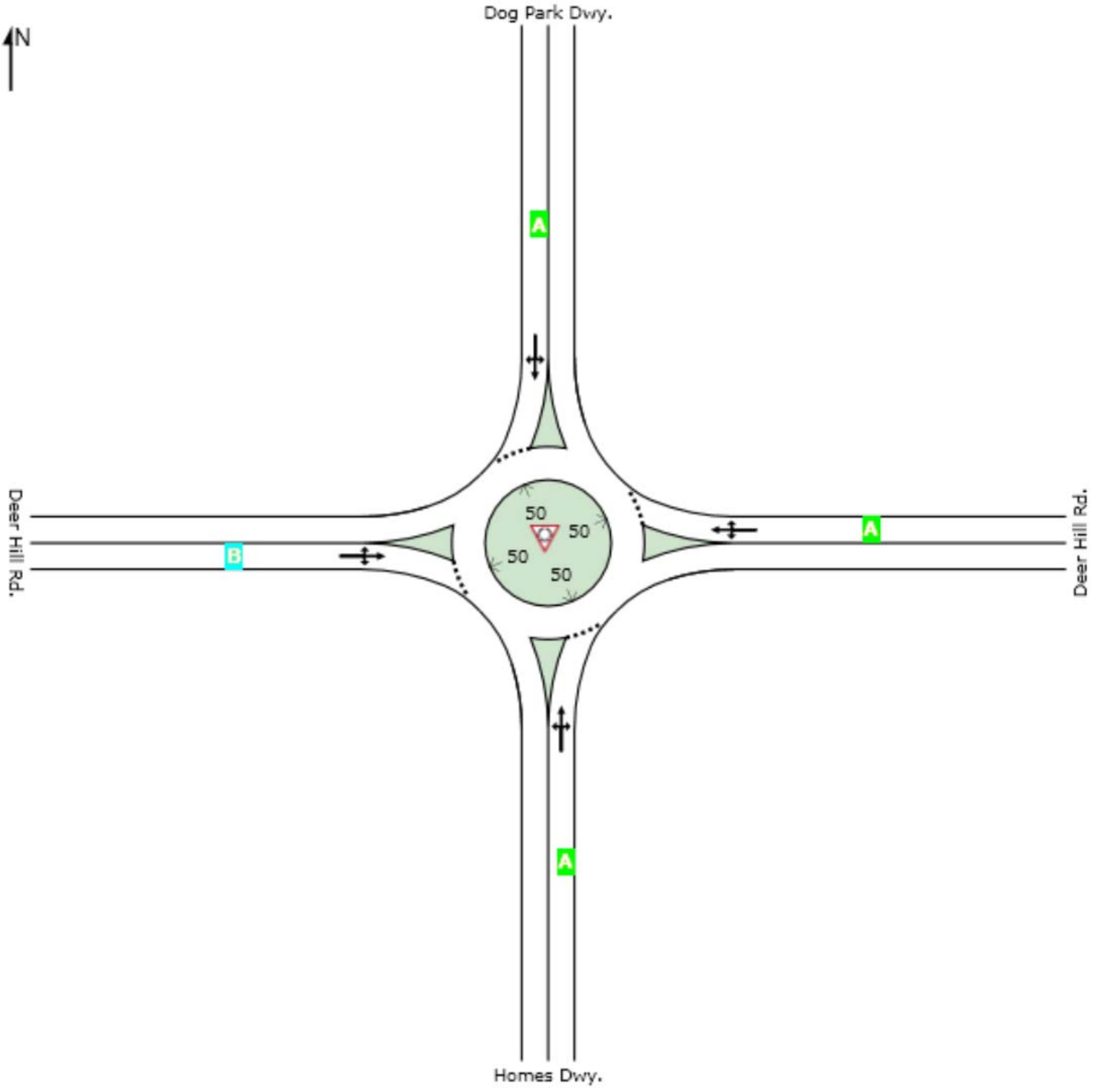
LEVEL OF SERVICE

Site: Int #13 - Existing Plus Project PM

Roundabout with 1-lane approaches and circulating road
MUTCD (FHWA 2009) example number: 2B-22
Roundabout Guide (TRB 2010) example number: A-1
Roundabout

All Movement Classes

	South	East	North	West	Intersection
LOS	A	A	A	B	A

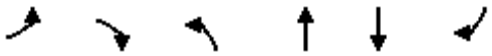


Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	809	15	0	354	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	879	16	0	385	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				372		
pX, platoon unblocked						
vC, conflicting volume			896		1272	888
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			896		1272	888
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			758		185	343

Direction, Lane #	EB 1	WB 1
Volume Total	896	385
Volume Left	0	0
Volume Right	16	0
cSH	1700	1700
Volume to Capacity	0.53	0.23
Queue Length 95th (ft)	0	0
Control Delay (s)	0.0	0.0
Lane LOS		
Approach Delay (s)	0.0	0.0
Approach LOS		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		

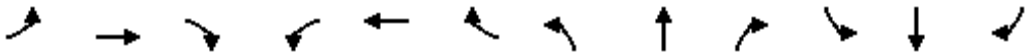


Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	40	0	1388	1003	39
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	43	0	1509	1090	42
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					244	
pX, platoon unblocked	0.67	0.67	0.67			
vC, conflicting volume	1614	566	1133			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	930	0	211			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	94	100			
cM capacity (veh/h)	178	726	908			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	43	503	503	503	727	406
Volume Left	0	0	0	0	0	0
Volume Right	43	0	0	0	0	42
cSH	726	1700	1700	1700	1700	1700
Volume to Capacity	0.06	0.30	0.30	0.30	0.43	0.24
Queue Length 95th (ft)	5	0	0	0	0	0
Control Delay (s)	10.3	0.0	0.0	0.0	0.0	0.0
Lane LOS	B					
Approach Delay (s)	10.3	0.0			0.0	
Approach LOS	B					

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	39.0%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix D – Level of Service Worksheets: Cumulative Year 2030 No Project Conditions

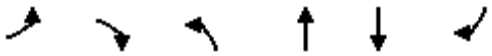


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	37	0	0	0	23	781	0	0	1701	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0					4.0	5.0			5.0	
Lane Util. Factor		1.00					1.00	0.95			0.95	
Frt		0.86					1.00	1.00			1.00	
Flt Protected		1.00					0.95	1.00			1.00	
Satd. Flow (prot)		1611					1770	3539			3536	
Flt Permitted		1.00					0.95	1.00			1.00	
Satd. Flow (perm)		1611					1770	3539			3536	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	0	0	41	0	0	0	29	976	0	0	2126	12
RTOR Reduction (vph)	0	40	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1	0	0	0	0	29	976	0	0	2138	0
Turn Type	Perm			Perm			Prot					
Protected Phases		8			4		5	2			6	
Permitted Phases	8			4								
Actuated Green, G (s)		2.0					2.7	51.0			44.3	
Effective Green, g (s)		2.0					2.7	51.0			44.3	
Actuated g/C Ratio		0.03					0.04	0.82			0.71	
Clearance Time (s)		4.0					4.0	5.0			5.0	
Vehicle Extension (s)		2.5					2.0	4.0			4.0	
Lane Grp Cap (vph)		52					77	2911			2527	
v/s Ratio Prot		c0.00					0.02	c0.28			c0.60	
v/s Ratio Perm												
v/c Ratio		0.03					0.38	0.34			0.85	
Uniform Delay, d1		29.1					28.8	1.3			6.4	
Progression Factor		1.00					0.92	2.18			1.00	
Incremental Delay, d2		0.1					1.1	0.3			3.7	
Delay (s)		29.2					27.5	3.2			10.1	
Level of Service		C					C	A			B	
Approach Delay (s)		29.2			0.0			3.9			10.1	
Approach LOS		C			A			A			B	

Intersection Summary			
HCM Average Control Delay	8.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	58.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

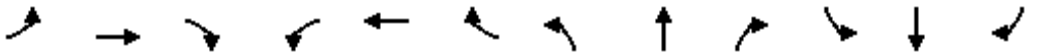
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	0	5	23	0	12	0	800	18	8	1832	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			4.0	4.0		5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00			1.00	1.00		0.95	1.00	1.00	0.95	1.00
Frt		0.90			1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99			0.95	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1653			1770	1583		3539	1583	1770	3539	1583
Flt Permitted		0.91			1.00	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1531			1863	1583		3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	2	0	6	26	0	13	0	889	20	9	2036	1
RTOR Reduction (vph)	0	6	0	0	0	12	0	0	5	0	0	0
Lane Group Flow (vph)	0	2	0	0	26	1	0	889	15	9	2036	1
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4		4			2			6
Actuated Green, G (s)		3.7			2.7	2.7		45.2	45.2	1.1	50.3	50.3
Effective Green, g (s)		3.7			2.7	2.7		45.2	45.2	1.1	50.3	50.3
Actuated g/C Ratio		0.06			0.04	0.04		0.73	0.73	0.02	0.81	0.81
Clearance Time (s)		3.0			4.0	4.0		5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5			2.0	2.0		4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)		91			81	69		2580	1154	31	2871	1284
v/s Ratio Prot								0.25		0.01	c0.58	
v/s Ratio Perm		0.00			c0.01	0.00			0.01			0.00
v/c Ratio		0.03			0.32	0.01		0.34	0.01	0.29	0.71	0.00
Uniform Delay, d1		27.5			28.8	28.4		3.0	2.3	30.1	2.6	1.1
Progression Factor		1.00			1.00	1.00		1.80	2.42	1.02	2.35	0.97
Incremental Delay, d2		0.1			0.8	0.0		0.4	0.0	1.3	1.1	0.0
Delay (s)		27.5			29.6	28.4		5.8	5.6	31.9	7.2	1.1
Level of Service		C			C	C		A	A	C	A	A
Approach Delay (s)		27.5			29.2			5.8			7.3	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	7.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	61.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	24	242	102	802	1945	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3539	1583
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	28	285	120	944	2288	13
RTOR Reduction (vph)	0	91	0	0	0	2
Lane Group Flow (vph)	28	194	120	944	2288	11
Turn Type		Perm	Prot			Perm
Protected Phases	8		5	2	6	
Permitted Phases		8				6
Actuated Green, G (s)	18.8	18.8	11.5	96.2	80.7	80.7
Effective Green, g (s)	18.8	18.8	11.5	96.2	80.7	80.7
Actuated g/C Ratio	0.15	0.15	0.09	0.78	0.65	0.65
Clearance Time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Vehicle Extension (s)	2.5	2.5	2.0	4.0	4.0	4.0
Lane Grp Cap (vph)	268	240	164	2746	2303	1030
v/s Ratio Prot	0.02		c0.07	0.27	c0.65	
v/s Ratio Perm		c0.12				0.01
v/c Ratio	0.10	0.81	0.73	0.34	0.99	0.01
Uniform Delay, d1	45.3	50.9	54.7	4.2	21.4	7.6
Progression Factor	1.00	1.00	0.93	1.15	1.07	1.25
Incremental Delay, d2	0.1	17.5	13.3	0.3	15.6	0.0
Delay (s)	45.5	68.3	64.1	5.2	38.4	9.5
Level of Service	D	E	E	A	D	A
Approach Delay (s)	66.3			11.9	38.3	
Approach LOS	E			B	D	

Intersection Summary			
HCM Average Control Delay	33.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	76.2%	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)	64	5	131	66	24	10	101	679	46	47	2245	86
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1550	1550	1550
Total Lost time (s)		3.5	3.5		3.5		3.5	4.1	4.1	3.5	4.1	4.1
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.97		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1780	1583		1779		1770	3539	1583	1444	2887	1292
Flt Permitted		0.68	1.00		0.68		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1258	1583		1254		1770	3539	1583	1444	2887	1292
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	70	5	142	72	26	11	110	738	50	51	2440	93
RTOR Reduction (vph)	0	0	124	0	4	0	0	0	12	0	0	5
Lane Group Flow (vph)	0	75	18	0	105	0	110	738	38	51	2440	88
Turn Type	Perm		Perm	Perm			Prot		Perm	Prot		Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8		8	4					2			6
Actuated Green, G (s)		13.5	13.5		13.5		11.1	91.8	91.8	7.6	88.3	88.3
Effective Green, g (s)		13.5	13.5		13.5		11.1	91.8	91.8	7.6	88.3	88.3
Actuated g/C Ratio		0.11	0.11		0.11		0.09	0.74	0.74	0.06	0.71	0.71
Clearance Time (s)		3.5	3.5		3.5		3.5	4.1	4.1	3.5	4.1	4.1
Vehicle Extension (s)		2.0	2.0		2.0		1.0	4.0	4.0	1.5	4.0	4.0
Lane Grp Cap (vph)		137	172		137		158	2620	1172	89	2056	920
v/s Ratio Prot							c0.06	c0.21		0.04	c0.85	
v/s Ratio Perm		0.06	0.01		c0.08				0.02			0.07
v/c Ratio		0.55	0.11		0.77		0.70	0.28	0.03	0.57	1.19	0.10
Uniform Delay, d1		52.4	49.8		53.7		54.8	5.3	4.3	56.6	17.9	5.5
Progression Factor		1.00	1.00		1.00		0.79	1.67	3.50	1.17	0.36	0.24
Incremental Delay, d2		2.4	0.1		20.5		9.1	0.2	0.0	1.7	85.7	0.1
Delay (s)		54.7	49.9		74.3		52.2	9.0	15.0	68.0	92.1	1.4
Level of Service		D	D		E		D	A	B	E	F	A
Approach Delay (s)		51.6			74.3			14.7			88.4	
Approach LOS		D			E			B			F	

Intersection Summary			
HCM Average Control Delay	68.5	HCM Level of Service	E
HCM Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	15.2
Intersection Capacity Utilization	102.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

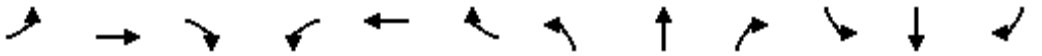
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	224	67	64	301	144	61	35	177	742	229	20	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1500
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	5.0		4.0
Lane Util. Factor	0.97	1.00		0.95	0.95	1.00		1.00	0.95	1.00		1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00	1.00	0.76		1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
Frt	1.00	0.93		1.00	1.00	0.85		1.00	1.00	0.85		1.00
Flt Protected	0.95	1.00		0.95	0.98	1.00		0.95	1.00	1.00		0.95
Satd. Flow (prot)	3433	1726		1681	1738	1559		1770	3539	1196		1397
Flt Permitted	0.95	1.00		0.95	0.98	1.00		0.95	1.00	1.00		0.95
Satd. Flow (perm)	3433	1726		1681	1738	1559		1770	3539	1196		1397
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	243	73	70	327	157	66	38	192	807	249	22	174
RTOR Reduction (vph)	0	31	0	0	0	55	0	0	0	154	0	0
Lane Group Flow (vph)	243	112	0	239	245	11	0	230	807	95	0	196
Confl. Peds. (#/hr)	2					2				74		74
Turn Type	Split			Split		Perm	Prot	Prot		Perm	Prot	Prot
Protected Phases	8	8		4	4		5	5	2		1	1
Permitted Phases						4				2		
Actuated Green, G (s)	13.5	13.5		21.2	21.2	21.2		26.0	47.3	47.3		25.0
Effective Green, g (s)	13.5	13.5		21.2	21.2	21.2		26.0	47.3	47.3		25.0
Actuated g/C Ratio	0.11	0.11		0.17	0.17	0.17		0.21	0.38	0.38		0.20
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	5.0		4.0
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0		2.0	3.0	3.0		2.0
Lane Grp Cap (vph)	374	188		287	297	267		371	1350	456		282
v/s Ratio Prot	c0.07	0.06		c0.14	0.14			0.13	0.23			c0.14
v/s Ratio Perm						0.01				0.08		
v/c Ratio	0.65	0.59		0.83	0.82	0.04		0.62	0.60	0.21		0.70
Uniform Delay, d1	53.0	52.6		49.7	49.6	42.9		44.5	30.7	25.8		46.0
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		0.81
Incremental Delay, d2	2.9	3.3		17.6	16.0	0.0		2.2	2.0	1.0		0.6
Delay (s)	55.9	56.0		67.3	65.6	42.9		46.7	32.7	26.8		37.6
Level of Service	E	E		E	E	D		D	C	C		D
Approach Delay (s)		55.9			63.6				34.1			
Approach LOS		E			E				C			

Intersection Summary			
HCM Average Control Delay	203.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	105.1%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations		
Volume (vph)	1700	674
Ideal Flow (vphpl)	1500	1500
Total Lost time (s)	5.0	5.0
Lane Util. Factor	0.95	1.00
Frpb, ped/bikes	1.00	1.00
Flpb, ped/bikes	1.00	1.00
Frt	1.00	0.85
Flt Protected	1.00	1.00
Satd. Flow (prot)	2794	1250
Flt Permitted	1.00	1.00
Satd. Flow (perm)	2794	1250
Peak-hour factor, PHF	0.92	0.92
Adj. Flow (vph)	1848	733
RTOR Reduction (vph)	0	63
Lane Group Flow (vph)	1848	670
Confl. Peds. (#/hr)		
Turn Type		Perm
Protected Phases	6	
Permitted Phases		6
Actuated Green, G (s)	46.3	46.3
Effective Green, g (s)	46.3	46.3
Actuated g/C Ratio	0.37	0.37
Clearance Time (s)	5.0	5.0
Vehicle Extension (s)	4.0	4.0
Lane Grp Cap (vph)	1043	467
v/s Ratio Prot	c0.66	
v/s Ratio Perm		0.54
v/c Ratio	1.77	1.44
Uniform Delay, d1	38.9	38.9
Progression Factor	1.22	1.27
Incremental Delay, d2	347.7	197.1
Delay (s)	395.0	246.6
Level of Service	F	F
Approach Delay (s)	330.6	
Approach LOS	F	

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	243	331	123	0	0	0	276	720	473	0	597	662
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5				4.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	1.00				1.00	0.95	1.00		0.95	1.00
Frt	1.00	1.00	0.85				1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00				0.95	1.00	1.00		1.00	1.00
Satd. Flow (prot)	1770	3539	1583				1770	3539	1583		3539	1583
Flt Permitted	0.95	1.00	1.00				0.95	1.00	1.00		1.00	1.00
Satd. Flow (perm)	1770	3539	1583				1770	3539	1583		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	264	360	134	0	0	0	300	783	514	0	649	720
RTOR Reduction (vph)	0	0	103	0	0	0	0	0	111	0	0	478
Lane Group Flow (vph)	264	360	31	0	0	0	300	783	403	0	649	242
Turn Type	Perm		Perm				Prot		Perm			Perm
Protected Phases		4					5	2			6	
Permitted Phases	4		4						2			6
Actuated Green, G (s)	16.1	16.1	16.1				16.9	44.4	44.4		23.5	23.5
Effective Green, g (s)	16.1	16.1	16.1				16.9	44.4	44.4		23.5	23.5
Actuated g/C Ratio	0.23	0.23	0.23				0.24	0.63	0.63		0.34	0.34
Clearance Time (s)	4.5	4.5	4.5				4.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	2.0	2.0	2.0				2.0	4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	407	814	364				427	2245	1004		1188	531
v/s Ratio Prot		0.10					c0.17	0.22			c0.18	
v/s Ratio Perm	c0.15		0.02						0.25			0.15
v/c Ratio	0.65	0.44	0.08				0.70	0.35	0.40		0.55	0.46
Uniform Delay, d1	24.4	23.1	21.2				24.3	6.0	6.3		18.9	18.2
Progression Factor	1.00	1.00	1.00				1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.7	0.1	0.0				4.2	0.4	1.2		1.8	2.8
Delay (s)	27.1	23.2	21.2				28.5	6.4	7.5		20.7	21.0
Level of Service	C	C	C				C	A	A		C	C
Approach Delay (s)		24.2			0.0			10.9			20.9	
Approach LOS		C			A			B			C	

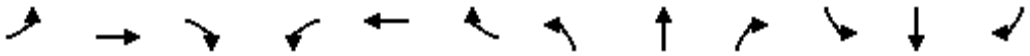
Intersection Summary			
HCM Average Control Delay	17.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	63.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Volume (vph)	75	35	143	26	0	150	0	1205	22	5	112	533
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	1.00	1.00		1.00		0.91			1.00	0.95
Frt		1.00	0.85	1.00		0.85		1.00			1.00	1.00
Flt Protected		0.97	1.00	0.95		1.00		1.00			0.95	1.00
Satd. Flow (prot)		1801	1583	1770		1583		5072			1770	3539
Flt Permitted		0.97	1.00	0.68		1.00		1.00			0.98	1.00
Satd. Flow (perm)		1801	1583	1266		1583		5072			1817	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	38	155	28	0	163	0	1310	24	5	122	579
RTOR Reduction (vph)	0	0	131	0	0	143	0	2	0	0	0	0
Lane Group Flow (vph)	0	120	24	28	0	20	0	1332	0	0	127	579
Turn Type	Split		Perm	custom		custom				custom	Prot	
Protected Phases	4	4						2			1	6
Permitted Phases			4	8		8				1		
Actuated Green, G (s)		9.6	9.6	7.3		7.3		23.8			4.1	31.9
Effective Green, g (s)		9.6	9.6	7.3		7.3		23.8			4.1	31.9
Actuated g/C Ratio		0.16	0.16	0.12		0.12		0.39			0.07	0.52
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)		284	250	152		190		1985			123	1857
v/s Ratio Prot		c0.07						c0.26				0.16
v/s Ratio Perm			0.02	c0.02		0.01					c0.07	
v/c Ratio		0.42	0.10	0.18		0.10		0.67			1.03	0.31
Uniform Delay, d1		23.1	21.9	24.1		23.8		15.3			28.3	8.2
Progression Factor		1.00	1.00	1.00		1.00		1.00			1.00	1.00
Incremental Delay, d2		1.0	0.2	0.6		0.2		0.9			90.1	0.1
Delay (s)		24.1	22.1	24.7		24.1		16.2			118.5	8.3
Level of Service		C	C	C		C		B			F	A
Approach Delay (s)		23.0			24.2			16.2				28.1
Approach LOS		C			C			B				C

Intersection Summary			
HCM Average Control Delay	20.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	60.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR
Lane Configurations	
Volume (vph)	0
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	0
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

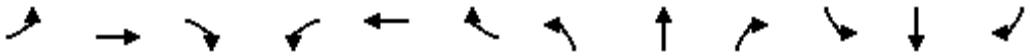
Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	38	282	70	200	738	42	124	17	111	28	8	52
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	41	307	76	217	802	46	135	18	121	30	9	57
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	848			383			1725	1710	345	1779	1725	825
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	848			383			1725	1710	345	1779	1725	825
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			82			0	74	83	13	87	85
cM capacity (veh/h)	790			1176			44	70	698	35	69	372

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1
Volume Total	41	383	217	848	153	121	96
Volume Left	41	0	217	0	135	0	30
Volume Right	0	76	0	46	0	121	57
cSH	790	1700	1176	1700	46	698	83
Volume to Capacity	0.05	0.23	0.18	0.50	3.31	0.17	1.15
Queue Length 95th (ft)	4	0	17	0	Err	16	170
Control Delay (s)	9.8	0.0	8.8	0.0	Err	11.2	233.5
Lane LOS	A		A		F	B	F
Approach Delay (s)	1.0		1.8		5599.6		233.5
Approach LOS					F		F

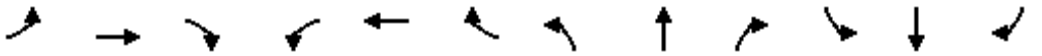
Intersection Summary			
Average Delay	838.5		
Intersection Capacity Utilization	69.1%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	26	262	1020	179	497	3	377	13	95	8	22	27
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	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.95	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)	1770	1676	1583	1770	1861		1681	1691	1583		1732	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)	1770	1676	1583	1770	1861		1681	1691	1583		1732	
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)	27	276	1074	188	523	3	397	14	100	8	23	28
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	79	0	25	0
Lane Group Flow (vph)	27	276	1074	188	526	0	206	205	21	0	34	0
Parking (#/hr)		0										
Turn Type	Prot		Free	Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			Free						2			
Actuated Green, G (s)	1.4	16.1	57.2	6.1	20.8		12.2	12.2	12.2		6.8	
Effective Green, g (s)	1.4	16.1	57.2	6.1	20.8		12.2	12.2	12.2		6.8	
Actuated g/C Ratio	0.02	0.28	1.00	0.11	0.36		0.21	0.21	0.21		0.12	
Clearance Time (s)	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	
Lane Grp Cap (vph)	43	472	1583	189	677		359	361	338		206	
v/s Ratio Prot	0.02	0.16		0.11	c0.28		0.12	0.12			0.02	
v/s Ratio Perm			c0.68						0.01			
v/c Ratio	0.63	0.58	0.68	0.99	0.78		0.57	0.57	0.06		0.17	
Uniform Delay, d1	27.6	17.7	0.0	25.5	16.1		20.2	20.1	17.9		22.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	25.3	1.9	2.4	63.6	5.6		2.2	2.0	0.1		0.4	
Delay (s)	52.9	19.5	2.4	89.1	21.7		22.4	22.2	18.0		23.0	
Level of Service	D	B	A	F	C		C	C	B		C	
Approach Delay (s)		6.8			39.5			21.5			23.0	
Approach LOS		A			D			C			C	

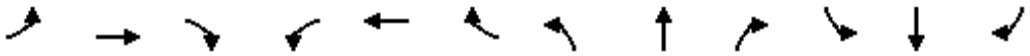
Intersection Summary			
HCM Average Control Delay	18.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	57.2	Sum of lost time (s)	0.0
Intersection Capacity Utilization	57.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group



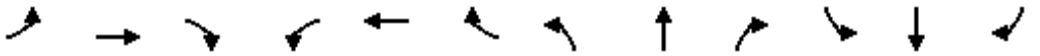
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	595	372	400	508	3	962	8	622	19	6	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	0.88		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (prot)	1770	3539	1583	1770	3536		1681	1687	2787		1748	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (perm)	1770	3539	1583	1770	3536		1681	1687	2787		1748	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	647	404	435	552	3	1046	9	676	21	7	10
RTOR Reduction (vph)	0	0	293	0	1	0	0	0	467	0	9	0
Lane Group Flow (vph)	1	647	111	435	554	0	523	532	209	0	29	0
Turn Type	Prot		Perm	Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4						2			
Actuated Green, G (s)	0.8	19.2	19.2	16.0	34.4		26.0	26.0	26.0		6.9	
Effective Green, g (s)	0.8	19.2	19.2	16.0	34.4		26.0	26.0	26.0		6.9	
Actuated g/C Ratio	0.01	0.23	0.23	0.19	0.41		0.31	0.31	0.31		0.08	
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)	17	808	361	337	1446		520	522	862		143	
v/s Ratio Prot	0.00	c0.18		c0.25	0.16		0.31	c0.32			c0.02	
v/s Ratio Perm			0.07						0.07			
v/c Ratio	0.06	0.80	0.31	1.29	0.38		1.01	1.02	0.24		0.20	
Uniform Delay, d1	41.3	30.6	26.9	34.0	17.4		29.0	29.0	21.7		36.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	1.5	5.7	0.5	151.4	0.2		40.9	44.3	0.1		0.7	
Delay (s)	42.7	36.4	27.4	185.4	17.6		70.0	73.4	21.8		36.7	
Level of Service	D	D	C	F	B		E	E	C		D	
Approach Delay (s)		32.9			91.3			52.2			36.7	
Approach LOS		C			F			D			D	

Intersection Summary			
HCM Average Control Delay	56.9	HCM Level of Service	E
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	84.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



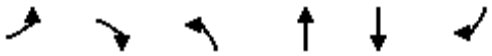
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	6	0	19	0	0	0	21	2271	0	0	841	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0					4.0	5.0			5.0	
Lane Util. Factor		1.00					1.00	0.95			0.95	
Frt		0.90					1.00	1.00			1.00	
Flt Protected		0.99					0.95	1.00			1.00	
Satd. Flow (prot)		1653					1770	3539			3528	
Flt Permitted		0.96					0.95	1.00			1.00	
Satd. Flow (perm)		1610					1770	3539			3528	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	7	0	21	0	0	0	23	2523	0	0	934	21
RTOR Reduction (vph)	0	20	0	0	0	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	8	0	0	0	0	23	2523	0	0	953	0
Turn Type	Perm			Perm			Prot					
Protected Phases		8			4		5	2			6	
Permitted Phases	8			4								
Actuated Green, G (s)		2.6					1.7	50.4			44.7	
Effective Green, g (s)		2.6					1.7	50.4			44.7	
Actuated g/C Ratio		0.04					0.03	0.81			0.72	
Clearance Time (s)		4.0					4.0	5.0			5.0	
Vehicle Extension (s)		2.5					2.0	4.0			4.0	
Lane Grp Cap (vph)		68					49	2877			2544	
v/s Ratio Prot							0.01	c0.71			0.27	
v/s Ratio Perm		c0.00										
v/c Ratio		0.12					0.47	0.88			0.37	
Uniform Delay, d1		28.6					29.7	3.8			3.3	
Progression Factor		1.00					1.21	1.63			1.00	
Incremental Delay, d2		0.6					1.5	2.4			0.4	
Delay (s)		29.1					37.3	8.6			3.7	
Level of Service		C					D	A			A	
Approach Delay (s)		29.1			0.0			8.8			3.7	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM Average Control Delay	7.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



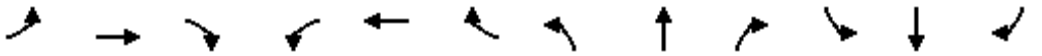
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	7	0	3	12	0	16	3	2310	24	12	819	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			4.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00			1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.96			1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96			0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1731			1770	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		1.00			1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1794			1863	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	8	0	3	13	0	17	3	2511	26	13	890	4
RTOR Reduction (vph)	0	3	0	0	0	16	0	0	5	0	0	1
Lane Group Flow (vph)	0	8	0	0	13	1	3	2511	21	13	890	3
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4		4			2			6
Actuated Green, G (s)		3.4			2.4	2.4	1.0	45.4	45.4	1.2	45.6	45.6
Effective Green, g (s)		3.4			2.4	2.4	1.0	45.4	45.4	1.2	45.6	45.6
Actuated g/C Ratio		0.05			0.04	0.04	0.02	0.73	0.73	0.02	0.74	0.74
Clearance Time (s)		3.0			4.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5			2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)		98			72	61	29	2591	1159	34	2603	1164
v/s Ratio Prot							0.00	c0.71		c0.01	0.25	
v/s Ratio Perm		0.00			c0.01	0.00			0.01			0.00
v/c Ratio		0.08			0.18	0.01	0.10	0.97	0.02	0.38	0.34	0.00
Uniform Delay, d1		27.8			28.8	28.7	30.1	7.7	2.3	30.0	2.9	2.2
Progression Factor		1.00			1.00	1.00	1.29	0.31	0.12	0.76	2.26	1.95
Incremental Delay, d2		0.3			0.4	0.0	0.2	5.2	0.0	2.5	0.3	0.0
Delay (s)		28.1			29.3	28.7	38.9	7.6	0.3	25.2	6.9	4.2
Level of Service		C			C	C	D	A	A	C	A	A
Approach Delay (s)		28.1			28.9			7.5			7.2	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	7.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	81.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	35	181	182	2322	755	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	197	198	2524	821	30
RTOR Reduction (vph)	0	175	0	0	0	15
Lane Group Flow (vph)	38	22	198	2524	821	15
Turn Type		Perm	Prot			Perm
Protected Phases	8		5	2	6	
Permitted Phases		8				6
Actuated Green, G (s)	7.0	7.0	11.2	46.0	30.8	30.8
Effective Green, g (s)	7.0	7.0	11.2	46.0	30.8	30.8
Actuated g/C Ratio	0.11	0.11	0.18	0.74	0.50	0.50
Clearance Time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Vehicle Extension (s)	2.5	2.5	2.0	4.0	4.0	4.0
Lane Grp Cap (vph)	200	179	320	2626	1758	786
v/s Ratio Prot	c0.02		0.11	c0.71	0.23	
v/s Ratio Perm		0.01				0.01
v/c Ratio	0.19	0.12	0.62	0.96	0.47	0.02
Uniform Delay, d1	24.9	24.7	23.4	7.2	10.2	7.9
Progression Factor	1.00	1.00	0.79	1.56	0.86	0.69
Incremental Delay, d2	0.3	0.2	0.8	4.3	0.9	0.0
Delay (s)	25.3	25.0	19.3	15.6	9.7	5.5
Level of Service	C	C	B	B	A	A
Approach Delay (s)	25.0			15.8	9.6	
Approach LOS	C			B	A	

Intersection Summary			
HCM Average Control Delay	15.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	75.0%	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)	21	2	94	22	0	6	129	2477	37	16	946	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1550	1550	1550
Total Lost time (s)		3.5	3.5		3.5		3.5	4.1	4.1	3.5	4.1	4.1
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.96		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1781	1583		1739		1770	3539	1583	1444	2887	1292
Flt Permitted		0.78	1.00		0.76		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1460	1583		1369		1770	3539	1583	1444	2887	1292
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	23	2	102	24	0	7	140	2692	40	17	1028	29
RTOR Reduction (vph)	0	0	94	0	6	0	0	0	3	0	0	7
Lane Group Flow (vph)	0	25	8	0	25	0	140	2692	37	17	1028	22
Turn Type	Perm		Perm	Perm			Prot		Perm	Prot		Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8		8	4					2			6
Actuated Green, G (s)		4.9	4.9		4.9		7.5	44.7	44.7	1.3	38.5	38.5
Effective Green, g (s)		4.9	4.9		4.9		7.5	44.7	44.7	1.3	38.5	38.5
Actuated g/C Ratio		0.08	0.08		0.08		0.12	0.72	0.72	0.02	0.62	0.62
Clearance Time (s)		3.5	3.5		3.5		3.5	4.1	4.1	3.5	4.1	4.1
Vehicle Extension (s)		2.0	2.0		2.0		1.0	4.0	4.0	1.5	4.0	4.0
Lane Grp Cap (vph)		115	125		108		214	2552	1141	30	1793	802
v/s Ratio Prot							c0.08	c0.76		0.01	0.36	
v/s Ratio Perm		0.02	0.01		c0.02				0.02			0.02
v/c Ratio		0.22	0.06		0.23		0.65	1.05	0.03	0.57	0.57	0.03
Uniform Delay, d1		26.8	26.4		26.8		26.0	8.6	2.5	30.1	6.9	4.5
Progression Factor		1.00	1.00		1.00		0.74	3.30	1.67	1.34	0.51	0.11
Incremental Delay, d2		0.3	0.1		0.4		0.5	25.9	0.0	12.8	1.2	0.1
Delay (s)		27.1	26.5		27.2		19.8	54.4	4.1	53.1	4.7	0.6
Level of Service		C	C		C		B	D	A	D	A	A
Approach Delay (s)		26.6			27.2			52.1			5.4	
Approach LOS		C			C			D			A	

Intersection Summary			
HCM Average Control Delay	38.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	11.1
Intersection Capacity Utilization	90.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

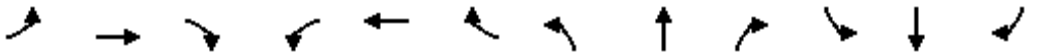
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	742	114	46	232	83	178	9	22	1758	229	6	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1500	1500
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.5	4.5		4.0
Lane Util. Factor	0.97	1.00		0.95	0.95	1.00		1.00	*0.92	1.00		1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00	1.00	0.76		1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
Frt	1.00	0.96		1.00	1.00	0.85		1.00	1.00	0.85		1.00
Flt Protected	0.95	1.00		0.95	0.98	1.00		0.95	1.00	1.00		0.95
Satd. Flow (prot)	3433	1783		1681	1728	1558		1770	3427	1196		1397
Flt Permitted	0.95	1.00		0.95	0.98	1.00		0.95	1.00	1.00		0.95
Satd. Flow (perm)	3433	1783		1681	1728	1558		1770	3427	1196		1397
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.97	0.97	0.97	0.97	0.95	0.95
Adj. Flow (vph)	781	120	48	244	87	187	9	23	1812	236	6	127
RTOR Reduction (vph)	0	11	0	0	0	50	0	0	0	75	0	0
Lane Group Flow (vph)	781	157	0	163	168	137	0	32	1812	161	0	133
Confl. Peds. (#/hr)	2					2				74		74
Turn Type	Split			Split		Perm	Prot	Prot		Perm	Prot	Prot
Protected Phases	8	8		4	4		5	5	2		1	1
Permitted Phases						4				2		
Actuated Green, G (s)	34.1	34.1		16.9	16.9	16.9		4.8	42.2	42.2		14.3
Effective Green, g (s)	34.1	34.1		16.9	16.9	16.9		4.8	42.2	42.2		14.3
Actuated g/C Ratio	0.28	0.28		0.14	0.14	0.14		0.04	0.34	0.34		0.12
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.5	4.5		4.0
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0		2.0	3.0	3.0		2.0
Lane Grp Cap (vph)	944	490		229	236	212		69	1166	407		161
v/s Ratio Prot	c0.23	0.09		0.10	c0.10			0.02	c0.53			c0.10
v/s Ratio Perm						0.09				0.13		
v/c Ratio	0.83	0.32		0.71	0.71	0.65		0.46	1.55	0.40		0.83
Uniform Delay, d1	42.2	35.7		51.2	51.2	50.7		58.3	40.9	31.2		53.6
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.11
Incremental Delay, d2	5.8	0.1		8.4	8.2	5.0		1.8	253.6	2.9		24.5
Delay (s)	47.9	35.9		59.6	59.4	55.7		60.1	294.5	34.0		84.2
Level of Service	D	D		E	E	E		E	F	C		F
Approach Delay (s)		45.8			58.1				261.3			
Approach LOS		D			E				F			

Intersection Summary			
HCM Average Control Delay	139.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	103.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBT	SBR
Lane Configurations		
Volume (vph)	788	190
Ideal Flow (vphpl)	1500	1500
Total Lost time (s)	5.0	5.0
Lane Util. Factor	0.95	1.00
Frpb, ped/bikes	1.00	1.00
Flpb, ped/bikes	1.00	1.00
Frt	1.00	0.85
Flt Protected	1.00	1.00
Satd. Flow (prot)	2794	1250
Flt Permitted	1.00	1.00
Satd. Flow (perm)	2794	1250
Peak-hour factor, PHF	0.95	0.95
Adj. Flow (vph)	829	200
RTOR Reduction (vph)	0	38
Lane Group Flow (vph)	829	162
Confl. Peds. (#/hr)		
Turn Type		Perm
Protected Phases	6	
Permitted Phases		6
Actuated Green, G (s)	51.2	51.2
Effective Green, g (s)	51.2	51.2
Actuated g/C Ratio	0.41	0.41
Clearance Time (s)	5.0	5.0
Vehicle Extension (s)	4.0	4.0
Lane Grp Cap (vph)	1154	516
v/s Ratio Prot	0.30	
v/s Ratio Perm		0.13
v/c Ratio	0.72	0.31
Uniform Delay, d1	30.4	24.6
Progression Factor	0.80	0.79
Incremental Delay, d2	3.5	1.4
Delay (s)	27.7	21.0
Level of Service	C	C
Approach Delay (s)	33.0	
Approach LOS	C	

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	244	437	263	0	0	0	247	632	334	0	608	473
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5				4.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	1.00				1.00	0.95	1.00		0.95	1.00
Frt	1.00	1.00	0.85				1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00				0.95	1.00	1.00		1.00	1.00
Satd. Flow (prot)	1770	3539	1583				1770	3539	1583		3539	1583
Flt Permitted	0.95	1.00	1.00				0.95	1.00	1.00		1.00	1.00
Satd. Flow (perm)	1770	3539	1583				1770	3539	1583		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	265	475	286	0	0	0	268	687	363	0	661	514
RTOR Reduction (vph)	0	0	181	0	0	0	0	0	76	0	0	332
Lane Group Flow (vph)	265	475	105	0	0	0	268	687	287	0	661	182
Turn Type	Perm		Perm				Prot		Perm			Perm
Protected Phases		4					5	2			6	
Permitted Phases	4		4						2			6
Actuated Green, G (s)	17.5	17.5	17.5				14.2	43.0	43.0		24.8	24.8
Effective Green, g (s)	17.5	17.5	17.5				14.2	43.0	43.0		24.8	24.8
Actuated g/C Ratio	0.25	0.25	0.25				0.20	0.61	0.61		0.35	0.35
Clearance Time (s)	4.5	4.5	4.5				4.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	2.0	2.0	2.0				2.0	4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	443	885	396				359	2174	972		1254	561
v/s Ratio Prot		0.13					c0.15	0.19			c0.19	
v/s Ratio Perm	c0.15		0.07						0.18			0.12
v/c Ratio	0.60	0.54	0.27				0.75	0.32	0.29		0.53	0.32
Uniform Delay, d1	23.1	22.7	21.1				26.2	6.5	6.4		17.9	16.5
Progression Factor	1.00	1.00	1.00				1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.5	0.3	0.1				7.2	0.4	0.8		1.6	1.5
Delay (s)	24.6	23.1	21.2				33.4	6.8	7.1		19.5	18.0
Level of Service	C	C	C				C	A	A		B	B
Approach Delay (s)		22.9			0.0			12.3			18.9	
Approach LOS		C			A			B			B	

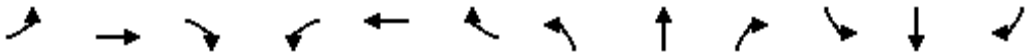
Intersection Summary			
HCM Average Control Delay	17.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	55.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Volume (vph)	114	58	293	28	0	181	0	906	19	5	113	794
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	1.00	1.00		1.00		0.91			1.00	0.95
Frt		1.00	0.85	1.00		0.85		1.00			1.00	1.00
Flt Protected		0.97	1.00	0.95		1.00		1.00			0.95	1.00
Satd. Flow (prot)		1803	1583	1770		1583		5069			1770	3539
Flt Permitted		0.97	1.00	0.64		1.00		1.00			0.66	1.00
Satd. Flow (perm)		1803	1583	1192		1583		5069			1221	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	124	63	318	30	0	197	0	985	21	5	123	863
RTOR Reduction (vph)	0	0	254	0	0	172	0	3	0	0	0	0
Lane Group Flow (vph)	0	187	64	30	0	25	0	1003	0	0	128	863
Turn Type	Split		Perm	custom		custom				custom	Prot	
Protected Phases	4	4						2			1	6
Permitted Phases			4	8		8				1		
Actuated Green, G (s)		11.4	11.4	7.3		7.3		15.7			6.1	25.8
Effective Green, g (s)		11.4	11.4	7.3		7.3		15.7			6.1	25.8
Actuated g/C Ratio		0.20	0.20	0.13		0.13		0.28			0.11	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)		364	319	154		205		1409			132	1616
v/s Ratio Prot		c0.10						c0.20				0.24
v/s Ratio Perm			0.04	c0.03		0.02					c0.10	
v/c Ratio		0.51	0.20	0.19		0.12		0.71			0.97	0.53
Uniform Delay, d1		20.1	18.8	22.0		21.8		18.4			25.1	11.0
Progression Factor		1.00	1.00	1.00		1.00		1.00			1.00	1.00
Incremental Delay, d2		1.2	0.3	0.6		0.3		1.7			68.1	0.3
Delay (s)		21.3	19.1	22.6		22.0		20.1			93.2	11.4
Level of Service		C	B	C		C		C			F	B
Approach Delay (s)		19.9			22.1			20.1				21.9
Approach LOS		B			C			C				C

Intersection Summary			
HCM Average Control Delay	20.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	56.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	58.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

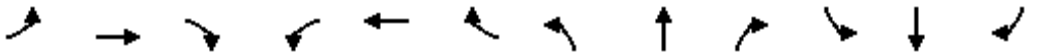
Movement	SBR
Lane Configurations	
Volume (vph)	0
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	0
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	62	636	66	115	304	92	68	9	127	61	12	19
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	67	691	72	125	330	100	74	10	138	66	13	21
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	430			763			1470	1542	727	1599	1528	380
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	430			763			1470	1542	727	1599	1528	380
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	94			85			5	89	67	0	86	97
cM capacity (veh/h)	1129			850			78	92	424	45	94	667

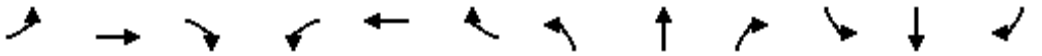
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1
Volume Total	67	763	125	430	84	138	100
Volume Left	67	0	125	0	74	0	66
Volume Right	0	72	0	100	0	138	21
cSH	1129	1700	850	1700	79	424	61
Volume to Capacity	0.06	0.45	0.15	0.25	1.06	0.33	1.64
Queue Length 95th (ft)	5	0	13	0	147	35	226
Control Delay (s)	8.4	0.0	10.0	0.0	211.2	17.5	462.2
Lane LOS	A		A		F	C	F
Approach Delay (s)	0.7		2.2		90.6		462.2
Approach LOS					F		F

Intersection Summary				
Average Delay	39.9			
Intersection Capacity Utilization	65.7%	ICU Level of Service	C	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	22	612	1497	146	287	3	300	19	152	5	24	9
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	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.95	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)	1770	1863	1583	1770	1860		1681	1695	1583		1793	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)	1770	1863	1583	1770	1860		1681	1695	1583		1793	
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)	23	644	1576	154	302	3	316	20	160	5	25	9
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	134	0	8	0
Lane Group Flow (vph)	23	644	1576	154	305	0	167	169	26	0	31	0
Turn Type	Prot		Free	Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			Free						2			
Actuated Green, G (s)	1.9	33.5	78.4	9.1	40.7		12.9	12.9	12.9		6.9	
Effective Green, g (s)	1.9	33.5	78.4	9.1	40.7		12.9	12.9	12.9		6.9	
Actuated g/C Ratio	0.02	0.43	1.00	0.12	0.52		0.16	0.16	0.16		0.09	
Clearance Time (s)	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	
Lane Grp Cap (vph)	43	796	1583	205	966		277	279	260		158	
v/s Ratio Prot	0.01	0.35		0.09	0.16		0.10	0.10			0.02	
v/s Ratio Perm			c1.00						0.02			
v/c Ratio	0.53	0.81	1.00	0.75	0.32		0.60	0.61	0.10		0.19	
Uniform Delay, d1	37.8	19.7	0.0	33.6	10.8		30.4	30.4	27.8		33.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	12.2	6.1	21.6	14.3	0.2		3.7	3.7	0.2		0.6	
Delay (s)	50.0	25.7	21.6	47.9	11.0		34.0	34.1	28.0		33.8	
Level of Service	D	C	C	D	B		C	C	C		C	
Approach Delay (s)		23.1			23.4			32.1			33.8	
Approach LOS		C			C			C			C	

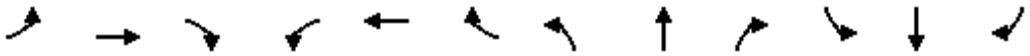
Intersection Summary			
HCM Average Control Delay	24.6	HCM Level of Service	C
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	78.4	Sum of lost time (s)	0.0
Intersection Capacity Utilization	65.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	1182	379	307	248	3	674	9	934	19	1	9
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	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	0.88		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (prot)	1770	3539	1583	1770	3533		1681	1688	2787		1727	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (perm)	1770	3539	1583	1770	3533		1681	1688	2787		1727	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	1285	412	334	270	3	733	10	1015	21	1	10
RTOR Reduction (vph)	0	0	148	0	1	0	0	0	574	0	9	0
Lane Group Flow (vph)	36	1285	264	334	272	0	374	369	441	0	23	0
Turn Type	Prot		Perm	Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4						2			
Actuated Green, G (s)	2.4	32.7	32.7	10.0	40.3		17.0	17.0	17.0		6.7	
Effective Green, g (s)	2.4	32.7	32.7	10.0	40.3		17.0	17.0	17.0		6.7	
Actuated g/C Ratio	0.03	0.40	0.40	0.12	0.49		0.21	0.21	0.21		0.08	
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)	52	1404	628	215	1728		347	348	575		140	
v/s Ratio Prot	0.02	c0.36		c0.19	0.08		c0.22	0.22			c0.01	
v/s Ratio Perm			0.17						0.16			
v/c Ratio	0.69	0.92	0.42	1.55	0.16		1.08	1.06	0.77		0.16	
Uniform Delay, d1	39.6	23.5	18.0	36.2	11.7		32.7	32.7	30.8		35.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	33.0	9.5	0.5	270.7	0.0		70.6	65.1	6.1		0.5	
Delay (s)	72.6	33.0	18.4	306.9	11.7		103.3	97.8	36.9		35.8	
Level of Service	E	C	B	F	B		F	F	D		D	
Approach Delay (s)		30.4			174.1			63.8			35.8	
Approach LOS		C			F			E			D	

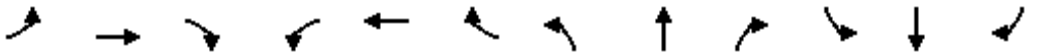
Intersection Summary			
HCM Average Control Delay	65.8	HCM Level of Service	E
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	82.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	85.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Appendix E – Level of Service Worksheets: Cumulative Year 2030 plus Project Conditions



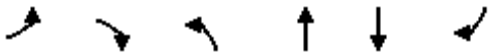
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	37	0	0	0	23	788	0	0	1708	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0					4.0	5.0			5.0	
Lane Util. Factor		1.00					1.00	0.95			0.95	
Frt		0.86					1.00	1.00			1.00	
Flt Protected		1.00					0.95	1.00			1.00	
Satd. Flow (prot)		1611					1770	3539			3536	
Flt Permitted		1.00					0.95	1.00			1.00	
Satd. Flow (perm)		1611					1770	3539			3536	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	0	0	41	0	0	0	29	985	0	0	2135	12
RTOR Reduction (vph)	0	40	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1	0	0	0	0	29	985	0	0	2147	0
Turn Type	Perm			Perm			Prot					
Protected Phases		8			4		5	2			6	
Permitted Phases	8			4								
Actuated Green, G (s)		2.0					2.7	51.0			44.3	
Effective Green, g (s)		2.0					2.7	51.0			44.3	
Actuated g/C Ratio		0.03					0.04	0.82			0.71	
Clearance Time (s)		4.0					4.0	5.0			5.0	
Vehicle Extension (s)		2.5					2.0	4.0			4.0	
Lane Grp Cap (vph)		52					77	2911			2527	
v/s Ratio Prot		c0.00					0.02	c0.28			c0.61	
v/s Ratio Perm												
v/c Ratio		0.03					0.38	0.34			0.85	
Uniform Delay, d1		29.1					28.8	1.4			6.4	
Progression Factor		1.00					0.92	2.19			1.00	
Incremental Delay, d2		0.1					1.1	0.3			3.8	
Delay (s)		29.2					27.6	3.3			10.2	
Level of Service		C					C	A			B	
Approach Delay (s)		29.2			0.0			4.0			10.2	
Approach LOS		C			A			A			B	

Intersection Summary			
HCM Average Control Delay	8.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	58.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



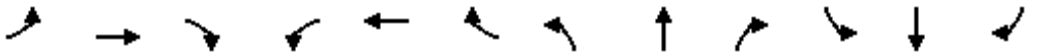
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	0	5	23	0	12	0	807	18	8	1839	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			4.0	4.0		5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00			1.00	1.00		0.95	1.00	1.00	0.95	1.00
Frt		0.90			1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99			0.95	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1653			1770	1583		3539	1583	1770	3539	1583
Flt Permitted		0.91			1.00	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1531			1863	1583		3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	2	0	6	26	0	13	0	897	20	9	2043	1
RTOR Reduction (vph)	0	6	0	0	0	12	0	0	5	0	0	0
Lane Group Flow (vph)	0	2	0	0	26	1	0	897	15	9	2043	1
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4		4			2			6
Actuated Green, G (s)		3.7			2.7	2.7		45.2	45.2	1.1	50.3	50.3
Effective Green, g (s)		3.7			2.7	2.7		45.2	45.2	1.1	50.3	50.3
Actuated g/C Ratio		0.06			0.04	0.04		0.73	0.73	0.02	0.81	0.81
Clearance Time (s)		3.0			4.0	4.0		5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5			2.0	2.0		4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)		91			81	69		2580	1154	31	2871	1284
v/s Ratio Prot								0.25		0.01	c0.58	
v/s Ratio Perm		0.00			c0.01	0.00			0.01			0.00
v/c Ratio		0.03			0.32	0.01		0.35	0.01	0.29	0.71	0.00
Uniform Delay, d1		27.5			28.8	28.4		3.0	2.3	30.1	2.6	1.1
Progression Factor		1.00			1.00	1.00		1.80	2.43	1.02	2.35	0.97
Incremental Delay, d2		0.1			0.8	0.0		0.4	0.0	1.3	1.1	0.0
Delay (s)		27.5			29.6	28.4		5.8	5.6	31.9	7.2	1.1
Level of Service		C			C	C		A	A	C	A	A
Approach Delay (s)		27.5			29.2			5.8			7.3	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	7.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	24	242	102	809	1952	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3539	1583
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	28	285	120	952	2296	13
RTOR Reduction (vph)	0	91	0	0	0	2
Lane Group Flow (vph)	28	194	120	952	2296	11
Turn Type		Perm	Prot			Perm
Protected Phases	8		5	2	6	
Permitted Phases		8				6
Actuated Green, G (s)	18.8	18.8	11.5	96.2	80.7	80.7
Effective Green, g (s)	18.8	18.8	11.5	96.2	80.7	80.7
Actuated g/C Ratio	0.15	0.15	0.09	0.78	0.65	0.65
Clearance Time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Vehicle Extension (s)	2.5	2.5	2.0	4.0	4.0	4.0
Lane Grp Cap (vph)	268	240	164	2746	2303	1030
v/s Ratio Prot	0.02		c0.07	0.27	c0.65	
v/s Ratio Perm		c0.12				0.01
v/c Ratio	0.10	0.81	0.73	0.35	1.00	0.01
Uniform Delay, d1	45.3	50.9	54.7	4.3	21.5	7.6
Progression Factor	1.00	1.00	0.93	1.14	1.07	1.26
Incremental Delay, d2	0.1	17.5	13.3	0.3	16.4	0.0
Delay (s)	45.5	68.3	64.2	5.2	39.3	9.6
Level of Service	D	E	E	A	D	A
Approach Delay (s)	66.3			11.8	39.1	
Approach LOS	E			B	D	

Intersection Summary			
HCM Average Control Delay	33.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	76.4%	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)	64	5	131	66	24	10	101	686	46	47	2252	86
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1550	1550	1550
Total Lost time (s)		3.5	3.5		3.5		3.5	4.1	4.1	3.5	4.1	4.1
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.97		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1780	1583		1779		1770	3539	1583	1444	2887	1292
Flt Permitted		0.68	1.00		0.68		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1258	1583		1254		1770	3539	1583	1444	2887	1292
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	70	5	142	72	26	11	110	746	50	51	2448	93
RTOR Reduction (vph)	0	0	124	0	4	0	0	0	12	0	0	5
Lane Group Flow (vph)	0	75	18	0	105	0	110	746	38	51	2448	88
Turn Type	Perm		Perm	Perm			Prot		Perm	Prot		Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8		8	4					2			6
Actuated Green, G (s)		13.5	13.5		13.5		11.1	91.8	91.8	7.6	88.3	88.3
Effective Green, g (s)		13.5	13.5		13.5		11.1	91.8	91.8	7.6	88.3	88.3
Actuated g/C Ratio		0.11	0.11		0.11		0.09	0.74	0.74	0.06	0.71	0.71
Clearance Time (s)		3.5	3.5		3.5		3.5	4.1	4.1	3.5	4.1	4.1
Vehicle Extension (s)		2.0	2.0		2.0		1.0	4.0	4.0	1.5	4.0	4.0
Lane Grp Cap (vph)		137	172		137		158	2620	1172	89	2056	920
v/s Ratio Prot							c0.06	c0.21		0.04	c0.85	
v/s Ratio Perm		0.06	0.01		c0.08				0.02			0.07
v/c Ratio		0.55	0.11		0.77		0.70	0.28	0.03	0.57	1.19	0.10
Uniform Delay, d1		52.4	49.8		53.7		54.8	5.3	4.3	56.6	17.9	5.5
Progression Factor		1.00	1.00		1.00		0.79	1.67	3.42	1.17	0.36	0.24
Incremental Delay, d2		2.4	0.1		20.5		9.1	0.2	0.0	1.7	87.4	0.1
Delay (s)		54.7	49.9		74.3		52.2	9.1	14.7	68.0	93.8	1.4
Level of Service		D	D		E		D	A	B	E	F	A
Approach Delay (s)		51.6			74.3			14.6			90.0	
Approach LOS		D			E			B			F	

Intersection Summary			
HCM Average Control Delay	69.5	HCM Level of Service	E
HCM Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	15.2
Intersection Capacity Utilization	102.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

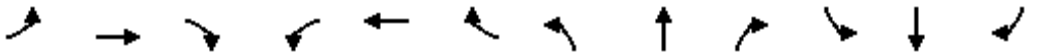
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	229	70	53	302	146	61	43	184	744	230	20	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1500
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	5.0		4.0
Lane Util. Factor	0.97	1.00		0.95	0.95	1.00		1.00	0.95	1.00		1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00	1.00	0.76		1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
Frt	1.00	0.94		1.00	1.00	0.85		1.00	1.00	0.85		1.00
Flt Protected	0.95	1.00		0.95	0.98	1.00		0.95	1.00	1.00		0.95
Satd. Flow (prot)	3433	1742		1681	1738	1559		1770	3539	1196		1397
Flt Permitted	0.95	1.00		0.95	0.98	1.00		0.95	1.00	1.00		0.95
Satd. Flow (perm)	3433	1742		1681	1738	1559		1770	3539	1196		1397
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	249	76	58	328	159	66	47	200	809	250	22	174
RTOR Reduction (vph)	0	25	0	0	0	55	0	0	0	155	0	0
Lane Group Flow (vph)	249	109	0	239	248	11	0	247	809	95	0	196
Confl. Peds. (#/hr)	2					2				74		74
Turn Type	Split			Split		Perm	Prot	Prot		Perm	Prot	Prot
Protected Phases	8	8		4	4		5	5	2		1	1
Permitted Phases						4				2		
Actuated Green, G (s)	13.5	13.5		21.2	21.2	21.2		28.3	47.2	47.2		25.1
Effective Green, g (s)	13.5	13.5		21.2	21.2	21.2		28.3	47.2	47.2		25.1
Actuated g/C Ratio	0.11	0.11		0.17	0.17	0.17		0.23	0.38	0.38		0.20
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	5.0	5.0		4.0
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0		2.0	3.0	3.0		2.0
Lane Grp Cap (vph)	374	190		287	297	267		404	1347	455		283
v/s Ratio Prot	c0.07	0.06		0.14	c0.14			0.14	c0.23			c0.14
v/s Ratio Perm						0.01				0.08		
v/c Ratio	0.67	0.57		0.83	0.84	0.04		0.61	0.60	0.21		0.69
Uniform Delay, d1	53.1	52.5		49.7	49.7	42.9		42.9	30.8	25.8		45.9
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		0.81
Incremental Delay, d2	3.4	2.6		17.6	17.3	0.0		1.9	2.0	1.0		0.5
Delay (s)	56.5	55.1		67.3	67.0	42.9		44.8	32.8	26.9		37.6
Level of Service	E	E		E	E	D		D	C	C		D
Approach Delay (s)		56.0			64.2				34.0			
Approach LOS		E			E				C			

Intersection Summary			
HCM Average Control Delay	225.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	22.0
Intersection Capacity Utilization	105.6%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

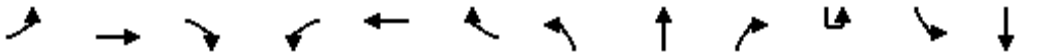
Movement	SBT	SBR
Lane Configurations		
Volume (vph)	1704	677
Ideal Flow (vphpl)	1500	1500
Total Lost time (s)	5.0	5.0
Lane Util. Factor	0.95	1.00
Frpb, ped/bikes	1.00	1.00
Flpb, ped/bikes	1.00	1.00
Frt	1.00	0.85
Flt Protected	1.00	1.00
Satd. Flow (prot)	2794	1250
Flt Permitted	1.00	1.00
Satd. Flow (perm)	2794	1250
Peak-hour factor, PHF	0.92	0.92
Adj. Flow (vph)	1852	736
RTOR Reduction (vph)	0	65
Lane Group Flow (vph)	1852	671
Confl. Peds. (#/hr)		
Turn Type		Perm
Protected Phases	6	
Permitted Phases		6
Actuated Green, G (s)	44.0	44.0
Effective Green, g (s)	44.0	44.0
Actuated g/C Ratio	0.35	0.35
Clearance Time (s)	5.0	5.0
Vehicle Extension (s)	4.0	4.0
Lane Grp Cap (vph)	991	444
v/s Ratio Prot	c0.66	
v/s Ratio Perm		0.54
v/c Ratio	1.87	1.51
Uniform Delay, d1	40.0	40.0
Progression Factor	1.22	1.27
Incremental Delay, d2	391.3	231.0
Delay (s)	439.9	281.7
Level of Service	F	F
Approach Delay (s)	369.8	
Approach LOS	F	

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	243	331	123	0	0	0	276	732	473	0	610	664
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5				4.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	1.00				1.00	0.95	1.00		0.95	1.00
Frt	1.00	1.00	0.85				1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00				0.95	1.00	1.00		1.00	1.00
Satd. Flow (prot)	1770	3539	1583				1770	3539	1583		3539	1583
Flt Permitted	0.95	1.00	1.00				0.95	1.00	1.00		1.00	1.00
Satd. Flow (perm)	1770	3539	1583				1770	3539	1583		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	264	360	134	0	0	0	300	796	514	0	663	722
RTOR Reduction (vph)	0	0	103	0	0	0	0	0	111	0	0	480
Lane Group Flow (vph)	264	360	31	0	0	0	300	796	403	0	663	242
Turn Type	Perm		Perm				Prot		Perm			Perm
Protected Phases		4					5	2			6	
Permitted Phases	4		4						2			6
Actuated Green, G (s)	16.1	16.1	16.1				16.9	44.4	44.4		23.5	23.5
Effective Green, g (s)	16.1	16.1	16.1				16.9	44.4	44.4		23.5	23.5
Actuated g/C Ratio	0.23	0.23	0.23				0.24	0.63	0.63		0.34	0.34
Clearance Time (s)	4.5	4.5	4.5				4.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	2.0	2.0	2.0				2.0	4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	407	814	364				427	2245	1004		1188	531
v/s Ratio Prot		0.10					c0.17	0.22			c0.19	
v/s Ratio Perm	c0.15		0.02						0.25			0.15
v/c Ratio	0.65	0.44	0.08				0.70	0.35	0.40		0.56	0.46
Uniform Delay, d1	24.4	23.1	21.2				24.3	6.0	6.3		19.0	18.2
Progression Factor	1.00	1.00	1.00				1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.7	0.1	0.0				4.2	0.4	1.2		1.9	2.8
Delay (s)	27.1	23.2	21.2				28.5	6.5	7.5		20.9	21.1
Level of Service	C	C	C				C	A	A		C	C
Approach Delay (s)		24.2			0.0			10.9			21.0	
Approach LOS		C			A			B			C	

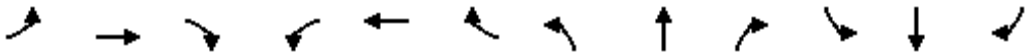
Intersection Summary			
HCM Average Control Delay	17.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	63.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Volume (vph)	75	35	143	26	0	151	0	1213	22	8	113	542
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	1.00	1.00		1.00		0.91			1.00	0.95
Frt		1.00	0.85	1.00		0.85		1.00			1.00	1.00
Flt Protected		0.97	1.00	0.95		1.00		1.00			0.95	1.00
Satd. Flow (prot)		1801	1583	1770		1583		5072			1770	3539
Flt Permitted		0.97	1.00	0.68		1.00		1.00			0.98	1.00
Satd. Flow (perm)		1801	1583	1266		1583		5072			1817	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	38	155	28	0	164	0	1318	24	9	123	589
RTOR Reduction (vph)	0	0	131	0	0	144	0	2	0	0	0	0
Lane Group Flow (vph)	0	120	24	28	0	20	0	1340	0	0	132	589
Turn Type	Split		Perm	custom		custom				custom	Prot	
Protected Phases	4	4						2			1	6
Permitted Phases			4	8		8				1		
Actuated Green, G (s)		9.6	9.6	7.3		7.3		23.8			4.1	31.9
Effective Green, g (s)		9.6	9.6	7.3		7.3		23.8			4.1	31.9
Actuated g/C Ratio		0.16	0.16	0.12		0.12		0.39			0.07	0.52
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)		284	250	152		190		1985			123	1857
v/s Ratio Prot		c0.07						c0.26				0.17
v/s Ratio Perm			0.02	c0.02		0.01					c0.07	
v/c Ratio		0.42	0.10	0.18		0.10		0.67			1.07	0.32
Uniform Delay, d1		23.1	21.9	24.1		23.8		15.3			28.3	8.2
Progression Factor		1.00	1.00	1.00		1.00		1.00			1.00	1.00
Incremental Delay, d2		1.0	0.2	0.6		0.2		0.9			102.1	0.1
Delay (s)		24.1	22.1	24.7		24.1		16.2			130.5	8.3
Level of Service		C	C	C		C		B			F	A
Approach Delay (s)		23.0			24.2			16.2				30.7
Approach LOS		C			C			B				C

Intersection Summary			
HCM Average Control Delay	21.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	60.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

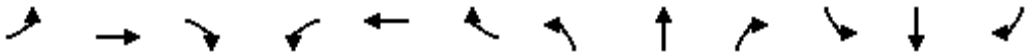
Movement	SBR
Lane Configurations	
Volume (vph)	0
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	0
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	38	291	70	200	750	42	124	17	111	28	8	52
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	41	316	76	217	815	46	135	18	121	30	9	57
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	861			392			1748	1733	354	1802	1748	838
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	861			392			1748	1733	354	1802	1748	838
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			81			0	73	83	9	87	85
cM capacity (veh/h)	781			1166			42	68	689	33	66	366

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1
Volume Total	41	392	217	861	153	121	96
Volume Left	41	0	217	0	135	0	30
Volume Right	0	76	0	46	0	121	57
cSH	781	1700	1166	1700	44	689	80
Volume to Capacity	0.05	0.23	0.19	0.51	3.46	0.17	1.20
Queue Length 95th (ft)	4	0	17	0	Err	16	176
Control Delay (s)	9.9	0.0	8.8	0.0	Err	11.3	256.6
Lane LOS	A		A		F	B	F
Approach Delay (s)	0.9		1.8		5599.7		256.6
Approach LOS					F		F

Intersection Summary			
Average Delay	829.5		
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	38	291	70	200	750	42	124	17	111	28	8	52
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	1.00		1.00	1.00			1.00	1.00		1.00	
Frt	1.00	0.97		1.00	0.99			1.00	0.85		0.92	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.98	
Satd. Flow (prot)	1770	1809		1770	1848			1784	1583		1687	
Flt Permitted	0.14	1.00		0.48	1.00			0.74	1.00		0.90	
Satd. Flow (perm)	252	1809		888	1848			1383	1583		1535	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	316	76	217	815	46	135	18	121	30	9	57
RTOR Reduction (vph)	0	16	0	0	4	0	0	0	84	0	39	0
Lane Group Flow (vph)	41	376	0	217	857	0	0	153	37	0	57	0
Turn Type	Perm			Perm			Perm		Perm	Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	33.5	33.5		33.5	33.5			18.5	18.5		18.5	
Effective Green, g (s)	33.5	33.5		33.5	33.5			18.5	18.5		18.5	
Actuated g/C Ratio	0.56	0.56		0.56	0.56			0.31	0.31		0.31	
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)	141	1010		496	1032			426	488		473	
v/s Ratio Prot		0.21			c0.46							
v/s Ratio Perm	0.16			0.24				c0.11	0.02		0.04	
v/c Ratio	0.29	0.37		0.44	0.83			0.36	0.08		0.12	
Uniform Delay, d1	7.0	7.4		7.7	10.9			16.1	14.7		14.9	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	1.1	0.2		0.6	5.8			2.3	0.3		0.5	
Delay (s)	8.1	7.6		8.4	16.7			18.5	15.0		15.4	
Level of Service	A	A		A	B			B	B		B	
Approach Delay (s)		7.7			15.0			16.9			15.4	
Approach LOS		A			B			B			B	

Intersection Summary			
HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

INTERSECTION SUMMARY

Site: Int #8 Cumul Plus Proj AM

Roundabout with 5 legs, and 1-lane approaches and circulating road

Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	27.8	mph	27.8	mph
Travel Distance (Total)	1180.6	veh-mi/h	1416.7	pers-mi/h
Travel Time (Total)	42.5	veh-h/h	51.0	pers-h/h
Demand Flows (Total)	1884	veh/h	2260	pers/h
Percent Heavy Vehicles (Demand)	0.3	%		
Degree of Saturation	0.912			
Practical Spare Capacity	-6.8	%		
Effective Intersection Capacity	2066	veh/h		
Control Delay (Total)	10.12	veh-h/h	12.14	pers-h/h
Control Delay (Average)	19.3	sec	19.3	sec
Control Delay (Worst Lane)	28.3	sec		
Control Delay (Worst Movement)	28.3	sec	28.3	sec
Geometric Delay (Average)	0.0	sec		
Stop-Line Delay (Average)	19.3	sec		
Idling Time (Average)	13.7	sec		
Intersection Level of Service (LOS)	LOS C			
95% Back of Queue - Vehicles (Worst Lane)	23.5	veh		
95% Back of Queue - Distance (Worst Lane)	588.8	ft		
Queue Storage Ratio (Worst Lane)	0.49			
Total Effective Stops	1376	veh/h	1651	pers/h
Effective Stop Rate	0.73	per veh	0.73	per pers
Proportion Queued	0.81		0.81	
Performance Index	102.6		102.6	
Cost (Total)	642.62	$/h	642.62	$/h
Fuel Consumption (Total)	47.0	gal/h		
Carbon Dioxide (Total)	418.5	kg/h		
Hydrocarbons (Total)	0.167	kg/h		
Carbon Monoxide (Total)	2.185	kg/h		
NOx (Total)	0.411	kg/h		

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	904,174	veh/y	1,085,009	pers/y
Delay	4,857	veh-h/y	5,828	pers-h/y
Effective Stops	660,260	veh/y	792,312	pers/y
Travel Distance	566,668	veh-mi/y	680,001	pers-mi/y
Travel Time	20,403	veh-h/y	24,484	pers-h/y
Cost	308,459	$/y	308,459	$/y
Fuel Consumption	22,565	gal/y		
Carbon Dioxide	200,881	kg/y		
Hydrocarbons	80	kg/y		
Carbon Monoxide	1,049	kg/y		
NOx	197	kg/y		

MOVEMENT SUMMARY

Site: Int #8 Cumul Plus Proj AM

Roundabout with 5 legs, and 1-lane approaches and circulating road

Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Brown Ave											
7	L2	135	0.0	0.279	6.5	LOS A	1.4	34.4	0.55	0.47	32.4
7a	L1	15	0.0	0.279	6.5	LOS A	1.4	34.4	0.55	0.47	32.1
14a	R1	3	0.0	0.279	6.5	LOS A	1.4	34.4	0.55	0.47	32.3
14	R2	121	0.0	0.279	6.5	LOS A	1.4	34.4	0.55	0.47	31.7
Approach		274	0.0	0.279	6.5	LOS A	1.4	34.4	0.55	0.47	32.1
East: Deer Hill Road											
5	L2	217	0.0	0.912	28.3	LOS D	23.5	588.8	1.00	0.93	25.1
2	T1	815	0.5	0.912	28.3	LOS D	23.5	588.8	1.00	0.93	25.1
12a	R1	37	0.0	0.912	28.3	LOS D	23.5	588.8	1.00	0.93	25.0
12b	R3	9	0.0	0.912	28.3	LOS D	23.5	588.8	1.00	0.93	24.6
Approach		1078	0.4	0.912	28.3	LOS D	23.5	588.8	1.00	0.93	25.1
NorthEast: Brown Ave											
5bx	L3	7	0.0	0.048	9.1	LOS A	0.2	4.3	0.71	0.71	31.7
5ax	L1	2	0.0	0.048	9.1	LOS A	0.2	4.3	0.71	0.71	31.2
12ax	R1	11	0.0	0.048	9.1	LOS A	0.2	4.3	0.71	0.71	31.3
12x	R2	1	0.0	0.048	9.1	LOS A	0.2	4.3	0.71	0.71	30.8
Approach		21	0.0	0.048	9.1	LOS A	0.2	4.3	0.71	0.71	31.4
NorthWest: Miller Dr											
3x	L2	1	0.0	0.173	10.7	LOS B	0.6	16.1	0.73	0.73	31.0
3ax	L1	24	0.0	0.173	10.7	LOS B	0.6	16.1	0.73	0.73	30.8
18ax	R1	7	0.0	0.173	10.7	LOS B	0.6	16.1	0.73	0.73	30.9
18bx	R3	46	0.0	0.173	10.7	LOS B	0.6	16.1	0.73	0.73	30.2
Approach		77	0.0	0.173	10.7	LOS B	0.6	16.1	0.73	0.73	30.4
West: Deer Hill Road											
1b	L3	9	0.0	0.389	7.2	LOS A	2.3	56.7	0.52	0.39	33.3
1a	L1	33	0.0	0.389	7.2	LOS A	2.3	56.7	0.52	0.39	32.8
6	T1	316	0.3	0.389	7.2	LOS A	2.3	56.7	0.52	0.39	33.1
16	R2	76	0.0	0.389	7.2	LOS A	2.3	56.7	0.52	0.39	32.4
Approach		434	0.3	0.389	7.2	LOS A	2.3	56.7	0.52	0.39	32.9
All Vehicles		1884	0.3	0.912	19.3	LOS C	23.5	588.8	0.81	0.73	27.8

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

LEVEL OF SERVICE

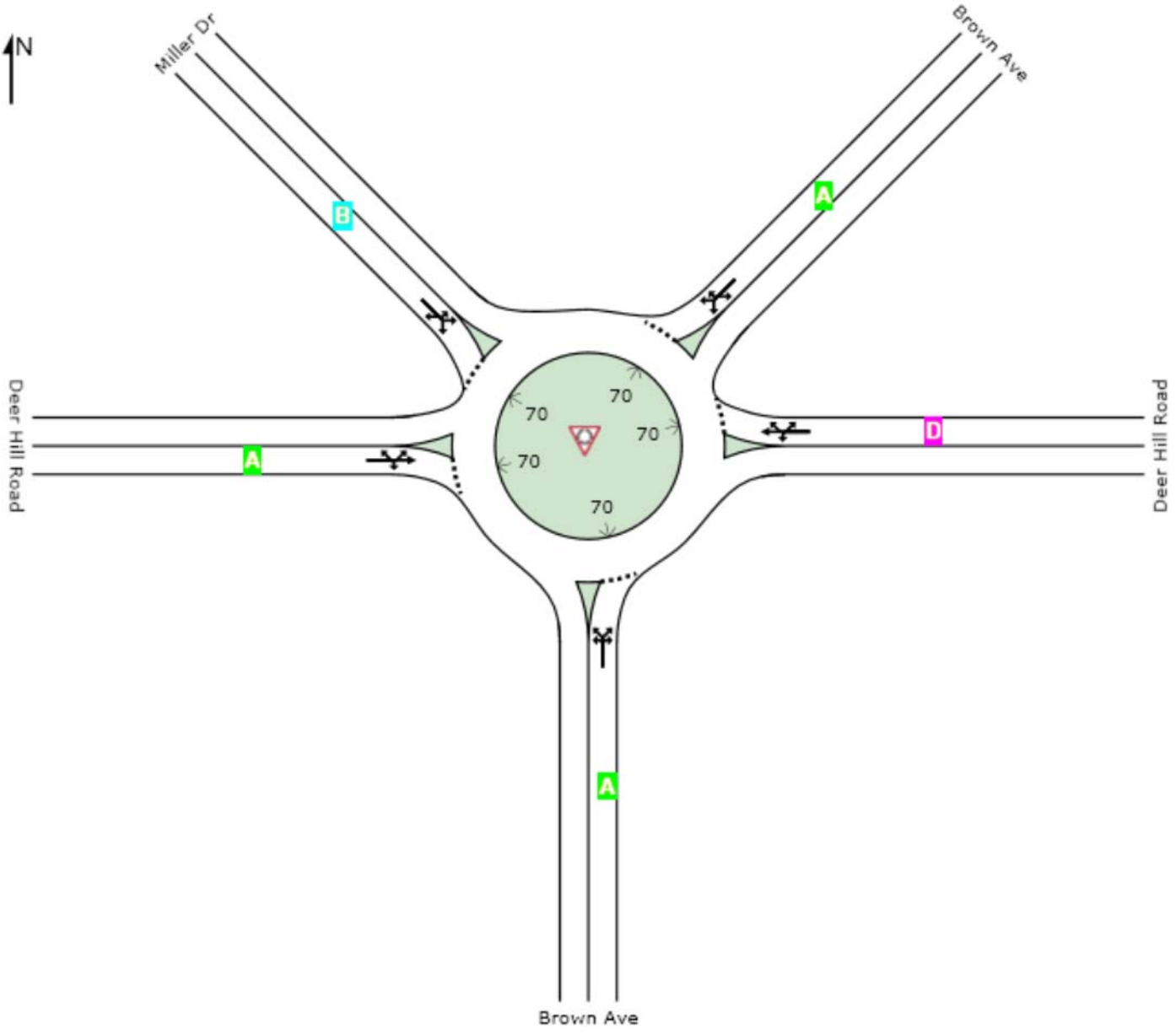
Site: Int #8 Cumul Plus Proj AM

Roundabout with 5 legs, and 1-lane approaches and circulating road

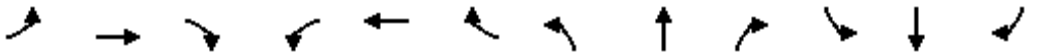
Roundabout

All Movement Classes

	South	East	Northeast	Northwest	West	Intersection
LOS	A	D	A	B	A	C



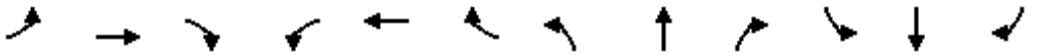
Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	26	270	1020	180	508	3	377	13	96	8	22	27
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	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.95	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)	1770	1676	1583	1770	1861		1681	1691	1583		1732	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)	1770	1676	1583	1770	1861		1681	1691	1583		1732	
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)	27	284	1074	189	535	3	397	14	101	8	23	28
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	80	0	25	0
Lane Group Flow (vph)	27	284	1074	189	538	0	206	205	21	0	34	0
Parking (#/hr)		0										
Turn Type	Prot		Free	Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			Free						2			
Actuated Green, G (s)	1.4	16.4	57.5	6.1	21.1		12.2	12.2	12.2		6.8	
Effective Green, g (s)	1.4	16.4	57.5	6.1	21.1		12.2	12.2	12.2		6.8	
Actuated g/C Ratio	0.02	0.29	1.00	0.11	0.37		0.21	0.21	0.21		0.12	
Clearance Time (s)	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	
Lane Grp Cap (vph)	43	478	1583	188	683		357	359	336		205	
v/s Ratio Prot	0.02	0.17		c0.11	c0.29		0.12	0.12			0.02	
v/s Ratio Perm			c0.68						0.01			
v/c Ratio	0.63	0.59	0.68	1.01	0.79		0.58	0.57	0.06		0.17	
Uniform Delay, d1	27.8	17.7	0.0	25.7	16.2		20.3	20.3	18.1		22.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	25.3	2.0	2.4	67.0	6.0		2.3	2.2	0.1		0.4	
Delay (s)	53.1	19.7	2.4	92.7	22.2		22.6	22.5	18.2		23.2	
Level of Service	D	B	A	F	C		C	C	B		C	
Approach Delay (s)		6.9			40.5			21.7			23.2	
Approach LOS		A			D			C			C	

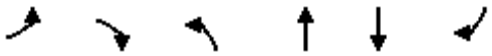
Intersection Summary			
HCM Average Control Delay	19.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	57.5	Sum of lost time (s)	0.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	603	372	404	515	3	962	8	622	19	6	9
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	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	0.88		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (prot)	1770	3539	1583	1770	3536		1681	1687	2787		1748	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (perm)	1770	3539	1583	1770	3536		1681	1687	2787		1748	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	655	404	439	560	3	1046	9	676	21	7	10
RTOR Reduction (vph)	0	0	290	0	1	0	0	0	467	0	9	0
Lane Group Flow (vph)	1	655	114	439	562	0	523	532	209	0	29	0
Turn Type	Prot		Perm	Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4						2			
Actuated Green, G (s)	0.8	19.2	19.2	16.0	34.4		26.0	26.0	26.0		6.9	
Effective Green, g (s)	0.8	19.2	19.2	16.0	34.4		26.0	26.0	26.0		6.9	
Actuated g/C Ratio	0.01	0.23	0.23	0.19	0.41		0.31	0.31	0.31		0.08	
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)	17	808	361	337	1446		520	522	862		143	
v/s Ratio Prot	0.00	c0.19		c0.25	0.16		0.31	c0.32			c0.02	
v/s Ratio Perm			0.07						0.07			
v/c Ratio	0.06	0.81	0.32	1.30	0.39		1.01	1.02	0.24		0.20	
Uniform Delay, d1	41.3	30.7	27.0	34.0	17.5		29.0	29.0	21.7		36.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	1.5	6.2	0.5	156.2	0.2		40.9	44.3	0.1		0.7	
Delay (s)	42.7	36.9	27.5	190.3	17.6		70.0	73.4	21.8		36.7	
Level of Service	D	D	C	F	B		E	E	C		D	
Approach Delay (s)		33.3			93.3			52.2			36.7	
Approach LOS		C			F			D			D	

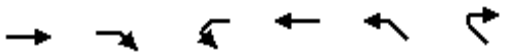
Intersection Summary			
HCM Average Control Delay	57.6	HCM Level of Service	E
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	84.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	53	0	1110	2054	27
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	58	0	1207	2233	29
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					244	
pX, platoon unblocked	0.66	0.66	0.66			
vC, conflicting volume	2649	1131	2262			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2469	170	1883			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	90	100			
cM capacity (veh/h)	16	557	208			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	58	402	402	402	1488	774
Volume Left	0	0	0	0	0	0
Volume Right	58	0	0	0	0	29
cSH	557	1700	1700	1700	1700	1700
Volume to Capacity	0.10	0.24	0.24	0.24	0.88	0.46
Queue Length 95th (ft)	9	0	0	0	0	0
Control Delay (s)	12.2	0.0	0.0	0.0	0.0	0.0
Lane LOS	B					
Approach Delay (s)	12.2	0.0			0.0	
Approach LOS	B					

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	67.6%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	379	0	0	1008	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	412	0	0	1096	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				650		
pX, platoon unblocked					0.93	
vC, conflicting volume			412		1508	412
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			412		1508	412
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1147		124	640

Direction, Lane #	EB 1	WB 1	NW 1
Volume Total	412	1096	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1147	1700
Volume to Capacity	0.24	0.00	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	0.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	56.4%	ICU Level of Service	B
Analysis Period (min)	15		

INTERSECTION SUMMARY

Site: Int #13 - Cumulative Plus Project AM

Roundabout with 1-lane approaches and circulating road
MUTCD (FHWA 2009) example number: 2B-22
Roundabout Guide (TRB 2010) example number: A-1
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	30.1	mph	30.1	mph
Travel Distance (Total)	973.0	veh-mi/h	1167.6	pers-mi/h
Travel Time (Total)	32.3	veh-h/h	38.8	pers-h/h
Demand Flows (Total)	1568	veh/h	1882	pers/h
Percent Heavy Vehicles (Demand)	0.5	%		
Degree of Saturation	0.785			
Practical Spare Capacity	8.2	%		
Effective Intersection Capacity	1997	veh/h		
Control Delay (Total)	5.28	veh-h/h	6.34	pers-h/h
Control Delay (Average)	12.1	sec	12.1	sec
Control Delay (Worst Lane)	15.0	sec		
Control Delay (Worst Movement)	15.0	sec	15.0	sec
Geometric Delay (Average)	0.0	sec		
Stop-Line Delay (Average)	12.1	sec		
Idling Time (Average)	10.8	sec		
Intersection Level of Service (LOS)	LOS B			
95% Back of Queue - Vehicles (Worst Lane)	14.4	veh		
95% Back of Queue - Distance (Worst Lane)	360.3	ft		
Queue Storage Ratio (Worst Lane)	0.30			
Total Effective Stops	118	veh/h	141	pers/h
Effective Stop Rate	0.08	per veh	0.08	per pers
Proportion Queued	0.26		0.26	
Performance Index	56.4		56.4	
Cost (Total)	469.69	$/h	469.69	$/h
Fuel Consumption (Total)	36.6	gal/h		
Carbon Dioxide (Total)	325.9	kg/h		
Hydrocarbons (Total)	0.124	kg/h		
Carbon Monoxide (Total)	1.729	kg/h		
NOx (Total)	0.340	kg/h		

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	752,869	veh/y	903,443	pers/y
Delay	2,534	veh-h/y	3,041	pers-h/y
Effective Stops	56,522	veh/y	67,826	pers/y
Travel Distance	467,039	veh-mi/y	560,447	pers-mi/y
Travel Time	15,508	veh-h/y	18,610	pers-h/y
Cost	225,451	$/y	225,451	$/y
Fuel Consumption	17,559	gal/y		
Carbon Dioxide	156,409	kg/y		
Hydrocarbons	59	kg/y		
Carbon Monoxide	830	kg/y		
NOx	163	kg/y		

MOVEMENT SUMMARY

Site: Int #13 - Cumulative Plus Project AM

Roundabout with 1-lane approaches and circulating road
MUTCD (FHWA 2009) example number: 2B-22
Roundabout Guide (TRB 2010) example number: A-1
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Homes Dwy.											
3	L2	12	0.0	0.037	4.1	LOS A	0.1	3.7	0.47	0.34	33.0
8	T1	1	0.0	0.037	4.1	LOS A	0.1	3.7	0.47	0.34	33.3
18	R2	22	0.0	0.037	4.1	LOS A	0.1	3.7	0.47	0.34	32.7
Approach		35	0.0	0.037	4.1	LOS A	0.1	3.7	0.47	0.34	32.8
East: Deer Hill Rd.											
1	L2	7	0.0	0.785	15.0	LOS C	14.4	360.3	0.31	0.08	28.8
6	T1	1096	0.5	0.785	15.0	LOS C	14.4	360.3	0.31	0.08	29.0
16	R2	7	0.0	0.785	15.0	LOS C	14.4	360.3	0.31	0.08	28.5
Approach		1109	0.5	0.785	15.0	LOS C	14.4	360.3	0.31	0.08	29.0
North: Dog Park Dwy.											
7	L2	4	0.0	0.014	7.7	LOS A	0.0	1.2	0.67	0.60	30.9
4	T1	1	0.0	0.014	7.7	LOS A	0.0	1.2	0.67	0.60	31.1
14	R2	1	0.0	0.014	7.7	LOS A	0.0	1.2	0.67	0.60	30.6
Approach		7	0.0	0.014	7.7	LOS A	0.0	1.2	0.67	0.60	30.9
West: Deer Hill Rd.											
5	L2	2	0.0	0.296	5.1	LOS A	1.8	44.0	0.09	0.02	33.1
2	T1	412	0.5	0.296	5.1	LOS A	1.8	44.0	0.09	0.02	33.3
12	R2	4	0.0	0.296	5.1	LOS A	1.8	44.0	0.09	0.02	32.7
Approach		418	0.5	0.296	5.1	LOS A	1.8	44.0	0.09	0.02	33.3
All Vehicles		1568	0.5	0.785	12.1	LOS B	14.4	360.3	0.26	0.08	30.1

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

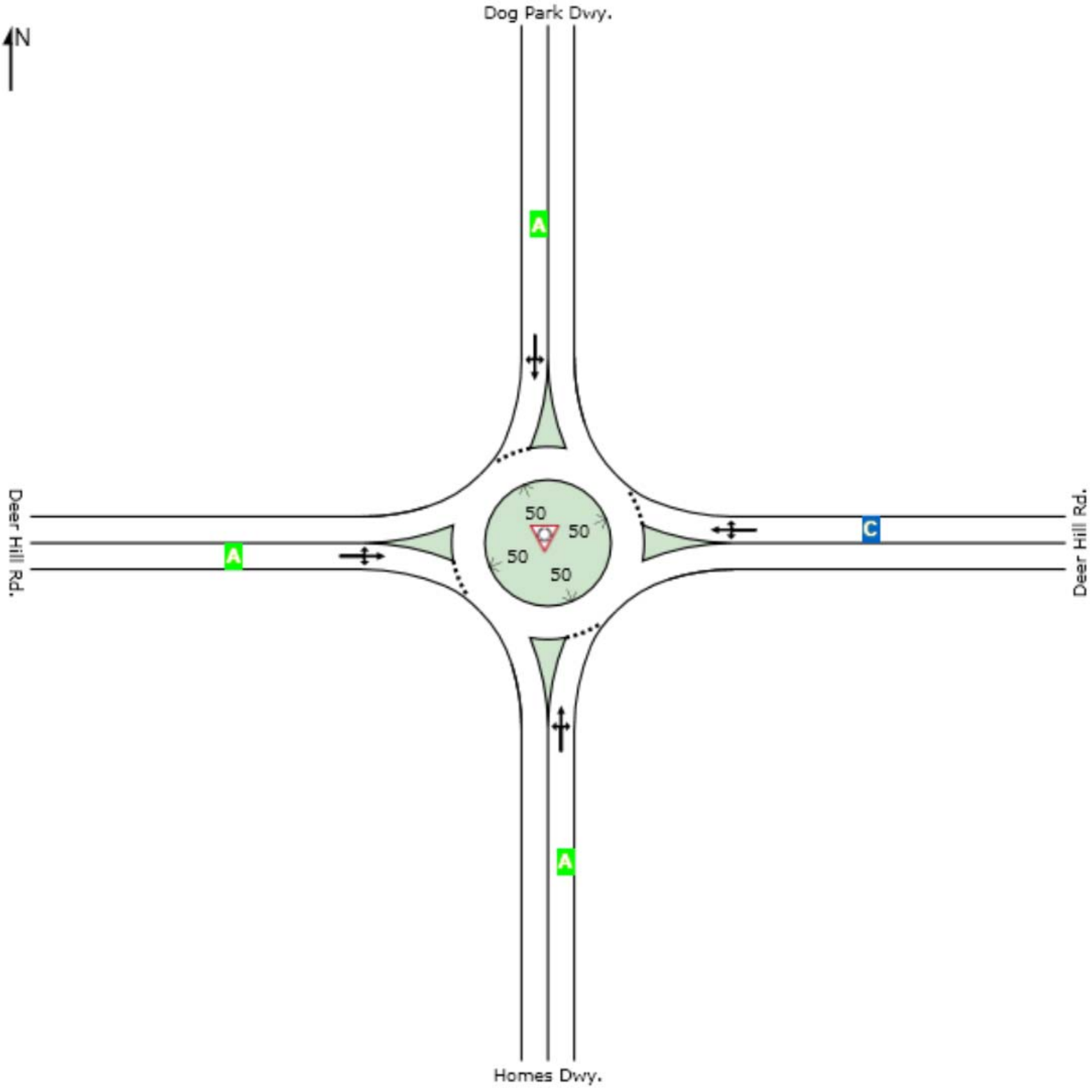
LEVEL OF SERVICE

Site: Int #13 - Cumulative Plus Project AM

Roundabout with 1-lane approaches and circulating road
MUTCD (FHWA 2009) example number: 2B-22
Roundabout Guide (TRB 2010) example number: A-1
Roundabout

All Movement Classes

	South	East	North	West	Intersection
LOS	A	C	A	A	B

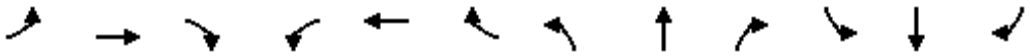


Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	352	30	0	1008	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	383	33	0	1096	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)	278			372		
pX, platoon unblocked					0.90	
vC, conflicting volume			415		1495	399
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			415		1494	399
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1144		123	651

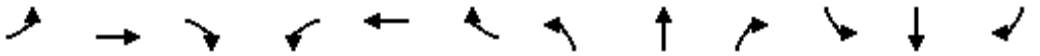
Direction, Lane #	EB 1	WB 1
Volume Total	415	1096
Volume Left	0	0
Volume Right	33	0
cSH	1700	1700
Volume to Capacity	0.24	0.64
Queue Length 95th (ft)	0	0
Control Delay (s)	0.0	0.0
Lane LOS		
Approach Delay (s)	0.0	0.0
Approach LOS		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	56.4%	ICU Level of Service	B
Analysis Period (min)	15		



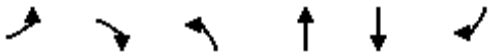
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	6	0	19	0	0	0	21	2287	0	0	861	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0					4.0	5.0			5.0	
Lane Util. Factor		1.00					1.00	0.95			0.95	
Frt		0.90					1.00	1.00			1.00	
Flt Protected		0.99					0.95	1.00			1.00	
Satd. Flow (prot)		1653					1770	3539			3528	
Flt Permitted		0.96					0.95	1.00			1.00	
Satd. Flow (perm)		1610					1770	3539			3528	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	7	0	21	0	0	0	23	2541	0	0	957	21
RTOR Reduction (vph)	0	20	0	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	8	0	0	0	0	23	2541	0	0	977	0
Turn Type	Perm			Perm			Prot					
Protected Phases		8			4		5	2			6	
Permitted Phases	8			4								
Actuated Green, G (s)		2.6					1.6	50.4			44.8	
Effective Green, g (s)		2.6					1.6	50.4			44.8	
Actuated g/C Ratio		0.04					0.03	0.81			0.72	
Clearance Time (s)		4.0					4.0	5.0			5.0	
Vehicle Extension (s)		2.5					2.0	4.0			4.0	
Lane Grp Cap (vph)		68					46	2877			2549	
v/s Ratio Prot							0.01	c0.72			0.28	
v/s Ratio Perm		c0.00										
v/c Ratio		0.12					0.50	0.88			0.38	
Uniform Delay, d1		28.6					29.8	3.8			3.3	
Progression Factor		1.00					1.19	1.61			1.00	
Incremental Delay, d2		0.6					1.7	2.5			0.4	
Delay (s)		29.1					37.3	8.7			3.7	
Level of Service		C					D	A			A	
Approach Delay (s)		29.1			0.0			9.0			3.7	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM Average Control Delay	7.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	74.1%	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)	7	0	3	12	0	16	3	2326	24	12	839	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			4.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor		1.00			1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.96			1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96			0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1731			1770	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		1.00			1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1794			1863	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	8	0	3	13	0	17	3	2528	26	13	912	4
RTOR Reduction (vph)	0	3	0	0	0	16	0	0	5	0	0	1
Lane Group Flow (vph)	0	8	0	0	13	1	3	2528	21	13	912	3
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4		4			2			6
Actuated Green, G (s)		3.4			2.4	2.4	1.0	45.4	45.4	1.2	45.6	45.6
Effective Green, g (s)		3.4			2.4	2.4	1.0	45.4	45.4	1.2	45.6	45.6
Actuated g/C Ratio		0.05			0.04	0.04	0.02	0.73	0.73	0.02	0.74	0.74
Clearance Time (s)		3.0			4.0	4.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)		2.5			2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0
Lane Grp Cap (vph)		98			72	61	29	2591	1159	34	2603	1164
v/s Ratio Prot							0.00	c0.71		c0.01	0.26	
v/s Ratio Perm		0.00			c0.01	0.00			0.01			0.00
v/c Ratio		0.08			0.18	0.01	0.10	0.98	0.02	0.38	0.35	0.00
Uniform Delay, d1		27.8			28.8	28.7	30.1	7.8	2.3	30.0	2.9	2.2
Progression Factor		1.00			1.00	1.00	1.29	0.32	0.12	0.77	2.25	1.93
Incremental Delay, d2		0.3			0.4	0.0	0.2	5.8	0.0	2.5	0.4	0.0
Delay (s)		28.1			29.3	28.7	38.9	8.2	0.3	25.6	6.9	4.2
Level of Service		C			C	C	D	A	A	C	A	A
Approach Delay (s)		28.1			28.9			8.2			7.2	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	8.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	81.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	35	181	182	2338	775	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	1770	3539	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	197	198	2541	842	30
RTOR Reduction (vph)	0	175	0	0	0	15
Lane Group Flow (vph)	38	22	198	2541	842	15
Turn Type		Perm	Prot			Perm
Protected Phases	8		5	2	6	
Permitted Phases		8				6
Actuated Green, G (s)	7.0	7.0	11.2	46.0	30.8	30.8
Effective Green, g (s)	7.0	7.0	11.2	46.0	30.8	30.8
Actuated g/C Ratio	0.11	0.11	0.18	0.74	0.50	0.50
Clearance Time (s)	4.0	4.0	4.0	5.0	5.0	5.0
Vehicle Extension (s)	2.5	2.5	2.0	4.0	4.0	4.0
Lane Grp Cap (vph)	200	179	320	2626	1758	786
v/s Ratio Prot	c0.02		0.11	c0.72	0.24	
v/s Ratio Perm		0.01				0.01
v/c Ratio	0.19	0.12	0.62	0.97	0.48	0.02
Uniform Delay, d1	24.9	24.7	23.4	7.3	10.3	7.9
Progression Factor	1.00	1.00	0.79	1.56	0.86	0.68
Incremental Delay, d2	0.3	0.2	0.8	4.7	0.9	0.0
Delay (s)	25.3	25.0	19.2	16.1	9.8	5.5
Level of Service	C	C	B	B	A	A
Approach Delay (s)	25.0			16.4	9.6	
Approach LOS	C			B	A	

Intersection Summary			
HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	75.5%	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)	21	2	94	22	0	6	129	2493	37	16	966	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1550	1550	1550
Total Lost time (s)		3.5	3.5		3.5		3.5	4.1	4.1	3.5	4.1	4.1
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		0.97		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00		0.96		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1781	1583		1739		1770	3539	1583	1444	2887	1292
Flt Permitted		0.78	1.00		0.76		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1460	1583		1369		1770	3539	1583	1444	2887	1292
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	23	2	102	24	0	7	140	2710	40	17	1050	29
RTOR Reduction (vph)	0	0	94	0	6	0	0	0	3	0	0	6
Lane Group Flow (vph)	0	25	8	0	25	0	140	2710	37	17	1050	23
Turn Type	Perm		Perm	Perm			Prot		Perm	Prot		Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8		8	4					2			6
Actuated Green, G (s)		4.9	4.9		4.9		7.5	44.7	44.7	1.3	38.5	38.5
Effective Green, g (s)		4.9	4.9		4.9		7.5	44.7	44.7	1.3	38.5	38.5
Actuated g/C Ratio		0.08	0.08		0.08		0.12	0.72	0.72	0.02	0.62	0.62
Clearance Time (s)		3.5	3.5		3.5		3.5	4.1	4.1	3.5	4.1	4.1
Vehicle Extension (s)		2.0	2.0		2.0		1.0	4.0	4.0	1.5	4.0	4.0
Lane Grp Cap (vph)		115	125		108		214	2552	1141	30	1793	802
v/s Ratio Prot							c0.08	c0.77		0.01	0.36	
v/s Ratio Perm		0.02	0.01		c0.02				0.02			0.02
v/c Ratio		0.22	0.06		0.23		0.65	1.06	0.03	0.57	0.59	0.03
Uniform Delay, d1		26.8	26.4		26.8		26.0	8.6	2.5	30.1	7.0	4.5
Progression Factor		1.00	1.00		1.00		0.74	3.31	1.66	1.34	0.50	0.12
Incremental Delay, d2		0.3	0.1		0.4		0.5	28.9	0.0	12.8	1.3	0.1
Delay (s)		27.1	26.5		27.2		19.8	57.6	4.1	52.9	4.8	0.6
Level of Service		C	C		C		B	E	A	D	A	A
Approach Delay (s)		26.6			27.2			55.0			5.5	
Approach LOS		C			C			E			A	

Intersection Summary			
HCM Average Control Delay	40.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	62.0	Sum of lost time (s)	11.1
Intersection Capacity Utilization	90.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

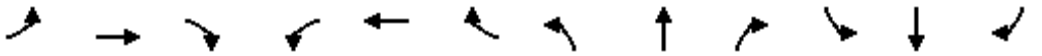
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Volume (vph)	750	118	63	235	86	178	19	55	1766	230	6	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1500	1500
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.5	4.5		4.0
Lane Util. Factor	0.97	1.00		0.95	0.95	1.00		1.00	*0.92	1.00		1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00	1.00	0.76		1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.00
Frt	1.00	0.95		1.00	1.00	0.85		1.00	1.00	0.85		1.00
Flt Protected	0.95	1.00		0.95	0.98	1.00		0.95	1.00	1.00		0.95
Satd. Flow (prot)	3433	1766		1681	1729	1558		1770	3427	1196		1397
Flt Permitted	0.95	1.00		0.95	0.98	1.00		0.95	1.00	1.00		0.95
Satd. Flow (perm)	3433	1766		1681	1729	1558		1770	3427	1196		1397
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.97	0.97	0.97	0.97	0.95	0.95
Adj. Flow (vph)	789	124	66	247	91	187	20	57	1821	237	6	127
RTOR Reduction (vph)	0	15	0	0	0	50	0	0	0	75	0	0
Lane Group Flow (vph)	789	175	0	168	170	137	0	77	1821	162	0	133
Confl. Peds. (#/hr)	2					2				74		74
Turn Type	Split			Split		Perm	Prot	Prot		Perm	Prot	Prot
Protected Phases	8	8		4	4		5	5	2		1	1
Permitted Phases						4				2		
Actuated Green, G (s)	33.8	33.8		17.2	17.2	17.2		7.6	42.2	42.2		14.3
Effective Green, g (s)	33.8	33.8		17.2	17.2	17.2		7.6	42.2	42.2		14.3
Actuated g/C Ratio	0.27	0.27		0.14	0.14	0.14		0.06	0.34	0.34		0.12
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.5	4.5		4.0
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0		2.0	3.0	3.0		2.0
Lane Grp Cap (vph)	936	481		233	240	216		108	1166	407		161
v/s Ratio Prot	c0.23	0.10		c0.10	0.10			0.04	c0.53			c0.10
v/s Ratio Perm						0.09				0.14		
v/c Ratio	0.84	0.36		0.72	0.71	0.63		0.71	1.56	0.40		0.83
Uniform Delay, d1	42.6	36.4		51.1	51.0	50.4		57.1	40.9	31.2		53.6
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00		1.11
Incremental Delay, d2	6.7	0.2		8.9	7.6	4.4		16.8	257.0	2.9		24.3
Delay (s)	49.3	36.6		60.1	58.6	54.9		74.0	297.9	34.1		83.8
Level of Service	D	D		E	E	D		E	F	C		F
Approach Delay (s)		46.8			57.7				260.5			
Approach LOS		D			E				F			

Intersection Summary			
HCM Average Control Delay	139.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	124.0	Sum of lost time (s)	16.5
Intersection Capacity Utilization	104.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

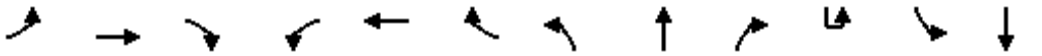
Movement	SBT	SBR
Lane Configurations		
Volume (vph)	791	207
Ideal Flow (vphpl)	1500	1500
Total Lost time (s)	5.0	5.0
Lane Util. Factor	0.95	1.00
Frpb, ped/bikes	1.00	1.00
Flpb, ped/bikes	1.00	1.00
Frt	1.00	0.85
Flt Protected	1.00	1.00
Satd. Flow (prot)	2794	1250
Flt Permitted	1.00	1.00
Satd. Flow (perm)	2794	1250
Peak-hour factor, PHF	0.95	0.95
Adj. Flow (vph)	833	218
RTOR Reduction (vph)	0	42
Lane Group Flow (vph)	833	176
Confl. Peds. (#/hr)		
Turn Type		Perm
Protected Phases	6	
Permitted Phases		6
Actuated Green, G (s)	48.4	48.4
Effective Green, g (s)	48.4	48.4
Actuated g/C Ratio	0.39	0.39
Clearance Time (s)	5.0	5.0
Vehicle Extension (s)	4.0	4.0
Lane Grp Cap (vph)	1091	488
v/s Ratio Prot	0.30	
v/s Ratio Perm		0.14
v/c Ratio	0.76	0.36
Uniform Delay, d1	32.8	26.8
Progression Factor	0.81	0.79
Incremental Delay, d2	4.5	1.8
Delay (s)	31.0	23.0
Level of Service	C	C
Approach Delay (s)	35.4	
Approach LOS	D	

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	244	437	263	0	0	0	247	666	334	0	638	478
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5				4.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	1.00				1.00	0.95	1.00		0.95	1.00
Frt	1.00	1.00	0.85				1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00				0.95	1.00	1.00		1.00	1.00
Satd. Flow (prot)	1770	3539	1583				1770	3539	1583		3539	1583
Flt Permitted	0.95	1.00	1.00				0.95	1.00	1.00		1.00	1.00
Satd. Flow (perm)	1770	3539	1583				1770	3539	1583		3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	265	475	286	0	0	0	268	724	363	0	693	520
RTOR Reduction (vph)	0	0	181	0	0	0	0	0	76	0	0	336
Lane Group Flow (vph)	265	475	105	0	0	0	268	724	287	0	693	184
Turn Type	Perm		Perm				Prot		Perm			Perm
Protected Phases		4					5	2			6	
Permitted Phases	4		4						2			6
Actuated Green, G (s)	17.5	17.5	17.5				14.2	43.0	43.0		24.8	24.8
Effective Green, g (s)	17.5	17.5	17.5				14.2	43.0	43.0		24.8	24.8
Actuated g/C Ratio	0.25	0.25	0.25				0.20	0.61	0.61		0.35	0.35
Clearance Time (s)	4.5	4.5	4.5				4.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	2.0	2.0	2.0				2.0	4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	443	885	396				359	2174	972		1254	561
v/s Ratio Prot		0.13					c0.15	0.20			c0.20	
v/s Ratio Perm	c0.15		0.07						0.18			0.12
v/c Ratio	0.60	0.54	0.27				0.75	0.33	0.29		0.55	0.33
Uniform Delay, d1	23.1	22.7	21.1				26.2	6.5	6.4		18.1	16.5
Progression Factor	1.00	1.00	1.00				1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.5	0.3	0.1				7.2	0.4	0.8		1.8	1.6
Delay (s)	24.6	23.1	21.2				33.4	7.0	7.1		19.9	18.1
Level of Service	C	C	C				C	A	A		B	B
Approach Delay (s)		22.9			0.0			12.2			19.1	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM Average Control Delay	17.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Volume (vph)	114	58	293	28	0	185	0	927	19	14	116	812
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	1.00	1.00		1.00		0.91			1.00	0.95
Frt		1.00	0.85	1.00		0.85		1.00			1.00	1.00
Flt Protected		0.97	1.00	0.95		1.00		1.00			0.95	1.00
Satd. Flow (prot)		1803	1583	1770		1583		5070			1770	3539
Flt Permitted		0.97	1.00	0.64		1.00		1.00			0.66	1.00
Satd. Flow (perm)		1803	1583	1192		1583		5070			1221	3539
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	124	63	318	30	0	201	0	1008	21	15	126	883
RTOR Reduction (vph)	0	0	254	0	0	175	0	3	0	0	0	0
Lane Group Flow (vph)	0	187	64	30	0	26	0	1026	0	0	141	883
Turn Type	Split		Perm	custom		custom				custom	Prot	
Protected Phases	4	4						2			1	6
Permitted Phases			4	8		8				1		
Actuated Green, G (s)		11.4	11.4	7.3		7.3		15.8			6.1	25.9
Effective Green, g (s)		11.4	11.4	7.3		7.3		15.8			6.1	25.9
Actuated g/C Ratio		0.20	0.20	0.13		0.13		0.28			0.11	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)		363	319	154		204		1415			132	1619
v/s Ratio Prot		c0.10						c0.20				0.25
v/s Ratio Perm			0.04	c0.03		0.02					c0.12	
v/c Ratio		0.52	0.20	0.19		0.13		0.73			1.07	0.55
Uniform Delay, d1		20.1	18.8	22.0		21.8		18.4			25.2	11.1
Progression Factor		1.00	1.00	1.00		1.00		1.00			1.00	1.00
Incremental Delay, d2		1.2	0.3	0.6		0.3		1.9			97.7	0.4
Delay (s)		21.4	19.1	22.6		22.1		20.3			123.0	11.5
Level of Service		C	B	C		C		C			F	B
Approach Delay (s)		20.0			22.2			20.3				26.8
Approach LOS		B			C			C				C

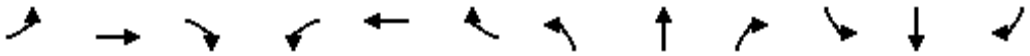
Intersection Summary			
HCM Average Control Delay	22.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	56.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR
Lane Configurations	
Volume (vph)	0
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	0
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	62	662	66	115	320	92	68	9	127	61	12	19
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	67	720	72	125	348	100	74	10	138	66	13	21
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	448			791			1515	1588	755	1645	1574	398
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	448			791			1515	1588	755	1645	1574	398
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	94			85			0	89	66	0	85	97
cM capacity (veh/h)	1112			829			71	86	408	41	88	652

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1
Volume Total	67	791	125	448	84	138	100
Volume Left	67	0	125	0	74	0	66
Volume Right	0	72	0	100	0	138	21
cSH	1112	1700	829	1700	73	408	55
Volume to Capacity	0.06	0.47	0.15	0.26	1.15	0.34	1.81
Queue Length 95th (ft)	5	0	13	0	158	37	238
Control Delay (s)	8.4	0.0	10.1	0.0	252.1	18.3	546.1
Lane LOS	A		B		F	C	F
Approach Delay (s)	0.7		2.2		106.5		546.1
Approach LOS					F		F

Intersection Summary				
Average Delay	45.7			
Intersection Capacity Utilization	67.1%	ICU Level of Service	C	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	62	662	66	115	320	92	68	9	127	61	12	19
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	1.00		1.00	1.00			1.00	1.00		1.00	
Frt	1.00	0.99		1.00	0.97			1.00	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	
Satd. Flow (prot)	1770	1837		1770	1800			1784	1583		1752	
Flt Permitted	0.42	1.00		0.15	1.00			0.74	1.00		0.80	
Satd. Flow (perm)	775	1837		281	1800			1377	1583		1452	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	67	720	72	125	348	100	74	10	138	66	13	21
RTOR Reduction (vph)	0	7	0	0	20	0	0	0	91	0	14	0
Lane Group Flow (vph)	67	785	0	125	428	0	0	84	47	0	86	0
Turn Type	Perm			Perm			Perm		Perm	Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	31.4	31.4		31.4	31.4			20.6	20.6		20.6	
Effective Green, g (s)	31.4	31.4		31.4	31.4			20.6	20.6		20.6	
Actuated g/C Ratio	0.52	0.52		0.52	0.52			0.34	0.34		0.34	
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)	406	961		147	942			473	543		499	
v/s Ratio Prot		0.43			0.24							
v/s Ratio Perm	0.09			c0.45				c0.06	0.03		0.06	
v/c Ratio	0.17	0.82		0.85	0.45			0.18	0.09		0.17	
Uniform Delay, d1	7.5	11.9		12.3	8.9			13.8	13.3		13.8	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.2	5.5		34.8	0.4			0.8	0.3		0.8	
Delay (s)	7.7	17.4		47.1	9.3			14.6	13.7		14.5	
Level of Service	A	B		D	A			B	B		B	
Approach Delay (s)		16.6			17.5			14.0			14.5	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	16.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

INTERSECTION SUMMARY

Site: Int #8 Cumul Plus Proj PM

Roundabout with 5 legs, and 1-lane approaches and circulating road

Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	31.0	mph	31.0	mph
Travel Distance (Total)	1098.8	veh-mi/h	1318.5	pers-mi/h
Travel Time (Total)	35.4	veh-h/h	42.5	pers-h/h
Demand Flows (Total)	1755	veh/h	2107	pers/h
Percent Heavy Vehicles (Demand)	0.4	%		
Degree of Saturation	0.734			
Practical Spare Capacity	15.8	%		
Effective Intersection Capacity	2392	veh/h		
Control Delay (Total)	5.39	veh-h/h	6.47	pers-h/h
Control Delay (Average)	11.0	sec	11.0	sec
Control Delay (Worst Lane)	14.7	sec		
Control Delay (Worst Movement)	14.7	sec	14.7	sec
Geometric Delay (Average)	0.0	sec		
Stop-Line Delay (Average)	11.0	sec		
Idling Time (Average)	7.4	sec		
Intersection Level of Service (LOS)	LOS B			
95% Back of Queue - Vehicles (Worst Lane)	8.9	veh		
95% Back of Queue - Distance (Worst Lane)	222.5	ft		
Queue Storage Ratio (Worst Lane)	0.18			
Total Effective Stops	912	veh/h	1094	pers/h
Effective Stop Rate	0.52	per veh	0.52	per pers
Proportion Queued	0.66		0.66	
Performance Index	65.2		65.2	
Cost (Total)	529.75	$/h	529.75	$/h
Fuel Consumption (Total)	41.5	gal/h		
Carbon Dioxide (Total)	369.9	kg/h		
Hydrocarbons (Total)	0.141	kg/h		
Carbon Monoxide (Total)	1.962	kg/h		
NOx (Total)	0.377	kg/h		

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	842,609	veh/y	1,011,130	pers/y
Delay	2,586	veh-h/y	3,104	pers-h/y
Effective Stops	437,631	veh/y	525,157	pers/y
Travel Distance	527,404	veh-mi/y	632,885	pers-mi/y
Travel Time	17,011	veh-h/y	20,413	pers-h/y
Cost	254,280	$/y	254,280	$/y
Fuel Consumption	19,940	gal/y		
Carbon Dioxide	177,558	kg/y		
Hydrocarbons	68	kg/y		
Carbon Monoxide	942	kg/y		
NOx	181	kg/y		

MOVEMENT SUMMARY

Site: Int #8 Cumul Plus Proj PM

Roundabout with 5 legs, and 1-lane approaches and circulating road

Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Brown Ave											
7	L2	74	0.0	0.291	8.1	LOS A	1.3	32.4	0.69	0.69	32.0
7a	L1	8	0.0	0.291	8.1	LOS A	1.3	32.4	0.69	0.69	31.7
14a	R1	2	0.0	0.291	8.1	LOS A	1.3	32.4	0.69	0.69	31.9
14	R2	138	0.0	0.291	8.1	LOS A	1.3	32.4	0.69	0.69	31.4
Approach		222	0.0	0.291	8.1	LOS A	1.3	32.4	0.69	0.69	31.6
East: Deer Hill Road											
5	L2	125	0.0	0.464	7.7	LOS A	3.2	79.7	0.45	0.29	32.5
2	T1	348	0.6	0.464	7.7	LOS A	3.2	79.7	0.45	0.29	32.6
12a	R1	80	0.0	0.464	7.7	LOS A	3.2	79.7	0.45	0.29	32.4
12b	R3	20	0.0	0.464	7.7	LOS A	3.2	79.7	0.45	0.29	31.6
Approach		573	0.4	0.464	7.7	LOS A	3.2	79.7	0.45	0.29	32.5
NorthEast: Brown Ave											
5bx	L3	13	0.0	0.027	5.0	LOS A	0.1	2.6	0.56	0.45	32.7
5ax	L1	2	0.0	0.027	5.0	LOS A	0.1	2.6	0.56	0.45	32.2
12ax	R1	4	0.0	0.027	5.0	LOS A	0.1	2.6	0.56	0.45	32.3
12x	R2	1	0.0	0.027	5.0	LOS A	0.1	2.6	0.56	0.45	31.8
Approach		21	0.0	0.027	5.0	LOS A	0.1	2.6	0.56	0.45	32.5
NorthWest: Miller Dr											
3x	L2	1	0.0	0.100	5.4	LOS A	0.4	10.3	0.55	0.48	32.9
3ax	L1	53	2.0	0.100	5.4	LOS A	0.4	10.3	0.55	0.48	32.6
18ax	R1	11	0.0	0.100	5.4	LOS A	0.4	10.3	0.55	0.48	32.8
18bx	R3	16	0.0	0.100	5.4	LOS A	0.4	10.3	0.55	0.48	32.0
Approach		82	1.3	0.100	5.4	LOS A	0.4	10.3	0.55	0.48	32.5
West: Deer Hill Road											
1b	L3	13	0.0	0.734	14.7	LOS B	8.9	222.5	0.80	0.64	30.0
1a	L1	54	0.0	0.734	14.7	LOS B	8.9	222.5	0.80	0.64	29.6
6	T1	720	0.5	0.734	14.7	LOS B	8.9	222.5	0.80	0.64	29.8
16	R2	72	0.0	0.734	14.7	LOS B	8.9	222.5	0.80	0.64	29.2
Approach		859	0.4	0.734	14.7	LOS B	8.9	222.5	0.80	0.64	29.8
All Vehicles		1755	0.4	0.734	11.0	LOS B	8.9	222.5	0.66	0.52	31.0

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

LEVEL OF SERVICE

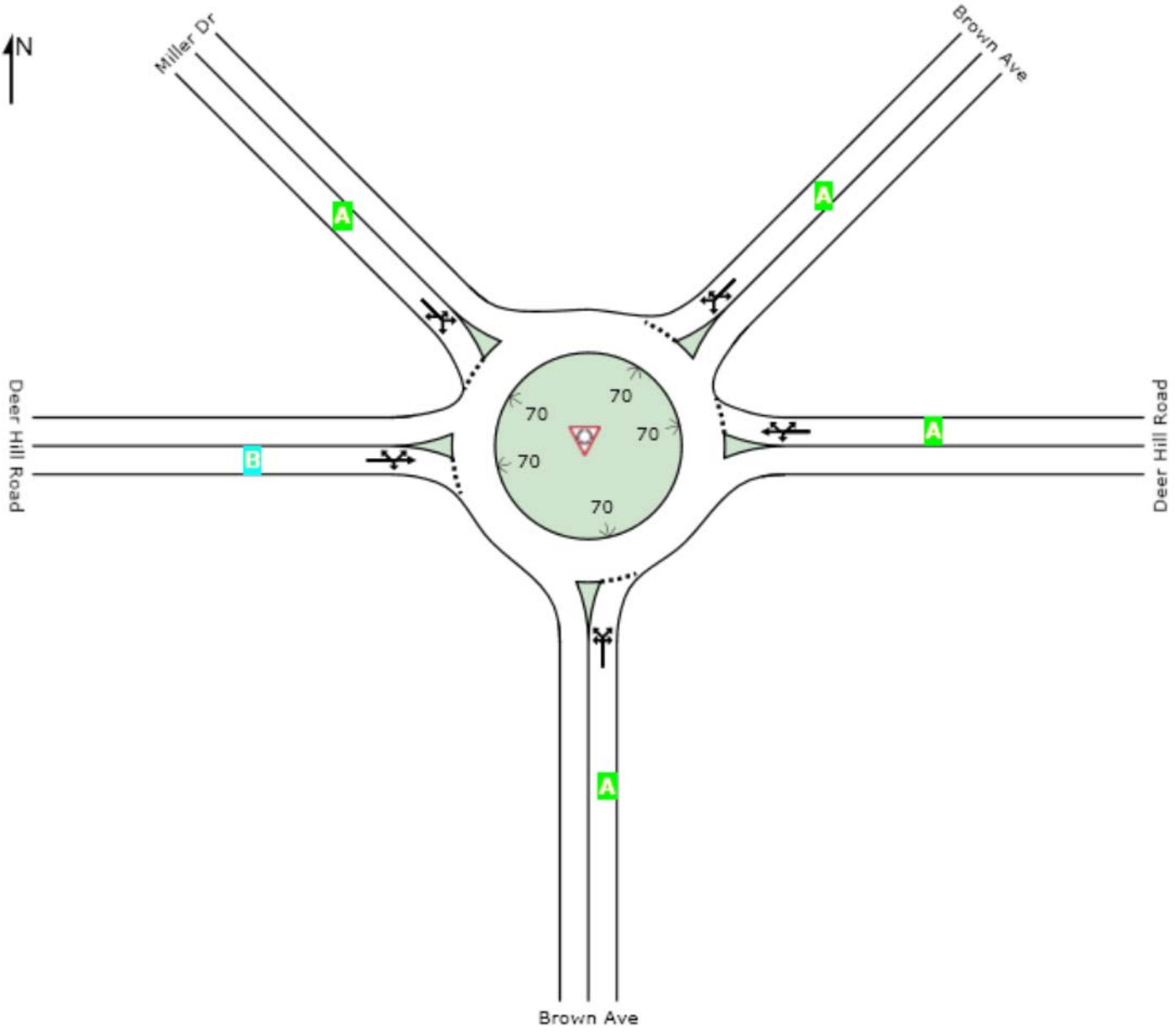
Site: Int #8 Cumul Plus Proj PM

Roundabout with 5 legs, and 1-lane approaches and circulating road

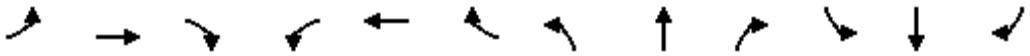
Roundabout

All Movement Classes

	South	East	Northeast	Northwest	West	Intersection
LOS	A	A	A	A	B	B



Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 2010).
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

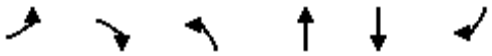


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	22	636	1497	150	299	3	300	19	154	5	24	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		0.95	0.95	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (prot)	1770	1863	1583	1770	1860		1681	1695	1583		1793	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.96	1.00		0.99	
Satd. Flow (perm)	1770	1863	1583	1770	1860		1681	1695	1583		1793	
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)	23	669	1576	158	315	3	316	20	162	5	25	9
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	136	0	8	0
Lane Group Flow (vph)	23	669	1576	158	318	0	167	169	26	0	31	0
Turn Type	Prot		Free	Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			Free						2			
Actuated Green, G (s)	1.9	34.7	79.6	9.0	41.8		13.0	13.0	13.0		6.9	
Effective Green, g (s)	1.9	34.7	79.6	9.0	41.8		13.0	13.0	13.0		6.9	
Actuated g/C Ratio	0.02	0.44	1.00	0.11	0.53		0.16	0.16	0.16		0.09	
Clearance Time (s)	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	
Lane Grp Cap (vph)	42	812	1583	200	977		275	277	259		155	
v/s Ratio Prot	0.01	0.36		0.09	0.17		0.10	0.10			0.02	
v/s Ratio Perm			c1.00						0.02			
v/c Ratio	0.55	0.82	1.00	0.79	0.33		0.61	0.61	0.10		0.20	
Uniform Delay, d1	38.4	19.8	0.0	34.4	10.8		30.9	30.9	28.3		33.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	13.8	6.8	21.6	18.8	0.2		3.8	3.9	0.2		0.6	
Delay (s)	52.2	26.6	21.6	53.2	11.0		34.7	34.9	28.5		34.4	
Level of Service	D	C	C	D	B		C	C	C		C	
Approach Delay (s)		23.4			25.0			32.7			34.4	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	79.6	Sum of lost time (s)	0.0
Intersection Capacity Utilization	67.3%	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)	33	1206	379	307	260	3	674	9	934	19	1	9
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	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95	0.88		1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (prot)	1770	3539	1583	1770	3534		1681	1688	2787		1727	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.95	1.00		0.97	
Satd. Flow (perm)	1770	3539	1583	1770	3534		1681	1688	2787		1727	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	1311	412	334	283	3	733	10	1015	21	1	10
RTOR Reduction (vph)	0	0	145	0	1	0	0	0	573	0	9	0
Lane Group Flow (vph)	36	1311	267	334	285	0	374	369	442	0	23	0
Turn Type	Prot		Perm	Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4						2			
Actuated Green, G (s)	2.4	32.7	32.7	10.0	40.3		17.0	17.0	17.0		6.7	
Effective Green, g (s)	2.4	32.7	32.7	10.0	40.3		17.0	17.0	17.0		6.7	
Actuated g/C Ratio	0.03	0.40	0.40	0.12	0.49		0.21	0.21	0.21		0.08	
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)	52	1404	628	215	1728		347	348	575		140	
v/s Ratio Prot	0.02	c0.37		c0.19	0.08		c0.22	0.22			c0.01	
v/s Ratio Perm			0.17						0.16			
v/c Ratio	0.69	0.93	0.43	1.55	0.17		1.08	1.06	0.77		0.16	
Uniform Delay, d1	39.6	23.8	18.0	36.2	11.7		32.7	32.7	30.8		35.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	33.0	11.6	0.5	270.7	0.0		70.6	65.1	6.1		0.5	
Delay (s)	72.6	35.4	18.5	306.9	11.7		103.3	97.8	37.0		35.8	
Level of Service	E	D	B	F	B		F	F	D		D	
Approach Delay (s)		32.2			170.7			63.9			35.8	
Approach LOS		C			F			E			D	

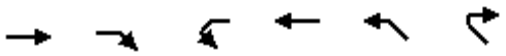
Intersection Summary			
HCM Average Control Delay	66.2	HCM Level of Service	E
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	82.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	85.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	35	0	2031	1100	16
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	38	0	2208	1196	17
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					244	
pX, platoon unblocked	0.75	0.75	0.75			
vC, conflicting volume	1940	607	1213			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1593	0	628			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	95	100			
cM capacity (veh/h)	74	817	716			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	38	736	736	736	797	416
Volume Left	0	0	0	0	0	0
Volume Right	38	0	0	0	0	17
cSH	817	1700	1700	1700	1700	1700
Volume to Capacity	0.05	0.43	0.43	0.43	0.47	0.24
Queue Length 95th (ft)	4	0	0	0	0	0
Control Delay (s)	9.6	0.0	0.0	0.0	0.0	0.0
Lane LOS	A					
Approach Delay (s)	9.6	0.0			0.0	
Approach LOS	A					

Intersection Summary				
Average Delay	0.1			
Intersection Capacity Utilization	42.6%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	920	7	17	350	6	18
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1000	8	18	380	7	20
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				653		
pX, platoon unblocked						
vC, conflicting volume			1008		1421	1004
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1008		1421	1004
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		96	93
cM capacity (veh/h)			688		146	294

Direction, Lane #	EB 1	WB 1	NW 1
Volume Total	1008	399	26
Volume Left	0	18	7
Volume Right	8	0	20
cSH	1700	688	234
Volume to Capacity	0.59	0.03	0.11
Queue Length 95th (ft)	0	2	9
Control Delay (s)	0.0	0.8	22.3
Lane LOS		A	C
Approach Delay (s)	0.0	0.8	22.3
Approach LOS			C

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	58.8%	ICU Level of Service	B
Analysis Period (min)	15		

INTERSECTION SUMMARY

Site: Int #13 - Cumulative Plus Project PM

Roundabout with 1-lane approaches and circulating road
MUTCD (FHWA 2009) example number: 2B-22
Roundabout Guide (TRB 2010) example number: A-1
Roundabout

Intersection Performance - Hourly Values				
Performance Measure	**Vehicles**		**Persons**	
Travel Speed (Average)	30.7	mph	30.7	mph
Travel Distance (Total)	911.0	veh-mi/h	1093.2	pers-mi/h
Travel Time (Total)	29.7	veh-h/h	35.6	pers-h/h
Demand Flows (Total)	1468	veh/h	1762	pers/h
Percent Heavy Vehicles (Demand)	0.5	%		
Degree of Saturation	0.736			
Practical Spare Capacity	15.5	%		
Effective Intersection Capacity	1996	veh/h		
Control Delay (Total)	4.36	veh-h/h	5.23	pers-h/h
Control Delay (Average)	10.7	sec	10.7	sec
Control Delay (Worst Lane)	13.1	sec		
Control Delay (Worst Movement)	13.1	sec	13.1	sec
Geometric Delay (Average)	0.0	sec		
Stop-Line Delay (Average)	10.7	sec		
Idling Time (Average)	9.1	sec		
Intersection Level of Service (LOS)	LOS B			
95% Back of Queue - Vehicles (Worst Lane)	10.5	veh		
95% Back of Queue - Distance (Worst Lane)	263.8	ft		
Queue Storage Ratio (Worst Lane)	0.22			
Total Effective Stops	185	veh/h	222	pers/h
Effective Stop Rate	0.13	per veh	0.13	per pers
Proportion Queued	0.32		0.32	
Performance Index	48.1		48.1	
Cost (Total)	433.67	$/h	433.67	$/h
Fuel Consumption (Total)	34.3	gal/h		
Carbon Dioxide (Total)	305.2	kg/h		
Hydrocarbons (Total)	0.115	kg/h		
Carbon Monoxide (Total)	1.617	kg/h		
NOx (Total)	0.326	kg/h		

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Intersection Performance - Annual Values				
Performance Measure	**Vehicles**		**Persons**	
Demand Flows (Total)	704,869	veh/y	845,843	pers/y
Delay	2,091	veh-h/y	2,509	pers-h/y
Effective Stops	88,703	veh/y	106,444	pers/y
Travel Distance	437,273	veh-mi/y	524,728	pers-mi/y
Travel Time	14,253	veh-h/y	17,103	pers-h/y
Cost	208,163	$/y	208,163	$/y
Fuel Consumption	16,447	gal/y		
Carbon Dioxide	146,512	kg/y		
Hydrocarbons	55	kg/y		
Carbon Monoxide	776	kg/y		
NOx	156	kg/y		

MOVEMENT SUMMARY

Site: Int #13 - Cumulative Plus Project PM

Roundabout with 1-lane approaches and circulating road
MUTCD (FHWA 2009) example number: 2B-22
Roundabout Guide (TRB 2010) example number: A-1
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Homes Dwy.											
3	L2	8	0.0	0.041	7.4	LOS A	0.2	3.8	0.65	0.63	31.5
8	T1	1	0.0	0.041	7.4	LOS A	0.2	3.8	0.65	0.63	31.8
18	R2	13	0.0	0.041	7.4	LOS A	0.2	3.8	0.65	0.63	31.2
Approach		22	0.0	0.041	7.4	LOS A	0.2	3.8	0.65	0.63	31.3
East: Deer Hill Rd.											
1	L2	23	0.0	0.292	5.1	LOS A	1.7	43.3	0.10	0.02	33.0
6	T1	374	0.6	0.292	5.1	LOS A	1.7	43.3	0.10	0.02	33.2
16	R2	16	0.0	0.292	5.1	LOS A	1.7	43.3	0.10	0.02	32.6
Approach		413	0.5	0.292	5.1	LOS A	1.7	43.3	0.10	0.02	33.2
North: Dog Park Dwy.											
7	L2	12	0.0	0.017	3.9	LOS A	0.1	1.7	0.46	0.30	32.5
4	T1	1	0.0	0.017	3.9	LOS A	0.1	1.7	0.46	0.30	32.8
14	R2	3	0.0	0.017	3.9	LOS A	0.1	1.7	0.46	0.30	32.2
Approach		16	0.0	0.017	3.9	LOS A	0.1	1.7	0.46	0.30	32.5
West: Deer Hill Rd.											
5	L2	5	0.0	0.736	13.1	LOS B	10.5	263.8	0.41	0.15	29.5
2	T1	1000	0.5	0.736	13.1	LOS B	10.5	263.8	0.41	0.15	29.7
12	R2	12	0.0	0.736	13.1	LOS B	10.5	263.8	0.41	0.15	29.2
Approach		1017	0.5	0.736	13.1	LOS B	10.5	263.8	0.41	0.15	29.7
All Vehicles		1468	0.5	0.736	10.7	LOS B	10.5	263.8	0.32	0.13	30.7

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

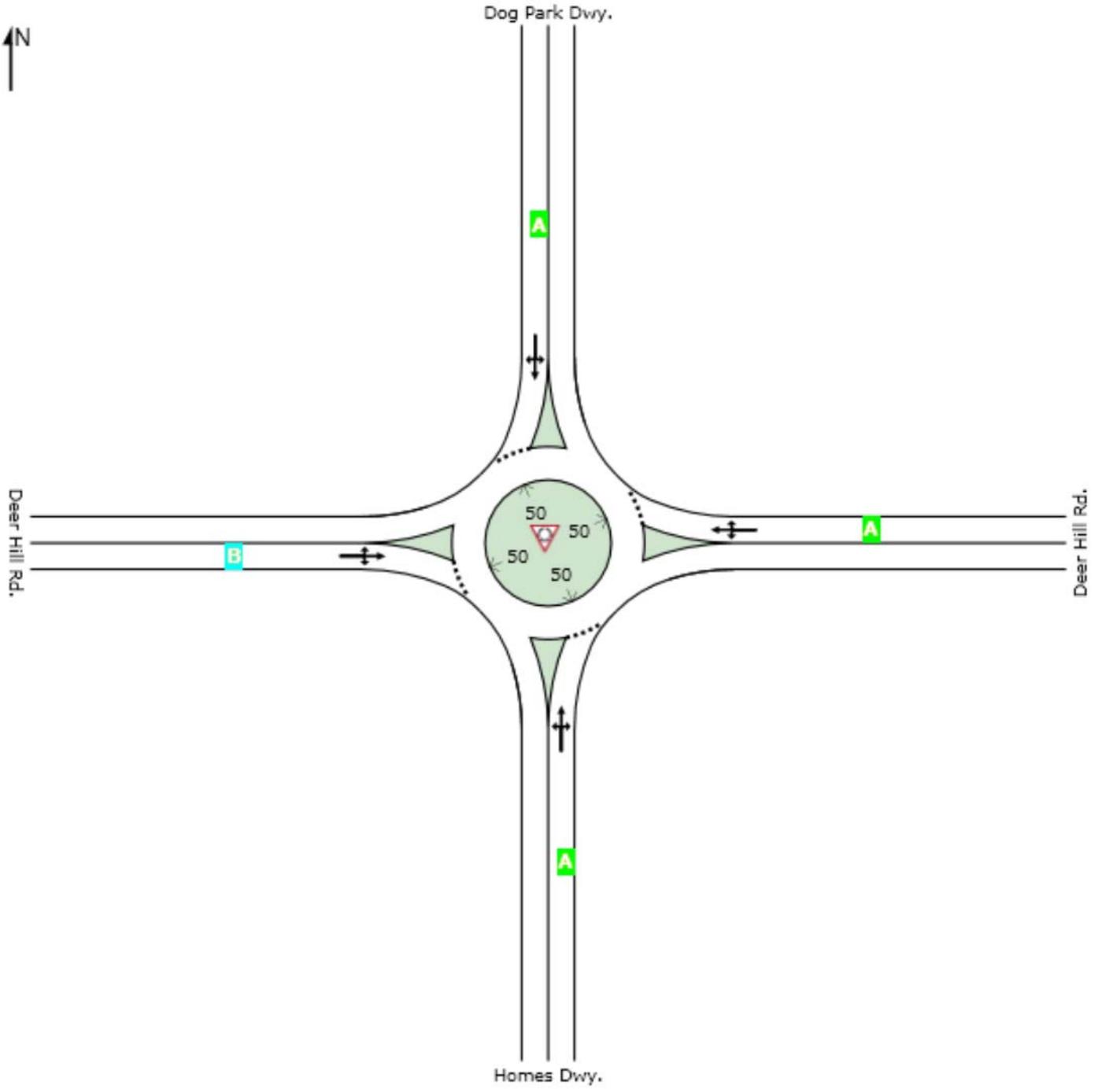
LEVEL OF SERVICE

Site: Int #13 - Cumulative Plus Project PM

Roundabout with 1-lane approaches and circulating road
MUTCD (FHWA 2009) example number: 2B-22
Roundabout Guide (TRB 2010) example number: A-1
Roundabout

All Movement Classes

	South	East	North	West	Intersection
LOS	A	A	A	B	B

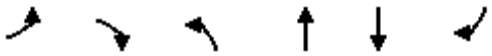


Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	931	15	0	350	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1012	16	0	380	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)	281			372		
pX, platoon unblocked						
vC, conflicting volume			1028		1401	1020
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1028		1401	1020
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			675		155	287

Direction, Lane #	EB 1	WB 1
Volume Total	1028	380
Volume Left	0	0
Volume Right	16	0
cSH	1700	1700
Volume to Capacity	0.60	0.22
Queue Length 95th (ft)	0	0
Control Delay (s)	0.0	0.0
Lane LOS		
Approach Delay (s)	0.0	0.0
Approach LOS		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	53.2%	ICU Level of Service	A
Analysis Period (min)	15		

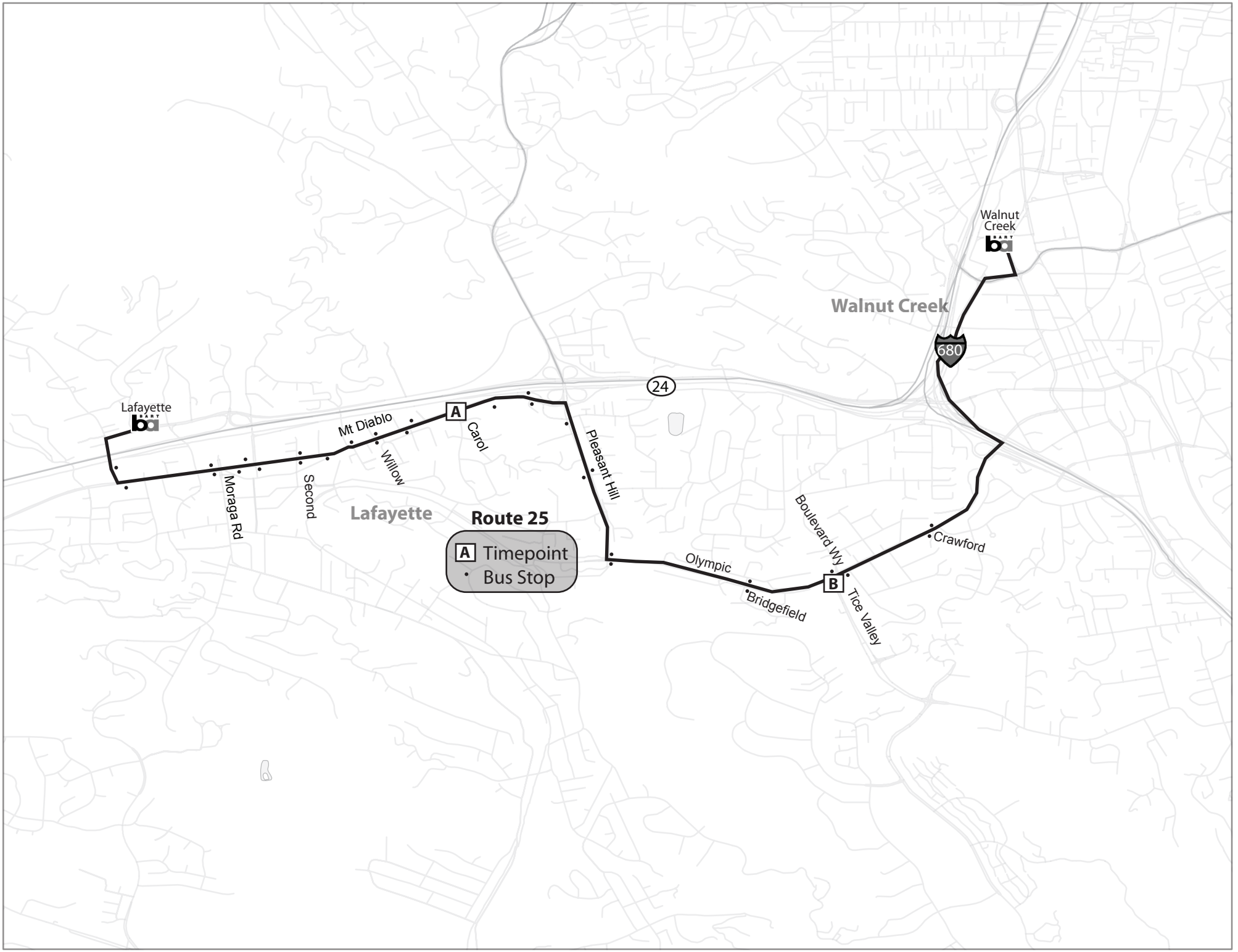


Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	40	0	1708	1241	39
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	43	0	1857	1349	42
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					244	
pX, platoon unblocked	0.66	0.66	0.66			
vC, conflicting volume	1989	696	1391			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1478	0	578			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	94	100			
cM capacity (veh/h)	77	720	659			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	43	619	619	619	899	492
Volume Left	0	0	0	0	0	0
Volume Right	43	0	0	0	0	42
cSH	720	1700	1700	1700	1700	1700
Volume to Capacity	0.06	0.36	0.36	0.36	0.53	0.29
Queue Length 95th (ft)	5	0	0	0	0	0
Control Delay (s)	10.3	0.0	0.0	0.0	0.0	0.0
Lane LOS	B					
Approach Delay (s)	10.3	0.0			0.0	
Approach LOS	B					

Intersection Summary				
Average Delay	0.1			
Intersection Capacity Utilization	45.5%	ICU Level of Service		A
Analysis Period (min)	15			

Appendix F – Bus Transit Route Maps


Lafayette
Mt Diablo
A
Carol
Willow
Moraga Rd
Second
Lafayette
Route 25
A Timepoint
Bus Stop
Pleasant Hill
24
Walnut Creek
680
Walnut Creek
Boulevard Wy
Crawford
Olympic
B
Bridgefield
Tice Valley

Acalanes & Orinda School Districts

Appendix G – CCCFPD Site Plan Review Letter

Contra Costa County **Fire Protection District**

July 21, 2014

Mr. Greg Wolff
City of Lafayette
Planning Services Division
3675 Mount Diablo Boulevard, Suite 210
Lafayette, CA 94549

Subject: The Terraces of Lafayette (The Homes at Deer Hill) Supplement EIR
3233 and 3312 Deer Hill Road, Lafayette
CCCFPD Project No.: P-2014-05797

Dear Mr. Wolf:

We have reviewed the vesting tentative map plans for the preparation of a draft supplemental impact report for an alternate plan to the Terraces of Lafayette project by proposing a 44-lot single-family residential subdivision with a public-access sports field, parking lot and dog park at the subject location. The following is required for Fire District approval in accordance with the 2013 California Fire Code (CFC), the 2013 California Building Code (CBC), the 2013 California Residential Code (CRC), and adopted ordinances and standards:

1. **Access as shown on Sheet C3.0 of the vesting tentative map, dated 3/6/14, does not comply with Fire District requirements.**

   a. The median at the entrance to the subdivision does not allow for the minimum required unobstructed access width of 20 feet. Because the median length is not excessive, the Fire District would accept each lane on either side of the median to be a minimum of 12 feet wide. (503) CFC, Contra Costa County Ordinance 2013-22

   b. Access throughout the proposed subdivision does not appear to meet the minimum required outside turning radius of 45 feet and the minimum inside turning radius of 25 feet. (503) CFC, Contra Costa County Ordinance 2013-22

   c. Dead-end emergency apparatus access roadways in excess of 150 feet in length are required to be provided with approved provisions for the turning around of Fire District apparatus. Contact the Fire District for approved designs. (503.2.5) CFC

2. ***NO PARKING – FIRE LANE*** signs **or** red curbs with the words ***NO PARKING – FIRE LANE*** shall be provided throughout the subdivision to maintain a minimum unobstructed emergency apparatus access width of 20 feet. (22500.1) CVC, (503.3) CFC

3. **The proposed number of hydrants and spacing as shown on Sheet C5.0 of the vesting tentative map does not meet Fire District requirements.**

   Hydrants shall be located such that all points on streets and access roads adjacent to a building are within 250 feet of a hydrant, and all portions of property frontage on dead end roadways shall be no further than 150 feet from a hydrant. Additionally, hydrants shall be provided on Deer Hill Road at the entrance to the subdivision and at the entrance to the handicap parking/sports field drop-off location. (C103.1) CFC

4. The developer shall provide an adequate and reliable water supply for fire protection with a minimum fire flow of 1,000 GPM. Required flow must be delivered from not more than 1 hydrant flowing for a duration of 120 minutes while maintaining 20-pounds residual pressure in the main. (507.1), (B105) CFC

5. The developer shall submit a minimum of two (2) copies of **revised** site improvement plans indicating proposed hydrant locations and fire apparatus access for review and approval prior to obtaining a building permit. ***Final placement of hydrants shall be determined by this office.*** (501.3) CFC

6. ***Emergency apparatus access roadways and hydrants shall be installed, in service, and inspected by the Fire District prior to construction or combustible storage on site.*** (501.4) CFC

   Note: A temporary aggregate base or asphalt grindings roadway is not considered an all-weather surface for emergency apparatus access. The first lift of asphalt concrete paving shall be installed as the minimum roadway material and must be engineered to support the designated gross vehicle weight of 37 tons.

7. The developer shall submit a computer-aided design (CAD) digital file copy of the subject project to the Fire District upon final approval of the site improvement plans or subdivision map. CAD file shall be saved in the latest AutoCAD® .DXF file format. (501) CFC

8. The homes as proposed shall be protected with an approved automatic fire sprinkler system complying with the 2013 edition of NFPA 13D or Section R313.3 of the 2013 California Residential Code. A minimum of two (2) sets of plans shall be submitted to this office for review and approval prior to installation. (903.2) CFC, (R313.3) CRC

9. The developer shall submit a minimum of two (2) complete sets of building plans and specifications of the restroom/storage buildings to the Fire District for review and approval ***prior to*** construction to ensure compliance with minimum requirements related to fire and life safety. Plan review and inspection fees shall be submitted at the time of plan review submittal. (105.4.1) CFC, (107) CBC

Our preliminary review comments shall not be construed to encompass the complete project. Additional plans and specifications may be required after further review.

If you have any questions regarding this matter, please contact this office at (925) 941-3300.

Sincerely,

Ted Leach
Fire Inspector

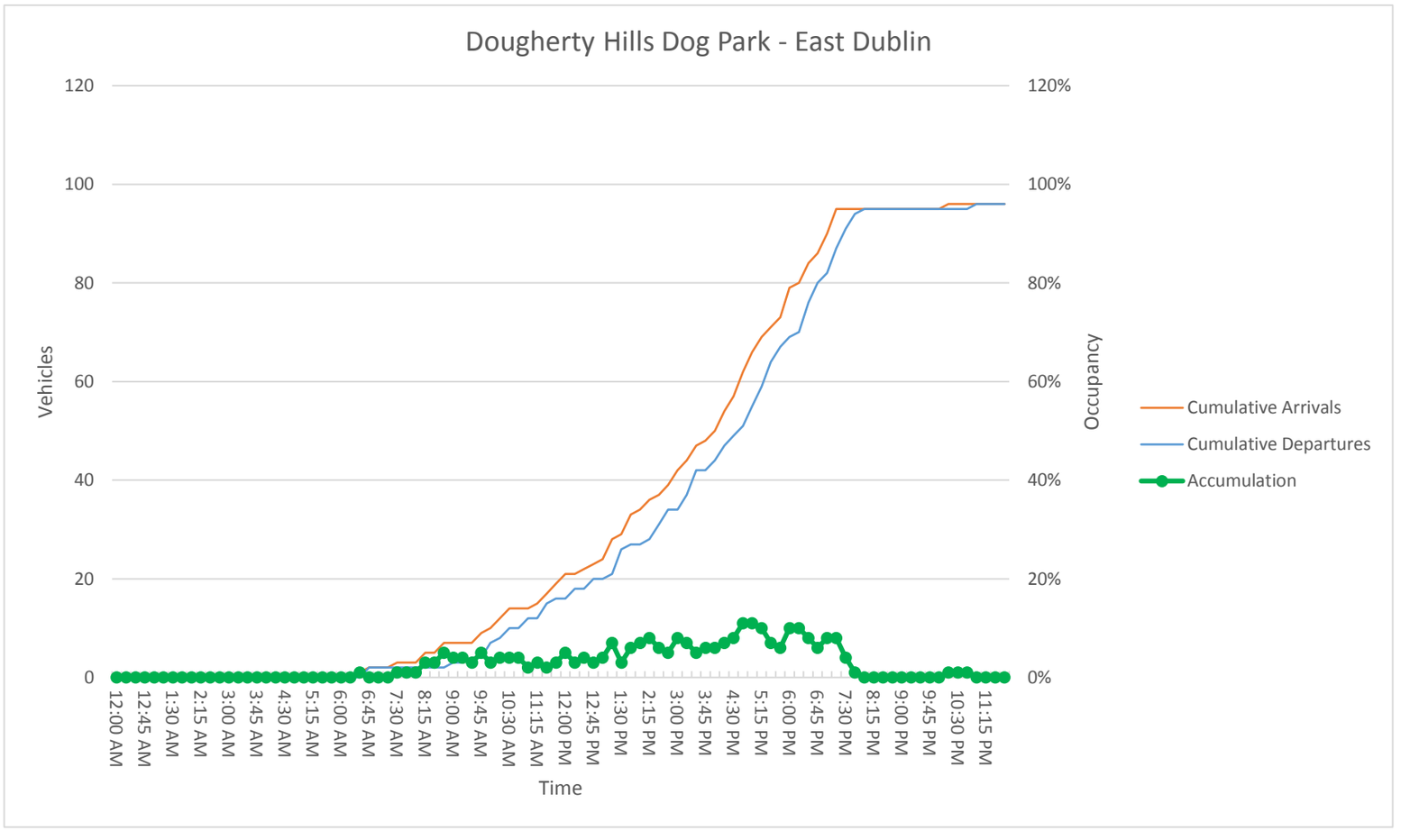
File:P-2014-05797.ltr

Appendix H – Dog Park and Soccer Field Survey Data

Date: **04/16/2014**
Location: **Dougherty Hills Dog Park - East - Dublin**

Hourly Trip Generation			
Hourly Trip Generation			
	In	out	total
12:00 AM	0	0	0
1:00 AM	0	0	0
2:00 AM	0	0	0
3:00 AM	0	0	0
4:00 AM	0	0	0
5:00 AM	0	0	0
6:00 AM	1	2	3
7:00 AM	1	0	1
8:00 AM	4	0	4
9:00 AM	2	2	4
10:00 AM	5	6	11
11:00 AM	5	6	11
12:00 PM	4	4	8
1:00 PM	10	7	17
2:00 PM	6	7	13
3:00 PM	9	8	17
4:00 PM	14	9	23
5:00 PM	12	16	28
6:00 PM	22	14	36
7:00 PM	9	14	23
8:00 PM	0	1	1
9:00 PM	0	0	0
10:00 PM	1	0	1
11:00 PM	0	1	1
total			202

Peak Hour Trip Generation				
		in	out	total
AM	7:00-8:00	1	0	1
	7:15-8:15	1	0	1
	7:30-8:30	3	0	3
	7:45-8:45	2	0	2
	8:00-9:00	4	0	4
PM	4:00- 5:00	14	9	23
	4:15 - 5:15	16	11	27
	4:30-5:30	15	12	27
	4:45-5:45	14	15	29
	5:00-6:00	12	16	28
	5:15-6:15	16	14	30
	5:30-6:30	18	12	30
	5:45-6:45	23	13	36
	6:00-7:00	22	14	36

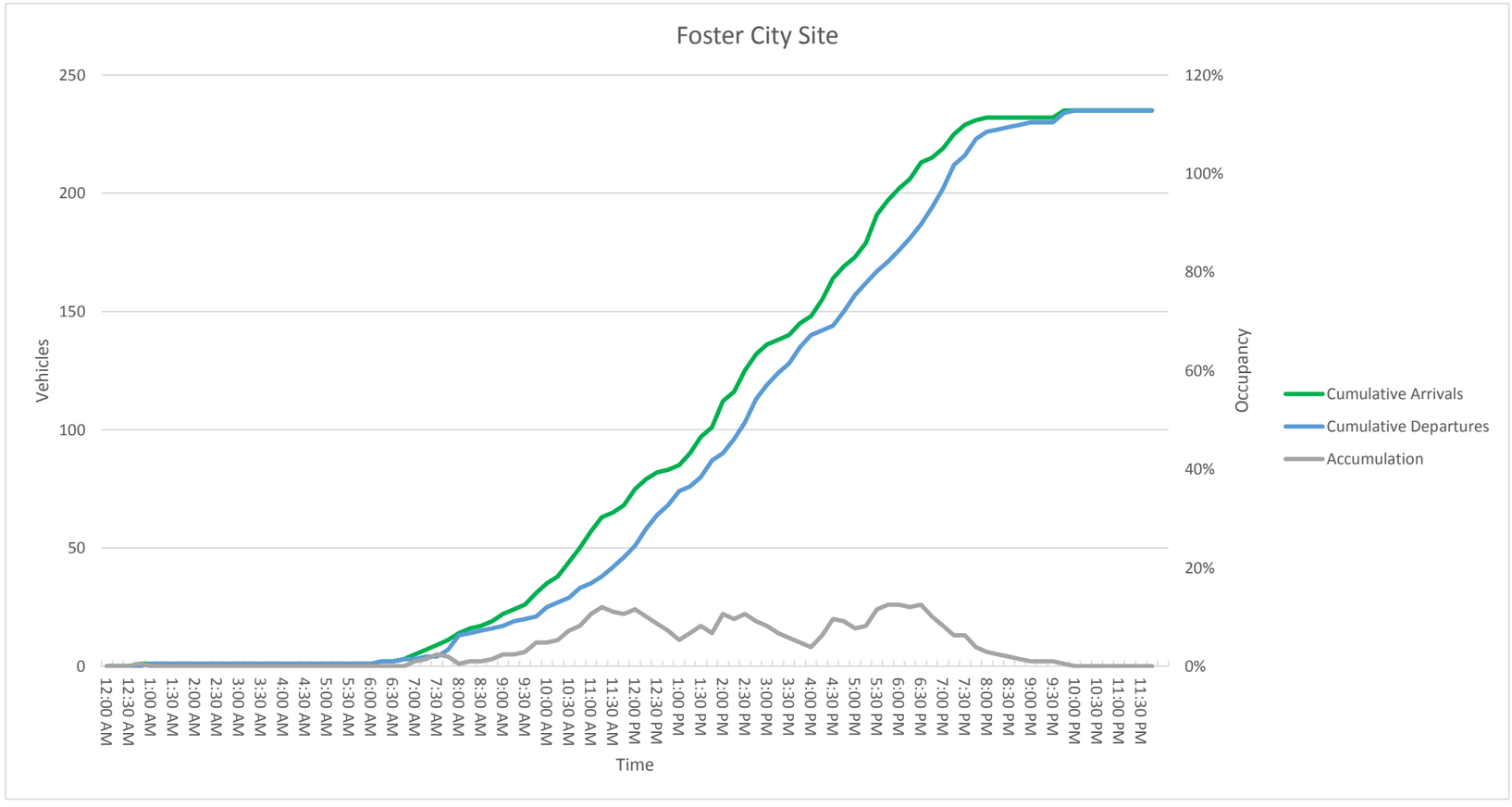


Parking Accumulation

Date: 4/16/2014

Location: Foster City Dog Park

Hourly Trip Generation				Peak Hour Trip Generation				
	In	out	total			in	out	total
12:00 AM	1	0	1		7:00-8:00	8	4	12
1:00 AM	0	1	1		7:15-8:15	9	10	19
2:00 AM	0	0	0	AM	7:30-8:30	9	10	19
3:00 AM	0	0	0		7:45-8:45	8	11	19
4:00 AM	0	0	0		8:00-9:00	8	9	17
5:00 AM	0	0	0		4:00- 5:00	24	15	39
6:00 AM	2	2	4		4:15 - 5:15	25	17	42
7:00 AM	8	4	12		4:30-5:30	24	20	44
8:00 AM	8	9	17		4:45-5:45	27	23	50
9:00 AM	12	5	17	PM	5:00-6:00	28	21	49
10:00 AM	19	12	31		5:15-6:15	29	19	48
11:00 AM	18	13	31		5:30-6:30	27	19	46
12:00 PM	15	22	37		5:45-6:45	22	20	42
1:00 PM	18	19	37		6:00-7:00	18	23	41
2:00 PM	31	26	57					
3:00 PM	13	22	35					
4:00 PM	24	15	39					
5:00 PM	28	21	49					
6:00 PM	18	23	41					
7:00 PM	16	29	45					
8:00 PM	1	6	7					
9:00 PM	3	5	8					
10:00 PM	0	1	1					
11:00 PM	0	0	0					



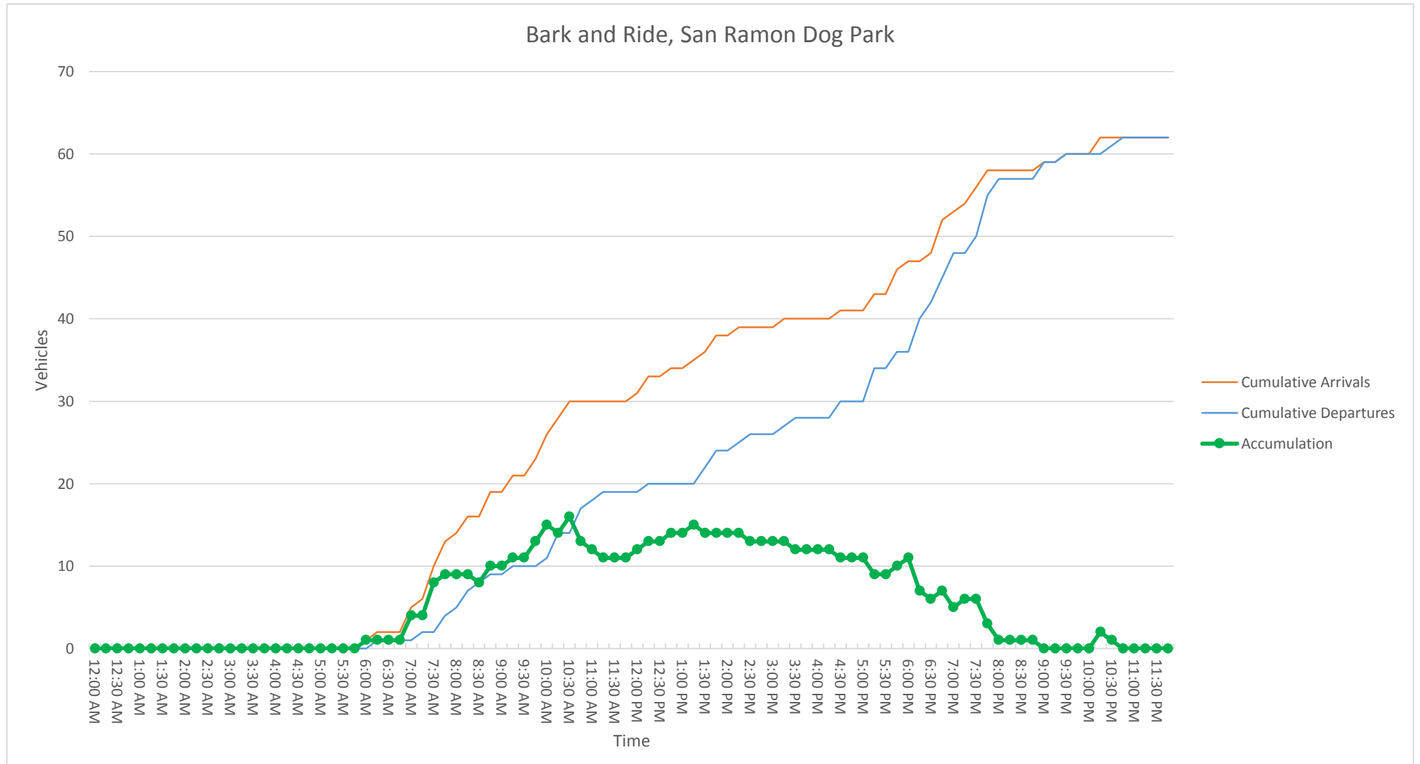
Parking Accumulation

Date: 4/16/2014

Location: Bark and Ride, San Ramon Dog Park

Hourly Trip Generation			
Hourly Trip Generation			
	Out	In	total
12:00 AM	0	0	0
1:00 AM	0	0	0
2:00 AM	0	0	0
3:00 AM	0	0	0
4:00 AM	0	0	0
5:00 AM	0	0	0
6:00 AM	1	2	3
7:00 AM	3	11	14
8:00 AM	5	6	11
9:00 AM	1	4	5
10:00 AM	7	7	14
11:00 AM	2	0	2
12:00 PM	1	4	5
1:00 PM	4	4	8
2:00 PM	2	1	3
3:00 PM	2	1	3
4:00 PM	2	1	3
5:00 PM	6	5	11
6:00 PM	9	6	15
7:00 PM	10	6	16
8:00 PM	2	0	2
9:00 PM	3	2	5
10:00 PM	2	2	4
11:00 PM	0	0	0

Peak Hour Trip Generation				
		OUT	IN	total
AM	7:00-8:00	11	3	14
	7:15-8:15	9	4	13
	7:30-8:30	10	5	15
	7:45-8:45	6	6	12
	8:00-9:00	6	5	11
PM	4:00- 5:00	1	2	3
	4:15 - 5:15	1	2	3
	4:30-5:30	3	6	9
	4:45-5:45	2	4	6
	5:00-6:00	5	6	11
	5:15-6:15	6	6	12
	5:30-6:30	4	6	10
	5:45-6:45	5	8	13
	6:00-7:00	6	9	15



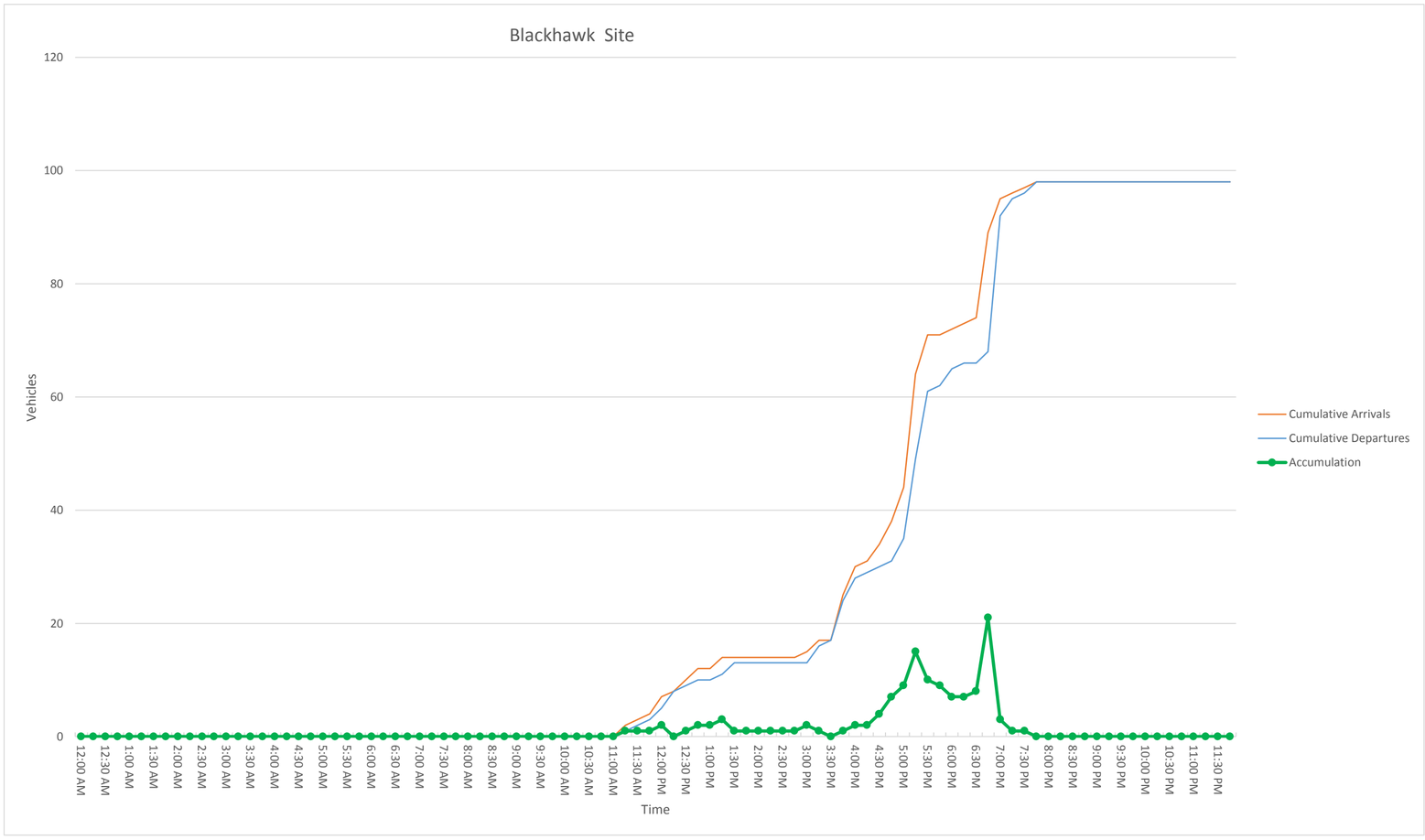
Parking Accumulation

Date: **4/21/2014**

Location: **Blackhawk Field** (Soccer Field)

Hourly Trip Generation			
	In	Out	total
12:00 AM	0	0	0
1:00 AM	0	0	0
2:00 AM	0	0	0
3:00 AM	0	0	0
4:00 AM	0	0	0
5:00 AM	0	0	0
6:00 AM	0	0	0
7:00 AM	0	0	0
8:00 AM	0	0	0
9:00 AM	0	0	0
10:00 AM	0	0	0
11:00 AM	4	3	7
12:00 PM	8	7	15
1:00 PM	2	3	5
2:00 PM	0	0	0
3:00 PM	11	11	22
4:00 PM	13	7	20
5:00 PM	33	31	64
6:00 PM	18	6	24
7:00 PM	9	30	39
8:00 PM	0	0	0
9:00 PM	0	0	0
10:00 PM	0	0	0
11:00 PM	0	0	0

Peak Hour Trip Generation				
		in	out	total
AM	7:00-8:00	0	0	0
	7:15-8:15	0	0	0
	7:30-8:30	0	0	0
	7:45-8:45	0	0	0
	8:00-9:00	0	0	0
PM	3:00-4:00	11	11	22
	3:15-4:15	15	15	30
	3:30-4:30	13	14	27
	3:45-4:45	13	17	30
	4:00- 5:00	7	13	20
	4:15 - 5:15	7	14	21
	4:30-5:30	20	33	53
	4:45-5:45	31	37	68
	5:00-6:00	31	33	64
	5:15-6:15	30	28	58
	5:30-6:30	17	9	26
	5:45-6:45	5	3	8
	6:00-7:00	6	18	24
	6:15-7:15	27	23	50
	6:30-7:30	29	23	52



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Parking Accumulation