Traffic Impact Study for the 853 Fourth Street West Project

Prepared for the City of Sonoma

Submitted by
W-Trans

June 15, 2018

TRAFFIC ENGINEERING
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Executive Summary

The proposed project would provide a total of 32 dwelling units, including 16 single family homes, four duplex units and 12 accessory dwelling units on a currently vacant site located on the northwest corner of the intersection of West MacArthur Street and Fourth Street West. The proposed project would be expected to generate an average of 268 daily trips, including 19 weekday a.m. peak hour trips and 25 trips during the weekday p.m. peak hour.

Three intersections along West MacArthur Street (at Fifth Street West, First Street West and Broadway) were evaluated under current volumes, projected future volumes, and with project-generated traffic added to both. All three intersections are expected to operate acceptably under all scenarios, resulting in a less-than-significant impact due to adding project-generated traffic.

There are continuous sidewalks in and around the project site, providing adequate connectivity for pedestrians. Existing and planned future Class II bike lanes, along with the shared use of minor streets, provide adequate access for bicyclists. There are existing bus stops along the project frontage on West MacArthur Street, providing access to transit facilities connecting the site to Santa Rosa, Sonoma Valley, and San Rafael.

Access to the project site is expected to operate acceptably, with adequate sight distance and no need for turn lanes. It is recommended that a stop sign be installed on the driveway where it intersects Fourth Street West.

Introduction

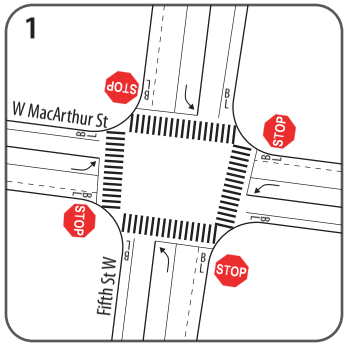
This report presents an analysis of the potential traffic impacts that would be associated with development of a proposed residential project to be located at 853 Fourth Street East in the City of Sonoma. The traffic study was completed in accordance with the criteria established by the City of Sonoma, and is consistent with standard traffic engineering techniques.

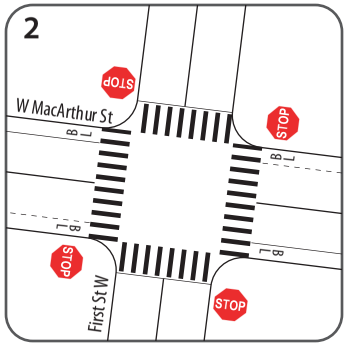
Prelude

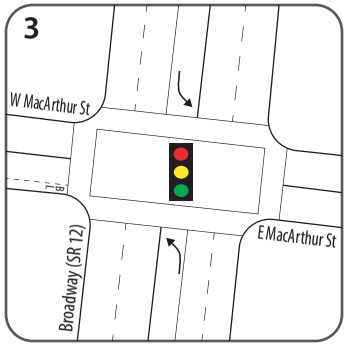
The purpose of a traffic impact study is to provide City staff and policy makers with data that they can use to make an informed decision regarding the potential traffic impacts of a proposed project, and any associated improvements that would be required to mitigate these impacts to a level of insignificance as defined by the City's General Plan or other policies. Vehicular traffic impacts are typically evaluated by determining the number of new trips that the proposed use would be expected to generate, distributing these trips to the surrounding street system based on existing travel patterns or anticipated travel patterns specific to the proposed project, then analyzing the impact the new traffic would be expected to have on critical intersections or roadway segments. Impacts relative to access for pedestrians, bicyclists, and to transit are also addressed.

Project Profile

The proposed project would include a total of 20 units on 18 lots, including four units in duplexes, together with 12 accessory dwelling units. The currently vacant project site is located on the northwest corner of Fourth Street West and West MacArthur Street in the City of Sonoma, as shown in Figure 1.







North

Not to Scale

LEGEND

Study Intersection

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Traffic Impact Study for the 853 Fourth Street West Project

Figure 1 – Study Area and Lane Configurations

Transportation Setting

Operational Analysis

Study Area and Periods

The study area included the following three intersections.

1. Fifth Street West/West MacArthur Street
2. First Street West/West MacArthur Street
3. Broadway/MacArthur Street

Fifth Street West/West MacArthur Street is a four-legged all-way stop-controlled intersection with marked crosswalks on all approaches.

First Street West/West MacArthur Street is a four-way stop-controlled intersection with crosswalks marked on all approaches.

Broadway/MacArthur Street is a signalized four-legged intersection with protected left turns on the north and south approaches and permitted left turns on the east and west approaches. The intersection includes crosswalks on all legs.

The locations of the study intersections and the existing lane configurations and controls are shown in Figure 1.

Operating conditions during the a.m. and p.m. peak periods were evaluated to capture the highest potential impacts for the proposed project as well as the highest volumes on the local transportation network. The morning peak hour occurs between 7:00 and 9:00 a.m. and reflects conditions during the home to work or school commute, while the p.m. peak hour occurs between 4:00 and 6:00 p.m. and typically reflects the highest level of congestion during the homeward bound commute.

Collision History

The collision histories for the study intersections were reviewed to determine any trends or patterns that may indicate a safety issue. Collision rates were calculated based on records available from the California Highway Patrol as published in their Statewide Integrated Traffic Records System (SWITRS) reports. The most current five-year period available is January 1, 2012 through December 31, 2016.

As presented in Table 1, the calculated collision rates for the study intersections were compared to the average collision rates for similar facilities statewide, as indicated in *2013 Collision Data on California State Highways*, California Department of Transportation (Caltrans). The calculated collision rates for the three study intersections are lower that the statewide averages for similar facilities, indicating that the intersections are operating within acceptable safety parameters. The collision rate calculations are provided in Appendix A.

Table 1 – Collision Rates at the Study Intersection			
Study Intersection	**Number of Collisions (2012-2016)**	**Calculated Collision Rate (c/mve)**	**Statewide Average Collision Rate (c/mve)**
1. Fifth St W/W MacArthur St	7	0.29	0.32
2. First St W/W MacArthur St	5	0.27	0.32
3. Broadway/MacArthur St	8	0.22	0.27

Note: c/mve = collisions per million vehicles entering

Alternative Modes

Pedestrian Facilities

Pedestrian facilities include sidewalks, crosswalks, pedestrian signal phases, curb ramps, curb extensions, and various streetscape amenities such as lighting, benches, etc. In general, a network of sidewalks, crosswalks, pedestrian signals, and curb ramps provide access for pedestrians in the vicinity of the proposed project site.

- **Fifth Street West** – Full sidewalk connectivity exists along Fifth Street West and crosswalks are marked at most major and minor street intersections. Lighting is provided via post-top street lights along the west side of the street.

- **West MacArthur Street** – Continuous sidewalks exist along the West MacArthur Street with lighting provided along its southern sidewalk. There are crosswalks and curb ramps at minor and major street intersections.

- **First Street West** – Pedestrian amenities along First Street West include full sidewalk coverage, marked crosswalks, lighting along its east side, and curb ramps.

- **Broadway** – Full sidewalk coverage is provided on both sides of Broadway between Napa Street and Clay Street. The signalized intersection of Broadway/MacArthur Street located east of the project area includes pedestrian phasing, marked crosswalks, and curb ramps.

Bicycle Facilities

The *Highway Design Manual*, Caltrans, 2017, classifies bikeways into four categories:

- **Class I Multi-Use Path** – a completely separated right-of-way for the exclusive use of bicycles and pedestrians with cross flows of motorized traffic minimized.
- **Class II Bike Lane** – a striped and signed lane for one-way bike travel on a street or highway.
- **Class III Bike Route** – signing only for shared use with motor vehicles within the same travel lane on a street or highway.
- **Class IV Bikeway** – also known as a separated bikeway, a Class IV Bikeway is for the exclusive use of bicycles and includes a separation between the bikeway and the motor vehicle traffic lane. The separation may include, but is not limited to, grade separation, flexible posts, inflexible physical barriers, or on-street parking.

There are existing Class II bike lanes along Fifth Street West and West MacArthur Street and future bicycle facilities are planned for Broadway and East MacArthur Street. Table 2 summarizes the existing and planned bicycle facilities in the project vicinity, as contained in the 2014 *Sonoma Bicycle and Pedestrian Master Plan.*

Table 2 – Bicycle Facility Summary				
Status **Facility**	**Class**	**Length (miles)**	**Begin Point**	**End Point**
Existing				
Fifth Street West	II	0.65	Oregon Street	Harrington Drive
West MacArthur Street	II	0.56	Fifth Street West	Broadway
Planned				
Broadway	II	1.12	Napa Street	Napa Road
East MacArthur Street	II	0.33	Sonoma City Limits	8th Street East

Source: *SCTA Countywide Bicycle and Pedestrian Master Plan*, Sonoma County Transportation Authority, 2014

Transit Facilities

Transit Services in the City of Sonoma, and throughout Sonoma County, are provided by Sonoma County Transit (SCT). There are four SCT transit stops within what is typically considered acceptable walking distance (one quarter-mile) of the site. SCT Route 32 provides loop service to destinations throughout the City and stops on both sides of Fifth Street West, just north of the intersection with West MacArthur Street. This route operates Monday through Friday with approximately 45-minute headways between 8:00 a.m. and 4:30 p.m. Saturday service operates with approximately one-hour headways between 9:00 a.m. and 3:00 p.m.

Routes 30 and 34 provide regional service to destinations throughout Santa Rosa and Sonoma Valley. Route 30 has stops located on both sides of West MacArthur Street, adjacent to the project frontage, and Route 34 has stops located on both sides of Fifth Street West. Route 30 operates seven days a week with approximately one-and-a-half-hour headways on weekdays between 6:00 a.m. and 9:00 p.m. and approximately 3-hour headways on weekends from 7:00 a.m. to 7:00 p.m. Route 34 offers weekday service from 8:00 a.m. to 4:00 p.m. with 45-minute headways and Saturday service from 9:00 a.m. to 2:00 p.m. with one-and-a-quarter-hour headways.

Routes 38 provides regional service to and from San Rafael and stops on both sides of Fifth Street West near the project site. Routes 38 operates on weekdays with service limited to the morning and evening peak hours.

Two to three bicycles can be carried on most SCT buses. Bike rack space is on a first-come, first-served basis. Additional bicycles are allowed on SCT buses at the discretion of the driver.

Dial-a-ride, also known as paratransit, or door-to-door service, is available for those who are unable to independently use the transit system due to a physical or mental disability. SCT Paratransit is designed to serve the needs of individuals with disabilities within Sonoma and the greater County of Sonoma area.

Capacity Analysis

Intersection Level of Service Methodologies

Level of Service (LOS) is used to rank traffic operation on various types of facilities based on traffic volumes and roadway capacity using a series of letter designations ranging from A to F. Generally, Level of Service A represents free flow conditions and Level of Service F represents forced flow or breakdown conditions. A unit of measure that indicates a level of delay generally accompanies the LOS designation. The study intersections were evaluated using methodologies published in the *Highway Capacity Manual* (HCM), Transportation Research Board, 2010. This source contains methodologies for various types of intersection control, all of which are related to a measurement of delay in average number of seconds per vehicle.

The study intersections of Fifth Street West/West MacArthur Street and First Street West/West MacArthur Street, which have stop signs on all approaches, were analyzed using the "All-Way Stop-Controlled" Intersection methodology from the HCM. This methodology evaluates delay for each approach based on turning movements, opposing and conflicting traffic volumes, and the number of lanes. Average vehicle delay is computed for the intersection overall, which is then related to a Level of Service.

Broadway/MacArthur Street was analyzed using the signalized methodology, which is based on factors including traffic volumes, green time for each movement, phasing, whether the signals are coordinated or not, truck traffic, and pedestrian activity. Average stopped delay per vehicle in seconds is used as the basis for evaluation in this LOS methodology. For purposes of this study, delays were calculated using actual signal timing from timing sheets provided by Caltrans.

The ranges of delay associated with the various levels of service are indicated in Table 3.

Table 3 – Intersection Level of Service Criteria

LOS	All-Way Stop-Controlled	Signalized
A	Delay of 0 to 10 seconds. Upon stopping, drivers are immediately able to proceed.	Delay of 0 to 10 seconds. Most vehicles arrive during the green phase, so do not stop at all.
B	Delay of 10 to 15 seconds. Drivers may wait for one or two vehicles to clear the intersection before proceeding from a stop.	Delay of 10 to 20 seconds. More vehicles stop than with LOS A, but many drivers still do not have to stop.
C	Delay of 15 to 25 seconds. Drivers will enter a queue of one or two vehicles on the same approach, and wait for vehicle to clear from one or more approaches prior to entering the intersection.	Delay of 20 to 35 seconds. The number of vehicles stopping is significant, although many still pass through without stopping.
D	Delay of 25 to 35 seconds. Queues of more than two vehicles are encountered on one or more approaches.	Delay of 35 to 55 seconds. The influence of congestion is noticeable, and most vehicles have to stop.
E	Delay of 35 to 50 seconds. Longer queues are encountered on more than one approach to the intersection.	Delay of 55 to 80 seconds. Most, if not all, vehicles must stop and drivers consider the delay excessive.
F	Delay of more than 50 seconds. Drivers enter long queues on all approaches.	Delay of more than 80 seconds. Vehicles may wait through more than one cycle to clear the intersection.

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

Traffic Operation Standards

City of Sonoma

In the *2016 Circulation Element* of the *City of Sonoma 2020 General Plan*, the following policy was adopted:

> ***Policy 1.5**: Establish a motor vehicle Level of Service (LOS) standard of LOS D at intersections. The following shall be taken into consideration in applying this standard:*
>
> - *Efforts to meet the vehicle LOS standard shall not result in diminished safety for other modes including walking, bicycling, or transit (see Policy 1.6).*
> - *The standard shall be applied to the overall intersection operation and not that of any individual approach or movement.*
> - *Consideration shall be given to the operation of the intersection over time, rather than relying exclusively on peak period conditions.*
> - *The five intersections surrounding the historic Sonoma Plaza shall be exempt from vehicle LOS standards in order to maintain the historic integrity of the Plaza and prioritize non-auto modes.*

Caltrans

The study intersection on Broadway, which serves as State Route (SR) 12 through the City of Sonoma, is under the jurisdiction of Caltrans, and their policy indicates that they endeavor to maintain operation at the transition from LOS C to LOS D. Where Caltrans facilities serve as part of a local street system, the local agency's policies are generally applied, so the City's LOS D standard was applied for purposes of this analysis.

Existing Conditions

The Existing Conditions scenario provides an evaluation of current operation based on existing traffic volumes during the a.m. and p.m. peak periods. This condition does not include project-generated traffic volumes. Volume data was collected in November 2017 and January 2018 while local schools were in session. It is noted that because these counts were collected after the firestorms that threatened the City of Sonoma in mid-October, the data was compared to counts obtained for other projects prior to the fire, and the highest volumes used to provide the most reasonable analysis.

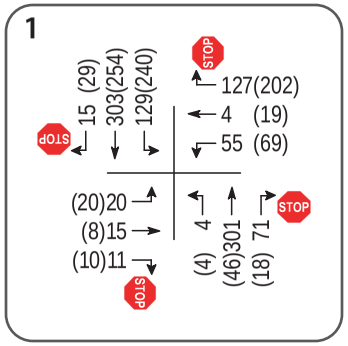
Intersection Levels of Service

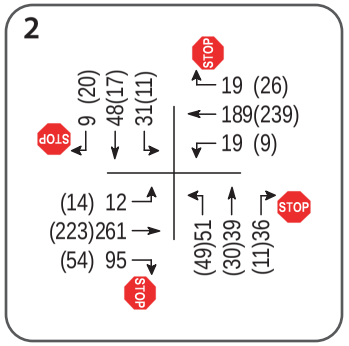
Under existing conditions, all the study intersections operate at an acceptable LOS C or better during both the morning and evening peak periods. A summary of the intersection level of service calculations is contained in Table 4, existing traffic volumes are shown in Figure 2, and copies of the Level of Service calculations are provided in Appendix B.

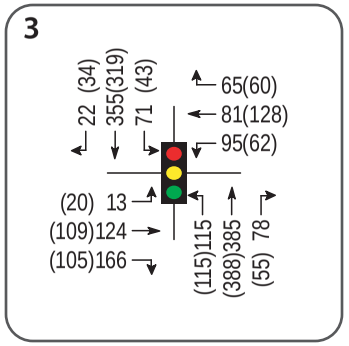
Table 4 – Existing Peak Hour Intersection Levels of Service

Study Intersection	AM Peak		PM Peak	
	Delay	LOS	Delay	LOS
1. Fifth St W/W MacArthur St	14.9	B	12.3	B
2. First St W/W MacArthur St	14.1	B	10.1	B
3. Broadway/MacArthur St	21.4	C	17.6	B

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service







North

Not to Scale

LEGEND

Study Intersection

xx AM Peak Hour Volume

(xx) PM Peak Hour Volume

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Figure 2– Existing Traffic Volumes

Future Conditions

Evening peak hour volumes for the horizon year of 2040 for the intersections of Fifth Street West/West MacArthur Street and Broadway/MacArthur Street were obtained from the Circulation Element of the City's General Plan.

Because the City's General Plan does not include future volume projections for the morning peak hour, the overall growth rate at Broadway/MacArthur Street was calculated based on the evening peak hour and applied to the existing morning peak hour turning movement counts to arrive at future volumes.

Application of the growth factor resulted in unreasonably high future volumes for the a.m. peak hour for the intersection of 5th Street West/MacArthur Street. Morning peak hour segment volumes for the horizon year of 2040 were obtained from the County's gravity demand model as maintained by the Sonoma County Transportation Authority (SCTA) and translated to turning movement volumes using the "Furness" method. The Furness method is an iterative process that employs existing turn movement data, existing link volumes, and future link volumes to project likely turning future movement volumes at intersections. This exercise provided volumes that represent a more realistic increase in volumes than were achieved using a growth factor, so these volumes were used for the analysis.

Future volume projections for the intersection of First Street West/West MacArthur Street are not included in the City's General Plan, nor are they included in the County's model. Therefore, future volumes for this intersection were estimated using a growth rate of half-a-percent per year at the minor First Street West approaches and one percent per year at the major West MacArthur Street approaches.

Under the anticipated Future volumes, the study intersections are expected to operate acceptably at LOS D or better. Future volumes are shown in Figure 3 and operating conditions are summarized in Table 5.

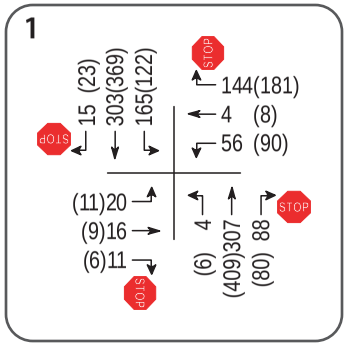
Table 5 – Future Peak Hour Intersection Levels of Service

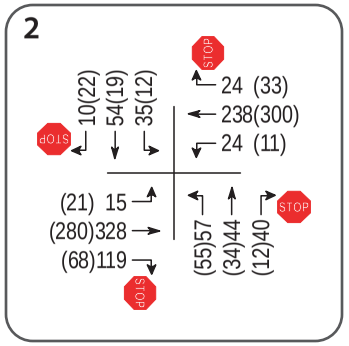
Study Intersection	AM Peak		PM Peak	
	Delay	LOS	Delay	LOS
1. Fifth St W/W MacArthur St	15.3	C	24.8	C
2. First St W/W MacArthur St	25.4	D	11.9	B
3. Broadway/MacArthur St	31.3	C	21.6	C

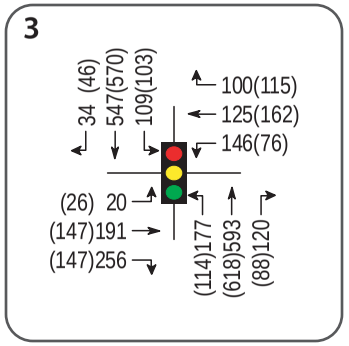
Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

Project Description

The proposed residential development would include 16 single family homes, four duplex units in two buildings, and 12 accessory dwelling units. The currently vacant project site is located on the northwest corner of Fourth Street West and West MacArthur Street. The project would have an internal street providing access to all 18 lots and connecting Hayes Street on the west to Fourth Street West just south of Nicoli Lane at its eastern end. Two units would have access directly to Hayes Street and two others to Fourth Street. The currently unimproved frontages along both Hayes Street and Fourth Street West would be improved to include curb, gutter and sidewalk, with Hayes Street extended northerly to connect to the existing terminus near the site's northerly property line. The project site plan is shown in Figure 4.







North

Not to Scale

LEGEND

Study Intersection

xx AM Peak Hour Volume

(xx) PM Peak Hour Volume

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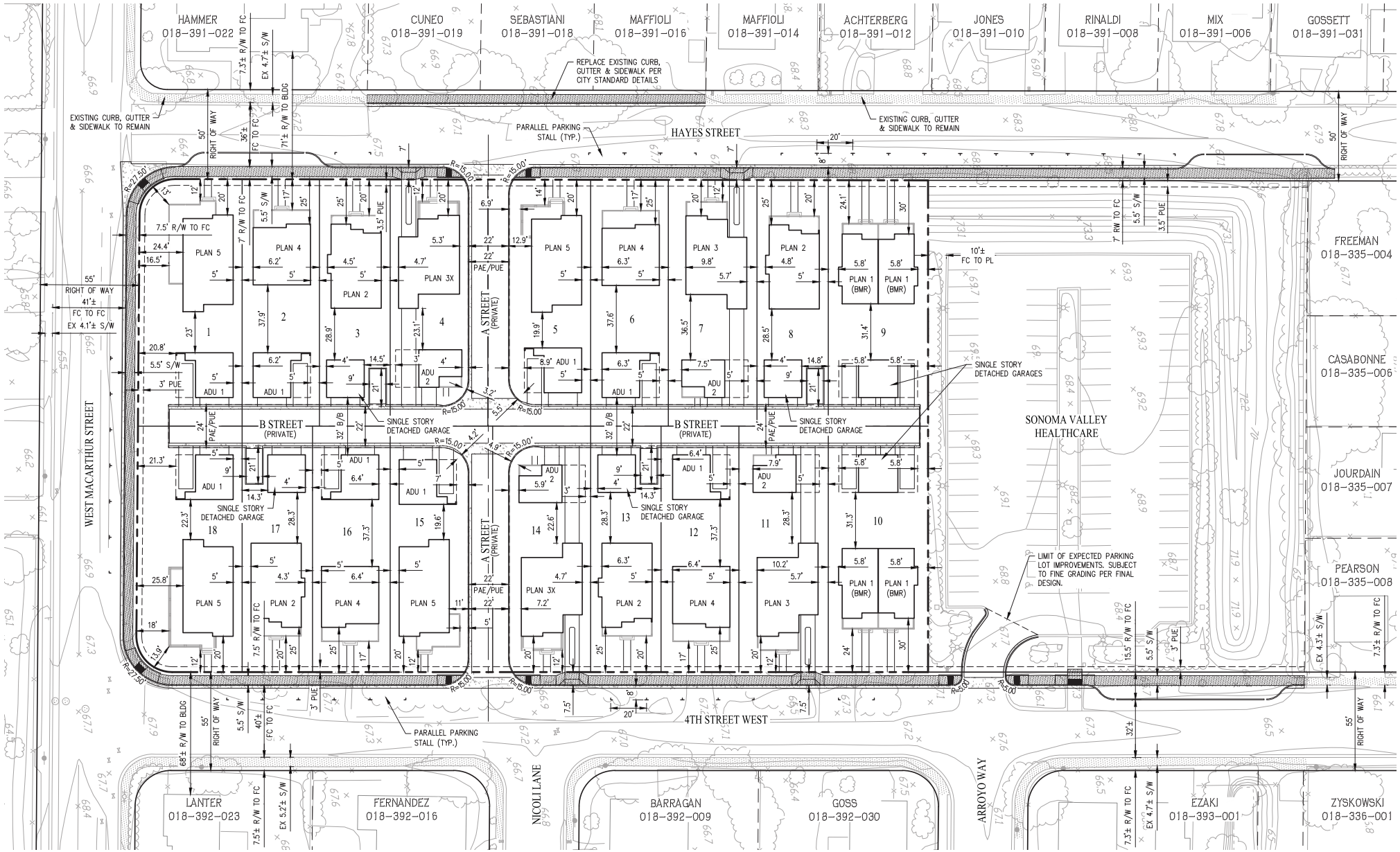
Traffic Impact Study for the 853 Fourth Street West Project

Figure 3 – Future Traffic Volumes

W-Trans



Source: Carlson, Barbee & Gibson, Inc. 5/18

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Traffic Impact Study for the 853 Fourth Street West Project

Figure 4 – Site Plan

Trip Generation

The anticipated trip generation for the proposed project was estimated using standard rates published by the Institute of Transportation Engineers (ITE) in *Trip Generation Manual*, 10th Edition, 2017 for "Single-Family Detached Housing" (ITE LU #210) and "Multifamily Housing (Low-Rise)" (ITE LU #220). As shown in Table 6, the proposed project is expected to generate an average of 268 trips per day, including 19 trips during the a.m. peak hour and 25 during the p.m. peak hour.

Table 6 – Trip Generation Summary

Land Use	Units	Daily		AM Peak Hour				PM Peak Hour			
		Rate	Trips	Rate	Trips	In	Out	Rate	Trips	In	Out
Single-Family Detached Housing	16 du	9.44	151	0.74	12	3	9	0.99	16	10	6
Multifamily Housing (Low-Rise)	16 du	7.32	117	0.46	7	2	5	0.56	9	6	3
Total			**268**		**19**	**5**	**14**		**25**	**16**	**9**

Note: du = dwelling unit

Trip Distribution

The pattern used to allocate new project trips to the street network was based on data from recent counts. The applied distribution assumptions and resulting trips are shown in Table 7. It is noted that all project trips were assigned to the access point on Fourth Street West rather than also being distributed to Hayes Street; this assigns more project-generated traffic to one location, resulting in a more conservative analysis.

Table 7 – Trip Distribution Assumptions

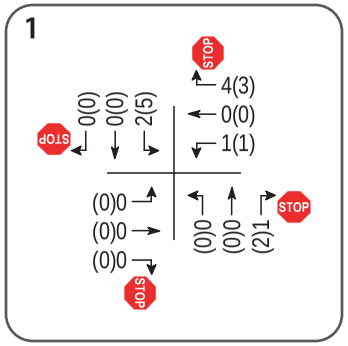
Route	Percent	Daily Trips	AM Trips	PM Trips
To/from the North via Fifth St W	30%	80	6	8
To/from the South via Fifth St W	10%	27	2	3
To/from the North via First St W	5%	13	1	1
To/from the South via First St W	10%	27	2	3
To/from the North via Broadway	5%	13	1	1
To/from the South via Broadway	20%	54	4	5
To/from the East via E MacArthur St	20%	54	4	5
TOTAL	**100%**	**268**	**20***	**26***

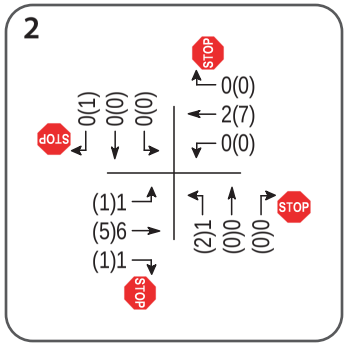
Note: * Trips may not add up to the calculated trip generation due to rounding

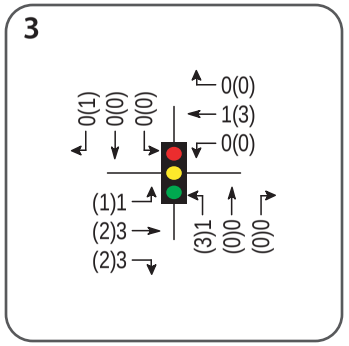
Intersection Operation

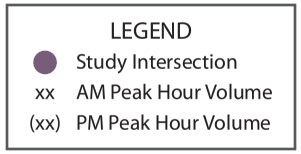
Existing plus Project Conditions

Upon the addition of project-related traffic to the Existing volumes, the study intersections are expected to continue operating at acceptable service levels. These results are summarized in Table 8. Project traffic volumes are shown in Figure 5.









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Traffic Impact Study for the 853 Fourth Street West Project

Figure 5 – Project Traffic Volumes

Table 8 – Existing and Existing plus Project Peak Hour Intersection Levels of Service								
Study Intersection	**Existing Conditions**				**Existing plus Project**			
	AM Peak		**PM Peak**		**AM Peak**		**PM Peak**	
	Delay	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
1. Fifth St W/W MacArthur St	14.9	B	12.3	B	15.0	B	12.4	B
2. First St W/W MacArthur St	14.1	B	10.1	B	14.5	B	10.3	B
3. Broadway/MacArthur St	21.4	C	17.6	B	21.6	C	17.8	B

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

Finding – The study intersections are expected to continue operating acceptably at the same levels of service upon the addition of project-generated traffic as without it.

Future plus Project Conditions

Upon the addition of project-generated traffic to the anticipated Future volumes, the study intersections are expected to continue operating acceptably. The Future plus Project operating conditions are summarized in Table 9.

Table 9 – Future and Future plus Project Peak Hour intersection Levels of Service								
Study Intersection	**Future Conditions**				**Future plus Project**			
	AM Peak		**PM Peak**		**AM Peak**		**PM Peak**	
	Delay	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
1. Fifth St West/West MacArthur St	15.3	C	24.8	C	15.5	C	25.2	D
2. First St West/West MacArthur St	25.4	D	11.9	B	27.1	D	12.1	B
3. Broadway/MacArthur St	31.3	C	21.6	C	31.8	C	21.8	C

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

Finding – The study intersections are expected to continue operating acceptably at LOS D or better with the addition of project traffic to future volumes.

Alternative Modes

Pedestrian Facilities

Given that the site is surrounded by primarily residential land uses, with some public and commercial land uses located to the north and east, it is reasonable to assume that some project residents will want to walk and/or bicycle to reach their destinations. Combined with the new sidewalks that would be constructed on both Hayes Street and Fourth Street West, the existing sidewalks on West MacArthur Street would adequately serve the project, effectively connecting the site to the surrounding pedestrian network. In general, the pedestrian network surrounding the project site is well connected and provides adequate access for pedestrians.

Finding – Pedestrian facilities serving the area will be improved by the project, and will be adequate to serve project demand.

Bicycle Facilities

Existing and planned future bicycle facilities, together with shared use of minor streets, provide adequate access for bicyclists.

Finding – Bicycle facilities serving the project site are adequate.

Bicycle Storage

Zoning regulations for the City of Sonoma do not state a rate at which bicycle parking should be provided for multifamily residential projects. According to the City of Santa Rosa's municipal code, Chapter 20.36.040, multifamily project should provide one space per four units if the units do not have a private garage or private storage space for bike storage. Based on the site plan, all units will have garages that can be used to store bicycles; bicycle storage is therefore adequate.

Transit

Existing transit routes are adequate to accommodate project-generated transit trips. Existing stops are within acceptable walking distance of the site.

Finding – Transit facilities serving the project site are adequate.

Access and Circulation

Site Access

As proposed, the project would take access via an internal street network, with "Street A" traversing the site east-west and connecting to Hayes Street on the west and Fourth Street West to the east. A north-south "Street B" would connect to the individual parcels, and intersection "Street A" approximately mid-site. The intersection of "Street A" with Fourth Street West would be offset to the south of Nicoli Lane, effectively creating a four-legged intersection. Consideration was given to potential benefits of moving "Street A" northerly one parcel (putting Parcels 5 and 14 on the south side of the street rather than the north side); however, the intersection would still be offset and the direction of the offset would be less conducive to vehicles turning left from both directions of Fourth Street East simultaneously so it is recommended that the proposed configuration be retained. To ensure that drivers exiting the site yield right-of-way to through traffic on Hayes Street and Fourth Street West it is recommended that stop signs be installed on "Street A" where it intersects both Hayes Street and Fourth Street West.

Sight Distance

At private street and driveway approaches a substantially clear line of sight should be maintained between the driver of a vehicle waiting on the driveway and the driver of an approaching vehicle. Adequate time must be provided for the waiting vehicle to either cross, turn left, or turn right, without requiring the through traffic to radically alter their speed. Sight distance is typically measured from a 3.5-foot height at the location of the driver on the minor road to a 4.25-foot object height in the center of the approaching lane of the major road. Set-back for a driver on the minor street approach is a minimum of 15 feet, measured from the edge of the traveled way, though a lesser set-back is generally more appropriate for a driveway approach.

Sight distances along Hayes Street and Fourth Street West were evaluated based on sight distance criteria contained in the *Highway Design Manual* published by Caltrans. The recommended sight distances for private street approaches are based on stopping sight distance, with the approach travel speeds used as the basis for determining the recommended sight distance. Additionally, the stopping sight distance needed for a following driver to stop if there is a vehicle waiting to turn into a side street or driveway is evaluated based on stopping sight distance criterion and the approach speed on the major street.

Based on a design speed of 25 mph, the minimum stopping sight distance needed is 155 feet. Both Hayes Street and Fourth Street West are straight and flat. As a result, sight lines exceed the 155 feet needed to meet the criteria recommended. Similarly, drivers would have clear visibility of a vehicle waiting to turn left into the site.

Upon widening both Hayes Street and Fourth Street West to provide a full cross-section, there may be sufficient width to accommodate parking. Should that be the case, parking should be prohibited for 50 feet on either side Street A at both Hayes Street and Fourth Street West; this could be accomplished by painting the curb red.

Consideration was also given to the adequacy of sight distance for the four driveways proposed on Fourth Street West and Hayes Street. Given that both streets are straight and flat, adequate stopping sight distance would be available, with better sight lines available from the elevated height of the driveway than from street-level.

Left-Turn Lane Warrant

Consideration was given to the potential need for a left-turn pocket on Fourth Street West at "Street A" based on criteria contained in the *Intersection Channelization Design Guide*, National Cooperative Highway Research Program (NCHRP) Report No. 279, Transportation Research Board, 1985, as well as a more recent update of the

methodology developed by the Washington State Department of Transportation. To estimate volumes for Fourth Street West the number of residences around the site and parking spaces at the Sonoma Valley Hospital lot north of the site were counted to arrive at a conservative estimate for the traffic volume on Fourth Street West. There are 60 residences accessible via Fourth Street West, between Bettencourt Street and West MacArthur Street, in the general vicinity of the project site and 80 parking spaces at the Sonoma Valley Hospital lot directly north of the project site. Additionally, trips to and from the Sonoma Valley Hospital and other residences in the greater vicinity that may use Fourth Street West were accounted for to arrive at an assumed peak hour volume of 250 vehicles each direction, which is likely substantially higher than the actual traffic volume. Under these conservative estimates, a left-turn lane is not warranted on Fourth Street West at the project's driveway. It is similarly concluded that Hayes Street, which has lower volumes than Fourth Street West, would not warrant a left-turn pocket at the new street connection. The turn lane warrant analysis spreadsheets are provided in Appendix D.

Conclusions and Recommendations

Conclusions

- The proposed project is expected to generate an average of 268 daily trips, including 19 weekday a.m. peak hour trips and 25 trips during the weekday p.m. peak hour.
- Under existing conditions, the study intersections operate acceptably at LOS B or C, and they would be expected to continue operating at the same service levels with project-generated traffic added.
- Under anticipated future volumes and with project-related traffic added, the study intersections are expected to operate acceptably at LOS D or better.
- Pedestrian facilities exist along the project frontages on West MacArthur Street and Fourth Street West are adequate for the proposed project.
- Existing and planned future Class II bike lanes, along with the shared use of minor streets, provide adequate access for bicyclists.
- Transit facilities connect the site to Santa Rosa, Sonoma Valley, and San Rafael and the site is served by bus stops along the project frontage on West MacArthur Street.
- Sight distance along East MacArthur Street at the project driveway is adequate for the posted 25-mph speed limit.

Recommendations

- Stop signs should be installed on both ends of "Street A' where they intersect Hayes Street and Fourth Street West.
- The curbs should be painted red for 50 feet on both sides of the intersections of "Street A" with Hayes Street and Fourth Street.

Study Participants and References

Study Participants

Principal in Charge	Dalene J. Whitlock, PE, PTOE
Assistant Engineer	Kevin Rangel, EIT
Graphics	Angela McCoy
Editing/Formatting	Alex Scrobonia
Report Review	Dalene J. Whitlock, PE, PTOE

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SON057

Appendix A

Collision Rate Calculations

Intersection Collision Rate Calculations

853 Fourth Street West Project

Intersection # 1: Fifth Street West & West MacArthur Street

Date of Count: Tuesday, December 19, 2017

Number of Collisions: 7
Number of Injuries: 3
Number of Fatalities: 0
ADT: 13200
Start Date: January 1, 2012
End Date: December 31, 2016
Number of Years: 5

Intersection Type: Four-Legged
Control Type: 4 Way Stop
Area: Suburban

$$\text{collision rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times 365 \text{ Days per Year} \times \text{Number of Years}}$$

$$\text{collision rate} = \frac{7 \times 1{,}000{,}000}{13{,}200 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.29 c/mve**	**0.0%**	**42.9%**
Statewide Average*	**0.32 c/mve**	**0.4%**	**44.7%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 2: First Street West & West MacArthur Strret

Date of Count: Wednesday, January 17, 2018

Number of Collisions: 5
Number of Injuries: 1
Number of Fatalities: 0
ADT: 10100
Start Date: January 1, 2012
End Date: December 31, 2016
Number of Years: 5

Intersection Type: Four-Legged
Control Type: 4 Way Stop
Area: Suburban

$$\text{collision rate} = \frac{\text{Number of Collisions} \times 1 \text{ Million}}{\text{ADT} \times 365 \text{ Days per Year} \times \text{Number of Years}}$$

$$\text{collision rate} = \frac{5 \times 1{,}000{,}000}{10{,}100 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.27 c/mve**	**0.0%**	**20.0%**
Statewide Average*	**0.32 c/mve**	**0.4%**	**44.7%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Calculaions

853 Fourth Street West Project

Intersection # 3: Broadway & MacArthur Street

Date of Count: Wednesday, November 01, 2017

Number of Collisions: 8
Number of Injuries: 2
Number of Fatalities: 0
ADT: 19600
Start Date: January 1, 2012
End Date: December 31, 2016
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{8 \times 1{,}000{,}000}{19{,}600 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.22 c/mve**	**0.0%**	**25.0%**
Statewide Average*	**0.27 c/mve**	**0.4%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Appendix B

Intersection Level of Service Calculations

Intersection	
Intersection Delay, s/veh	14.9
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	15	11	55	4	127	4	301	71	129	303	15
Future Vol, veh/h	20	15	11	55	4	127	4	301	71	129	303	15
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	21	16	12	58	4	134	4	317	75	136	319	16
Number of Lanes	0	1	0	0	1	1	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	1
HCM Control Delay	11.1	10.9	18.2	14.1
HCM LOS	B	B	C	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	43%	93%	0%	100%	0%
Vol Thru, %	0%	81%	33%	7%	0%	0%	95%
Vol Right, %	0%	19%	24%	0%	100%	0%	5%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	4	372	46	59	127	129	318
LT Vol	4	0	20	55	0	129	0
Through Vol	0	301	15	4	0	0	303
RT Vol	0	71	11	0	127	0	15
Lane Flow Rate	4	392	48	62	134	136	335
Geometry Grp	7	7	6	7	7	7	7
Degree of Util (X)	0.008	0.635	0.097	0.127	0.23	0.24	0.542
Departure Headway (Hd)	6.483	5.841	7.223	7.375	6.188	6.369	5.829
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	552	619	494	485	579	564	619
Service Time	4.228	3.585	5.3	5.135	3.947	4.113	3.572
HCM Lane V/C Ratio	0.007	0.633	0.097	0.128	0.231	0.241	0.541
HCM Control Delay	9.3	18.3	11.1	11.2	10.8	11.1	15.3
HCM Lane LOS	A	C	B	B	B	B	C
HCM 95th-tile Q	0	4.5	0.3	0.4	0.9	0.9	3.2

Intersection	
Intersection Delay, s/veh	12.3
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	8	10	69	19	202	4	46	18	240	254	29
Future Vol, veh/h	20	8	10	69	19	202	4	46	18	240	254	29
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	9	11	74	20	217	4	49	19	258	273	31
Number of Lanes	0	1	0	0	1	1	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	1
HCM Control Delay	10.2	11	9.7	13.5
HCM LOS	B	B	A	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	53%	78%	0%	100%	0%
Vol Thru, %	0%	72%	21%	22%	0%	0%	90%
Vol Right, %	0%	28%	26%	0%	100%	0%	10%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	4	64	38	88	202	240	283
LT Vol	4	0	20	69	0	240	0
Through Vol	0	46	8	19	0	0	254
RT Vol	0	18	10	0	202	0	29
Lane Flow Rate	4	69	41	95	217	258	304
Geometry Grp	7	7	6	7	7	7	7
Degree of Util (X)	0.008	0.117	0.075	0.175	0.336	0.443	0.474
Departure Headway (Hd)	6.854	6.146	6.579	6.67	5.567	6.182	5.605
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	522	583	545	538	647	583	645
Service Time	4.593	3.884	4.616	4.401	3.298	3.905	3.328
HCM Lane V/C Ratio	0.008	0.118	0.075	0.177	0.335	0.443	0.471
HCM Control Delay	9.6	9.7	10.2	10.8	11.1	13.7	13.3
HCM Lane LOS	A	A	B	B	B	B	B
HCM 95th-tile Q	0	0.4	0.2	0.6	1.5	2.3	2.5

Intersection	
Intersection Delay, s/veh	14.1
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	261	95	19	189	19	51	39	36	31	48	9
Future Vol, veh/h	12	261	95	19	189	19	51	39	36	31	48	9
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	326	119	24	236	24	64	49	45	39	60	11
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	16.9	12.4	11.2	10.7
HCM LOS	C	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	40%	3%	8%	35%
Vol Thru, %	31%	71%	83%	55%
Vol Right, %	29%	26%	8%	10%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	126	368	227	88
LT Vol	51	12	19	31
Through Vol	39	261	189	48
RT Vol	36	95	19	9
Lane Flow Rate	158	460	284	110
Geometry Grp	1	1	1	1
Degree of Util (X)	0.262	0.645	0.425	0.189
Departure Headway (Hd)	5.985	5.048	5.393	6.194
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	599	713	667	576
Service Time	4.046	3.092	3.445	4.261
HCM Lane V/C Ratio	0.264	0.645	0.426	0.191
HCM Control Delay	11.2	16.9	12.4	10.7
HCM Lane LOS	B	C	B	B
HCM 95th-tile Q	1	4.7	2.1	0.7

Intersection	
Intersection Delay, s/veh	10.1
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	17	223	54	9	239	26	49	30	11	11	17	20
Future Vol, veh/h	17	223	54	9	239	26	49	30	11	11	17	20
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	18	232	56	9	249	27	51	31	11	11	18	21
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10.4	10.3	9.3	8.7
HCM LOS	B	B	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	54%	6%	3%	23%
Vol Thru, %	33%	76%	87%	35%
Vol Right, %	12%	18%	9%	42%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	90	294	274	48
LT Vol	49	17	9	11
Through Vol	30	223	239	17
RT Vol	11	54	26	20
Lane Flow Rate	94	306	285	50
Geometry Grp	1	1	1	1
Degree of Util (X)	0.14	0.386	0.365	0.072
Departure Headway (Hd)	5.365	4.537	4.603	5.202
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	664	790	779	682
Service Time	3.438	2.585	2.653	3.283
HCM Lane V/C Ratio	0.142	0.387	0.366	0.073
HCM Control Delay	9.3	10.4	10.3	8.7
HCM Lane LOS	A	B	B	A
HCM 95th-tile Q	0.5	1.8	1.7	0.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	124	166	95	81	65	115	385	78	71	355	22
Future Volume (veh/h)	13	124	166	95	81	65	115	385	78	71	355	22
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	1	0	0	3	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.96	0.98		0.97	1.00		0.97	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	16	149	112	114	98	48	139	464	72	86	428	21
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	60	306	207	219	192	77	188	1318	203	206	1560	672
Arrive On Green	0.31	0.31	0.31	0.31	0.31	0.31	0.11	0.43	0.43	0.12	0.44	0.44
Sat Flow, veh/h	42	961	681	519	595	252	1774	3059	472	1774	3539	1524
Grp Volume(v), veh/h	277	0	0	260	0	0	139	267	269	86	428	21
Grp Sat Flow(s),veh/h/ln	1684	0	0	1365	0	0	1774	1770	1761	1774	1770	1524
Q Serve(g_s), s	0.0	0.0	0.0	2.5	0.0	0.0	6.2	8.2	8.3	3.6	6.2	0.6
Cycle Q Clear(g_c), s	10.8	0.0	0.0	13.3	0.0	0.0	6.2	8.2	8.3	3.6	6.2	0.6
Prop In Lane	0.06		0.40	0.44		0.18	1.00		0.27	1.00		1.00
Lane Grp Cap(c), veh/h	571	0	0	490	0	0	188	763	759	206	1560	672
V/C Ratio(X)	0.49	0.00	0.00	0.53	0.00	0.00	0.74	0.35	0.35	0.42	0.27	0.03
Avail Cap(c_a), veh/h	730	0	0	622	0	0	350	764	761	263	1564	673
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.1	0.0	0.0	23.8	0.0	0.0	35.2	15.5	15.5	33.4	14.5	12.9
Incr Delay (d2), s/veh	0.6	0.0	0.0	0.9	0.0	0.0	5.6	1.3	1.3	1.4	0.4	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.3	0.0	0.0	5.5	0.0	0.0	3.3	4.3	4.3	1.9	3.1	0.3
LnGrp Delay(d),s/veh	23.8	0.0	0.0	25.3	0.0	0.0	40.8	16.8	16.8	34.7	14.9	13.0
LnGrp LOS	C			C			D	B	B	C	B	B
Approach Vol, veh/h		277			260			675			535	
Approach Delay, s/veh		23.8			25.3			21.7			18.0	
Approach LOS		C			C			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	12.4	40.0		28.6	11.6	40.8		28.6
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	12.0	35.0		33.0	16.0	35.0		33.0
Max Q Clear Time (g_c+I1), s	5.6	10.3		12.8	8.2	8.2		15.3
Green Ext Time (p_c), s	0.1	6.6		1.7	0.2	5.4		1.6

Intersection Summary	
HCM 2010 Ctrl Delay	21.4
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	109	105	62	128	60	115	388	55	43	319	34
Future Volume (veh/h)	20	109	105	62	128	60	115	388	55	43	319	34
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	1	0	0	1	0	0	1	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	22	122	70	70	144	49	129	436	51	48	358	31
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	77	240	125	139	229	69	208	1659	192	169	1758	786
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.12	0.52	0.52	0.10	0.50	0.50
Sat Flow, veh/h	92	1071	565	340	1024	312	1774	3193	372	1774	3539	1583
Grp Volume(v), veh/h	214	0	0	263	0	0	129	241	246	48	358	31
Grp Sat Flow(s),veh/h/ln	1728	0	0	1675	0	0	1774	1770	1795	1774	1770	1583
Q Serve(g_s), s	0.0	0.0	0.0	2.1	0.0	0.0	4.9	5.3	5.4	1.8	4.0	0.7
Cycle Q Clear(g_c), s	7.6	0.0	0.0	9.7	0.0	0.0	4.9	5.3	5.4	1.8	4.0	0.7
Prop In Lane	0.10		0.33	0.27		0.19	1.00		0.21	1.00		1.00
Lane Grp Cap(c), veh/h	442	0	0	438	0	0	208	919	932	169	1758	786
V/C Ratio(X)	0.48	0.00	0.00	0.60	0.00	0.00	0.62	0.26	0.26	0.28	0.20	0.04
Avail Cap(c_a), veh/h	849	0	0	822	0	0	403	920	933	302	1760	787
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.3	0.0	0.0	25.0	0.0	0.0	29.6	9.5	9.5	29.7	9.9	9.1
Incr Delay (d2), s/veh	0.8	0.0	0.0	1.3	0.0	0.0	3.0	0.7	0.7	0.9	0.3	0.1
Initial Q Delay(d3),s/veh	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.9	0.0	0.0	5.0	0.0	0.0	2.5	2.8	2.9	0.9	2.0	0.3
LnGrp Delay(d),s/veh	25.2	0.0	0.0	26.4	0.0	0.0	32.6	10.2	10.2	30.6	10.2	9.2
LnGrp LOS	C			C			C	B	B	C	B	A
Approach Vol, veh/h		214			263			616			437	
Approach Delay, s/veh		25.2			26.4			14.9			12.4	
Approach LOS		C			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.7	41.6		19.1	11.3	40.0		19.1
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	12.0	35.0		33.0	16.0	35.0		33.0
Max Q Clear Time (g_c+I1), s	3.8	7.4		9.6	6.9	6.0		11.7
Green Ext Time (p_c), s	0.0	6.1		1.3	0.2	4.7		1.7

Intersection Summary	
HCM 2010 Ctrl Delay	17.6
HCM 2010 LOS	B

Intersection	
Intersection Delay, s/veh	15.3
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	16	11	56	4	144	4	307	88	165	303	15
Future Vol, veh/h	20	16	11	56	4	144	4	307	88	165	303	15
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	20	16	11	57	4	147	4	313	90	168	309	15
Number of Lanes	0	1	0	0	1	1	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	1
HCM Control Delay	11.2	11.2	19.4	14.1
HCM LOS	B	B	C	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	43%	93%	0%	100%	0%
Vol Thru, %	0%	78%	34%	7%	0%	0%	95%
Vol Right, %	0%	22%	23%	0%	100%	0%	5%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	4	395	47	60	144	165	318
LT Vol	4	0	20	56	0	165	0
Through Vol	0	307	16	4	0	0	303
RT Vol	0	88	11	0	144	0	15
Lane Flow Rate	4	403	48	61	147	168	324
Geometry Grp	7	7	6	7	7	7	7
Degree of Util (X)	0.007	0.661	0.098	0.127	0.256	0.301	0.532
Departure Headway (Hd)	6.572	5.906	7.345	7.457	6.268	6.439	5.898
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	543	609	485	479	570	557	610
Service Time	4.326	3.661	5.431	5.221	4.032	4.192	3.651
HCM Lane V/C Ratio	0.007	0.662	0.099	0.127	0.258	0.302	0.531
HCM Control Delay	9.4	19.5	11.2	11.3	11.2	12	15.2
HCM Lane LOS	A	C	B	B	B	B	C
HCM 95th-tile Q	0	4.9	0.3	0.4	1	1.3	3.1

Intersection	
Intersection Delay, s/veh	24.8
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	9	6	90	8	181	6	409	80	122	369	23
Future Vol, veh/h	11	9	6	90	8	181	6	409	80	122	369	23
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	9	6	92	8	185	6	417	82	124	377	23
Number of Lanes	0	1	0	0	1	1	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	1
HCM Control Delay	11.8	12.8	37	20.1
HCM LOS	B	B	E	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	42%	92%	0%	100%	0%
Vol Thru, %	0%	84%	35%	8%	0%	0%	94%
Vol Right, %	0%	16%	23%	0%	100%	0%	6%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	6	489	26	98	181	122	392
LT Vol	6	0	11	90	0	122	0
Through Vol	0	409	9	8	0	0	369
RT Vol	0	80	6	0	181	0	23
Lane Flow Rate	6	499	27	100	185	124	400
Geometry Grp	7	7	6	7	7	7	7
Degree of Util (X)	0.012	0.868	0.061	0.217	0.34	0.237	0.701
Departure Headway (Hd)	6.886	6.261	8.299	7.813	6.626	6.856	6.305
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	517	574	434	457	537	520	568
Service Time	4.669	4.043	6.299	5.609	4.422	4.641	4.089
HCM Lane V/C Ratio	0.012	0.869	0.062	0.219	0.345	0.238	0.704
HCM Control Delay	9.8	37.3	11.8	12.8	12.8	11.8	22.7
HCM Lane LOS	A	E	B	B	B	B	C
HCM 95th-tile Q	0	9.7	0.2	0.8	1.5	0.9	5.6

Intersection	
Intersection Delay, s/veh	25.4
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	15	328	119	24	238	24	57	44	40	35	54	10
Future Vol, veh/h	15	328	119	24	238	24	57	44	40	35	54	10
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	19	410	149	30	298	30	71	55	50	44	68	13
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	36.9	17.3	13.3	12.4
HCM LOS	E	C	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	40%	3%	8%	35%
Vol Thru, %	31%	71%	83%	55%
Vol Right, %	28%	26%	8%	10%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	141	462	286	99
LT Vol	57	15	24	35
Through Vol	44	328	238	54
RT Vol	40	119	24	10
Lane Flow Rate	176	578	358	124
Geometry Grp	1	1	1	1
Degree of Util (X)	0.333	0.889	0.591	0.243
Departure Headway (Hd)	6.799	5.544	5.953	7.072
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	527	658	604	506
Service Time	4.863	3.544	4.006	5.143
HCM Lane V/C Ratio	0.334	0.878	0.593	0.245
HCM Control Delay	13.3	36.9	17.3	12.4
HCM Lane LOS	B	E	C	B
HCM 95th-tile Q	1.4	10.9	3.9	0.9

Intersection	
Intersection Delay, s/veh	11.9
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	21	280	68	11	300	33	55	34	12	12	19	22
Future Vol, veh/h	21	280	68	11	300	33	55	34	12	12	19	22
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	292	71	11	313	34	57	35	13	13	20	23
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	12.5	12.2	10.1	9.3
HCM LOS	B	B	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	54%	6%	3%	23%
Vol Thru, %	34%	76%	87%	36%
Vol Right, %	12%	18%	10%	42%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	101	369	344	53
LT Vol	55	21	11	12
Through Vol	34	280	300	19
RT Vol	12	68	33	22
Lane Flow Rate	105	384	358	55
Geometry Grp	1	1	1	1
Degree of Util (X)	0.171	0.502	0.475	0.088
Departure Headway (Hd)	5.851	4.701	4.773	5.727
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	617	757	745	629
Service Time	3.854	2.787	2.862	3.732
HCM Lane V/C Ratio	0.17	0.507	0.481	0.087
HCM Control Delay	10.1	12.5	12.2	9.3
HCM Lane LOS	B	B	B	A
HCM 95th-tile Q	0.6	2.9	2.6	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	191	256	146	125	100	177	593	120	109	547	34
Future Volume (veh/h)	20	191	256	146	125	100	177	593	120	109	547	34
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	1	0	0	3	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.96	0.99		0.97	1.00		0.97	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	22	210	201	160	137	83	195	652	112	120	601	32
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	58	334	274	182	167	77	232	1198	205	203	1355	582
Arrive On Green	0.36	0.36	0.36	0.36	0.36	0.36	0.13	0.40	0.40	0.11	0.38	0.38
Sat Flow, veh/h	45	877	799	386	420	225	1774	3005	515	1774	3539	1519
Grp Volume(v), veh/h	433	0	0	380	0	0	195	383	381	120	601	32
Grp Sat Flow(s),veh/h/ln	1722	0	0	1031	0	0	1774	1770	1751	1774	1770	1519
Q Serve(g_s), s	0.0	0.0	0.0	13.0	0.0	0.0	9.8	15.2	15.3	5.9	11.5	1.2
Cycle Q Clear(g_c), s	20.0	0.0	0.0	33.0	0.0	0.0	9.8	15.2	15.3	5.9	11.5	1.2
Prop In Lane	0.05		0.46	0.42		0.22	1.00		0.29	1.00		1.00
Lane Grp Cap(c), veh/h	663	0	0	435	0	0	232	706	698	203	1355	582
V/C Ratio(X)	0.65	0.00	0.00	0.87	0.00	0.00	0.84	0.54	0.55	0.59	0.44	0.06
Avail Cap(c_a), veh/h	663	0	0	428	0	0	310	706	698	233	1355	582
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.2	0.0	0.0	30.6	0.0	0.0	38.8	21.1	21.1	38.4	21.0	17.8
Incr Delay (d2), s/veh	2.3	0.0	0.0	18.0	0.0	0.0	14.4	3.0	3.0	3.0	1.1	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.9	0.0	0.0	12.3	0.0	0.0	5.7	7.9	7.9	3.0	5.8	0.5
LnGrp Delay(d),s/veh	27.5	0.0	0.0	51.3	0.0	0.0	53.2	24.1	24.2	41.5	22.0	18.0
LnGrp LOS	C			D			D	C	C	D	C	B
Approach Vol, veh/h		433			380			959			753	
Approach Delay, s/veh		27.5			51.3			30.0			25.0	
Approach LOS		C			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.5	41.5		36.5	14.9	40.0		36.5
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	12.0	35.0		33.0	16.0	35.0		33.0
Max Q Clear Time (g_c+I1), s	7.9	17.3		22.0	11.8	13.5		35.0
Green Ext Time (p_c), s	0.1	8.2		2.3	0.2	7.2		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	31.3
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	26	147	147	76	162	115	114	618	88	103	570	46
Future Volume (veh/h)	26	147	147	76	162	115	114	618	88	103	570	46
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	1	0	0	1	0	0	1	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	29	162	115	84	178	108	125	679	86	113	626	44
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	75	284	183	135	242	131	188	1391	175	225	1630	729
Arrive On Green	0.29	0.29	0.29	0.29	0.29	0.29	0.11	0.44	0.44	0.13	0.46	0.46
Sat Flow, veh/h	90	975	642	278	832	458	1774	3159	400	1774	3539	1583
Grp Volume(v), veh/h	306	0	0	370	0	0	125	380	385	113	626	44
Grp Sat Flow(s),veh/h/ln	1707	0	0	1567	0	0	1774	1770	1789	1774	1770	1583
Q Serve(g_s), s	0.0	0.0	0.0	5.2	0.0	0.0	5.4	12.2	12.2	4.7	9.2	1.2
Cycle Q Clear(g_c), s	12.1	0.0	0.0	17.3	0.0	0.0	5.4	12.2	12.2	4.7	9.2	1.2
Prop In Lane	0.09		0.38	0.23		0.29	1.00		0.22	1.00		1.00
Lane Grp Cap(c), veh/h	543	0	0	509	0	0	188	778	787	225	1630	729
V/C Ratio(X)	0.56	0.00	0.00	0.73	0.00	0.00	0.67	0.49	0.49	0.50	0.38	0.06
Avail Cap(c_a), veh/h	748	0	0	701	0	0	357	779	788	268	1632	730
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.5	0.0	0.0	26.1	0.0	0.0	34.2	15.9	15.9	32.4	14.1	11.9
Incr Delay (d2), s/veh	0.9	0.0	0.0	2.4	0.0	0.0	4.0	2.2	2.2	1.7	0.7	0.2
Initial Q Delay(d3),s/veh	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.0	0.0	0.0	8.0	0.0	0.0	2.9	6.5	6.5	2.4	4.6	0.6
LnGrp Delay(d),s/veh	25.5	0.0	0.0	28.6	0.0	0.0	38.2	18.1	18.1	34.1	14.8	12.1
LnGrp LOS	C			C			D	B	B	C	B	B
Approach Vol, veh/h		306			370			890			783	
Approach Delay, s/veh		25.5			28.6			20.9			17.4	
Approach LOS		C			C			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.1	40.0		26.4	11.4	41.7		26.4
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	12.0	35.0		33.0	16.0	35.0		33.0
Max Q Clear Time (g_c+I1), s	6.7	14.2		14.1	7.4	11.2		19.3
Green Ext Time (p_c), s	0.1	9.0		1.9	0.2	8.0		2.1

Intersection Summary		
HCM 2010 Ctrl Delay		21.6
HCM 2010 LOS		C

Intersection	
Intersection Delay, s/veh	15
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	15	11	56	4	131	4	301	72	131	303	15
Future Vol, veh/h	20	15	11	56	4	131	4	301	72	131	303	15
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	21	16	12	59	4	138	4	317	76	138	319	16
Number of Lanes	0	1	0	0	1	1	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	1
HCM Control Delay	11.1	11	18.4	14.2
HCM LOS	B	B	C	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	43%	93%	0%	100%	0%
Vol Thru, %	0%	81%	33%	7%	0%	0%	95%
Vol Right, %	0%	19%	24%	0%	100%	0%	5%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	4	373	46	60	131	131	318
LT Vol	4	0	20	56	0	131	0
Through Vol	0	301	15	4	0	0	303
RT Vol	0	72	11	0	131	0	15
Lane Flow Rate	4	393	48	63	138	138	335
Geometry Grp	7	7	6	7	7	7	7
Degree of Util (X)	0.008	0.639	0.097	0.13	0.237	0.245	0.544
Departure Headway (Hd)	6.506	5.862	7.248	7.387	6.199	6.39	5.85
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	549	616	492	484	576	561	616
Service Time	4.254	3.61	5.33	5.149	3.961	4.137	3.596
HCM Lane V/C Ratio	0.007	0.638	0.098	0.13	0.24	0.246	0.544
HCM Control Delay	9.3	18.5	11.1	11.3	10.9	11.2	15.4
HCM Lane LOS	A	C	B	B	B	B	C
HCM 95th-tile Q	0	4.6	0.3	0.4	0.9	1	3.3

Intersection	
Intersection Delay, s/veh	12.4
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	8	10	70	19	205	4	46	20	245	254	29
Future Vol, veh/h	20	8	10	70	19	205	4	46	20	245	254	29
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	9	11	75	20	220	4	49	22	263	273	31
Number of Lanes	0	1	0	0	1	1	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	1
HCM Control Delay	10.2	11.1	9.7	13.7
HCM LOS	B	B	A	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	53%	79%	0%	100%	0%
Vol Thru, %	0%	70%	21%	21%	0%	0%	90%
Vol Right, %	0%	30%	26%	0%	100%	0%	10%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	4	66	38	89	205	245	283
LT Vol	4	0	20	70	0	245	0
Through Vol	0	46	8	19	0	0	254
RT Vol	0	20	10	0	205	0	29
Lane Flow Rate	4	71	41	96	220	263	304
Geometry Grp	7	7	6	7	7	7	7
Degree of Util (X)	0.008	0.121	0.075	0.178	0.342	0.454	0.475
Departure Headway (Hd)	6.881	6.156	6.609	6.692	5.588	6.201	5.624
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	520	582	542	537	644	582	642
Service Time	4.62	3.895	4.646	4.424	3.32	3.924	3.347
HCM Lane V/C Ratio	0.008	0.122	0.076	0.179	0.342	0.452	0.474
HCM Control Delay	9.7	9.7	10.2	10.9	11.2	14	13.4
HCM Lane LOS	A	A	B	B	B	B	B
HCM 95th-tile Q	0	0.4	0.2	0.6	1.5	2.4	2.6

Intersection	
Intersection Delay, s/veh	14.5
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	267	96	19	191	19	52	39	36	31	48	9
Future Vol, veh/h	13	267	96	19	191	19	52	39	36	31	48	9
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	16	334	120	24	239	24	65	49	45	39	60	11
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	17.5	12.6	11.3	10.8
HCM LOS	C	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	41%	3%	8%	35%
Vol Thru, %	31%	71%	83%	55%
Vol Right, %	28%	26%	8%	10%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	127	376	229	88
LT Vol	52	13	19	31
Through Vol	39	267	191	48
RT Vol	36	96	19	9
Lane Flow Rate	159	470	286	110
Geometry Grp	1	1	1	1
Degree of Util (X)	0.266	0.661	0.431	0.191
Departure Headway (Hd)	6.025	5.066	5.421	6.237
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	594	710	661	572
Service Time	4.091	3.113	3.476	4.309
HCM Lane V/C Ratio	0.268	0.662	0.433	0.192
HCM Control Delay	11.3	17.5	12.6	10.8
HCM Lane LOS	B	C	B	B
HCM 95th-tile Q	1.1	5	2.2	0.7

Intersection	
Intersection Delay, s/veh	10.3
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	228	55	9	246	26	51	30	11	11	17	21
Future Vol, veh/h	18	228	55	9	246	26	51	30	11	11	17	21
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	19	238	57	9	256	27	53	31	11	11	18	22
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10.6	10.5	9.4	8.7
HCM LOS	B	B	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	55%	6%	3%	22%
Vol Thru, %	33%	76%	88%	35%
Vol Right, %	12%	18%	9%	43%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	92	301	281	49
LT Vol	51	18	9	11
Through Vol	30	228	246	17
RT Vol	11	55	26	21
Lane Flow Rate	96	314	293	51
Geometry Grp	1	1	1	1
Degree of Util (X)	0.144	0.397	0.376	0.074
Departure Headway (Hd)	5.405	4.557	4.624	5.235
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	658	787	773	677
Service Time	3.483	2.608	2.677	3.32
HCM Lane V/C Ratio	0.146	0.399	0.379	0.075
HCM Control Delay	9.4	10.6	10.5	8.7
HCM Lane LOS	A	B	B	A
HCM 95th-tile Q	0.5	1.9	1.8	0.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	14	127	169	95	82	65	116	385	78	71	355	22
Future Volume (veh/h)	14	127	169	95	82	65	116	385	78	71	355	22
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	1	0	0	3	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.96	0.98		0.97	1.00		0.97	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	17	153	116	114	99	48	140	464	72	86	428	21
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	61	306	209	216	192	76	188	1315	203	205	1556	670
Arrive On Green	0.31	0.31	0.31	0.31	0.31	0.31	0.11	0.43	0.43	0.12	0.44	0.44
Sat Flow, veh/h	45	955	682	510	592	248	1774	3059	472	1774	3539	1524
Grp Volume(v), veh/h	286	0	0	261	0	0	140	267	269	86	428	21
Grp Sat Flow(s),veh/h/ln	1683	0	0	1350	0	0	1774	1770	1761	1774	1770	1524
Q Serve(g_s), s	0.0	0.0	0.0	2.4	0.0	0.0	6.2	8.2	8.3	3.7	6.3	0.6
Cycle Q Clear(g_c), s	11.3	0.0	0.0	13.7	0.0	0.0	6.2	8.2	8.3	3.7	6.3	0.6
Prop In Lane	0.06		0.41	0.44		0.18	1.00		0.27	1.00		1.00
Lane Grp Cap(c), veh/h	573	0	0	488	0	0	188	761	757	205	1556	670
V/C Ratio(X)	0.50	0.00	0.00	0.54	0.00	0.00	0.75	0.35	0.36	0.42	0.28	0.03
Avail Cap(c_a), veh/h	728	0	0	615	0	0	349	762	759	262	1560	671
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.2	0.0	0.0	23.9	0.0	0.0	35.3	15.6	15.6	33.5	14.5	13.0
Incr Delay (d2), s/veh	0.7	0.0	0.0	0.9	0.0	0.0	5.8	1.3	1.3	1.4	0.4	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.6	0.0	0.0	5.6	0.0	0.0	3.3	4.3	4.3	1.9	3.1	0.3
LnGrp Delay(d),s/veh	23.9	0.0	0.0	25.4	0.0	0.0	41.1	16.9	16.9	34.8	15.0	13.1
LnGrp LOS	C			C			D	B	B	C	B	B
Approach Vol, veh/h		286			261			676			535	
Approach Delay, s/veh		23.9			25.4			21.9			18.1	
Approach LOS		C			C			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	12.4	40.0		28.8	11.6	40.8		28.8
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	12.0	35.0		33.0	16.0	35.0		33.0
Max Q Clear Time (g_c+I1), s	5.7	10.3		13.3	8.2	8.3		15.7
Green Ext Time (p_c), s	0.1	6.6		1.8	0.2	5.4		1.6

Intersection Summary	
HCM 2010 Ctrl Delay	21.6
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	21	111	107	62	131	60	118	388	55	43	319	35
Future Volume (veh/h)	21	111	107	62	131	60	118	388	55	43	319	35
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	1	0	0	1	0	0	1	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	24	125	72	70	147	49	133	436	51	48	358	32
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	79	241	125	138	233	69	209	1655	192	168	1751	784
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.12	0.52	0.52	0.10	0.50	0.50
Sat Flow, veh/h	101	1065	563	334	1029	308	1774	3193	372	1774	3539	1583
Grp Volume(v), veh/h	221	0	0	266	0	0	133	241	246	48	358	32
Grp Sat Flow(s),veh/h/ln	1729	0	0	1672	0	0	1774	1770	1795	1774	1770	1583
Q Serve(g_s), s	0.0	0.0	0.0	2.0	0.0	0.0	5.0	5.4	5.4	1.8	4.0	0.7
Cycle Q Clear(g_c), s	7.9	0.0	0.0	9.9	0.0	0.0	5.0	5.4	5.4	1.8	4.0	0.7
Prop In Lane	0.11		0.33	0.26		0.18	1.00		0.21	1.00		1.00
Lane Grp Cap(c), veh/h	445	0	0	440	0	0	209	917	930	168	1751	784
V/C Ratio(X)	0.50	0.00	0.00	0.60	0.00	0.00	0.64	0.26	0.26	0.28	0.20	0.04
Avail Cap(c_a), veh/h	845	0	0	819	0	0	402	918	931	301	1754	785
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.4	0.0	0.0	25.1	0.0	0.0	29.8	9.5	9.6	29.8	10.1	9.2
Incr Delay (d2), s/veh	0.9	0.0	0.0	1.3	0.0	0.0	3.2	0.7	0.7	0.9	0.3	0.1
Initial Q Delay(d3),s/veh	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.0	0.0	0.0	5.0	0.0	0.0	2.7	2.8	2.9	0.9	2.0	0.3
LnGrp Delay(d),s/veh	25.3	0.0	0.0	26.5	0.0	0.0	32.9	10.2	10.3	30.7	10.3	9.3
LnGrp LOS	C			C			C	B	B	C	B	A
Approach Vol, veh/h		221			266			620			438	
Approach Delay, s/veh		25.3			26.5			15.1			12.5	
Approach LOS		C			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.7	41.6		19.3	11.3	40.0		19.3
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	12.0	35.0		33.0	16.0	35.0		33.0
Max Q Clear Time (g_c+I1), s	3.8	7.4		9.9	7.0	6.0		11.9
Green Ext Time (p_c), s	0.0	6.1		1.4	0.2	4.7		1.7

Intersection Summary	
HCM 2010 Ctrl Delay	17.8
HCM 2010 LOS	B

Intersection	
Intersection Delay, s/veh	15.5
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	16	11	57	4	148	4	307	89	167	303	15
Future Vol, veh/h	20	16	11	57	4	148	4	307	89	167	303	15
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	20	16	11	58	4	151	4	313	91	170	309	15
Number of Lanes	0	1	0	0	1	1	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	1
HCM Control Delay	11.3	11.3	19.7	14.2
HCM LOS	B	B	C	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	43%	93%	0%	100%	0%
Vol Thru, %	0%	78%	34%	7%	0%	0%	95%
Vol Right, %	0%	22%	23%	0%	100%	0%	5%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	4	396	47	61	148	167	318
LT Vol	4	0	20	57	0	167	0
Through Vol	0	307	16	4	0	0	303
RT Vol	0	89	11	0	148	0	15
Lane Flow Rate	4	404	48	62	151	170	324
Geometry Grp	7	7	6	7	7	7	7
Degree of Util (X)	0.007	0.666	0.098	0.129	0.263	0.306	0.534
Departure Headway (Hd)	6.596	5.929	7.373	7.469	6.28	6.464	5.923
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	541	606	483	479	569	556	607
Service Time	4.35	3.683	5.461	5.237	4.046	4.216	3.675
HCM Lane V/C Ratio	0.007	0.667	0.099	0.129	0.265	0.306	0.534
HCM Control Delay	9.4	19.8	11.3	11.4	11.3	12.1	15.3
HCM Lane LOS	A	C	B	B	B	B	C
HCM 95th-tile Q	0	5	0.3	0.4	1	1.3	3.2

Intersection	
Intersection Delay, s/veh	25.2
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	9	6	91	8	184	6	409	82	127	369	23
Future Vol, veh/h	11	9	6	91	8	184	6	409	82	127	369	23
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	9	6	93	8	188	6	417	84	130	377	23
Number of Lanes	0	1	0	0	1	1	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	1
HCM Control Delay	11.9	13	38.1	20.2
HCM LOS	B	B	E	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	42%	92%	0%	100%	0%
Vol Thru, %	0%	83%	35%	8%	0%	0%	94%
Vol Right, %	0%	17%	23%	0%	100%	0%	6%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	6	491	26	99	184	127	392
LT Vol	6	0	11	91	0	127	0
Through Vol	0	409	9	8	0	0	369
RT Vol	0	82	6	0	184	0	23
Lane Flow Rate	6	501	27	101	188	130	400
Geometry Grp	7	7	6	7	7	7	7
Degree of Util (X)	0.012	0.875	0.061	0.22	0.347	0.248	0.703
Departure Headway (Hd)	6.913	6.285	8.34	7.831	6.644	6.88	6.328
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	515	571	432	456	537	518	568
Service Time	4.698	4.07	6.34	5.629	4.44	4.668	4.116
HCM Lane V/C Ratio	0.012	0.877	0.063	0.221	0.35	0.251	0.704
HCM Control Delay	9.8	38.4	11.9	12.9	13	12	22.9
HCM Lane LOS	A	E	B	B	B	B	C
HCM 95th-tile Q	0	9.9	0.2	0.8	1.5	1	5.6

Intersection	
Intersection Delay, s/veh	27.1
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	16	334	120	24	240	24	58	44	40	35	54	10
Future Vol, veh/h	16	334	120	24	240	24	58	44	40	35	54	10
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	20	418	150	30	300	30	73	55	50	44	68	13
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	40	17.7	13.4	12.5
HCM LOS	E	C	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	41%	3%	8%	35%
Vol Thru, %	31%	71%	83%	55%
Vol Right, %	28%	26%	8%	10%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	142	470	288	99
LT Vol	58	16	24	35
Through Vol	44	334	240	54
RT Vol	40	120	24	10
Lane Flow Rate	178	588	360	124
Geometry Grp	1	1	1	1
Degree of Util (X)	0.338	0.909	0.599	0.245
Departure Headway (Hd)	6.85	5.57	5.992	7.13
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	524	658	601	501
Service Time	4.918	3.57	4.047	5.205
HCM Lane V/C Ratio	0.34	0.894	0.599	0.248
HCM Control Delay	13.4	40	17.7	12.5
HCM Lane LOS	B	E	C	B
HCM 95th-tile Q	1.5	11.6	4	1

Intersection	
Intersection Delay, s/veh	12.1
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	22	285	69	11	307	33	57	34	12	12	19	23
Future Vol, veh/h	22	285	69	11	307	33	57	34	12	12	19	23
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	23	297	72	11	320	34	59	35	13	13	20	24
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	12.8	12.4	10.2	9.3
HCM LOS	B	B	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	55%	6%	3%	22%
Vol Thru, %	33%	76%	87%	35%
Vol Right, %	12%	18%	9%	43%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	103	376	351	54
LT Vol	57	22	11	12
Through Vol	34	285	307	19
RT Vol	12	69	33	23
Lane Flow Rate	107	392	366	56
Geometry Grp	1	1	1	1
Degree of Util (X)	0.176	0.514	0.487	0.09
Departure Headway (Hd)	5.898	4.72	4.792	5.768
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	612	752	742	624
Service Time	3.901	2.815	2.89	3.774
HCM Lane V/C Ratio	0.175	0.521	0.493	0.09
HCM Control Delay	10.2	12.8	12.4	9.3
HCM Lane LOS	B	B	B	A
HCM 95th-tile Q	0.6	3	2.7	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	21	194	259	146	126	100	178	593	120	109	547	34
Future Volume (veh/h)	21	194	259	146	126	100	178	593	120	109	547	34
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	1	0	0	3	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.96	0.99		0.97	1.00		0.97	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	23	213	205	160	138	83	196	652	112	120	601	32
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	58	332	274	179	166	76	233	1199	206	203	1354	581
Arrive On Green	0.36	0.36	0.36	0.36	0.36	0.36	0.13	0.40	0.40	0.11	0.38	0.38
Sat Flow, veh/h	47	873	800	378	416	221	1774	3005	515	1774	3539	1519
Grp Volume(v), veh/h	441	0	0	381	0	0	196	383	381	120	601	32
Grp Sat Flow(s),veh/h/ln	1720	0	0	1015	0	0	1774	1770	1751	1774	1770	1519
Q Serve(g_s), s	0.0	0.0	0.0	12.5	0.0	0.0	9.9	15.2	15.3	5.9	11.6	1.2
Cycle Q Clear(g_c), s	20.5	0.0	0.0	33.0	0.0	0.0	9.9	15.2	15.3	5.9	11.6	1.2
Prop In Lane	0.05		0.46	0.42		0.22	1.00		0.29	1.00		1.00
Lane Grp Cap(c), veh/h	662	0	0	429	0	0	233	706	699	203	1354	581
V/C Ratio(X)	0.67	0.00	0.00	0.89	0.00	0.00	0.84	0.54	0.54	0.59	0.44	0.06
Avail Cap(c_a), veh/h	662	0	0	422	0	0	310	706	699	233	1354	581
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.4	0.0	0.0	30.8	0.0	0.0	38.8	21.1	21.1	38.5	21.0	17.8
Incr Delay (d2), s/veh	2.5	0.0	0.0	20.0	0.0	0.0	14.6	3.0	3.0	3.0	1.1	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.2	0.0	0.0	12.6	0.0	0.0	5.8	7.9	7.9	3.0	5.8	0.5
LnGrp Delay(d),s/veh	28.0	0.0	0.0	54.0	0.0	0.0	53.4	24.1	24.1	41.5	22.1	18.0
LnGrp LOS	C			D			D	C	C	D	C	B
Approach Vol, veh/h		441			381			960			753	
Approach Delay, s/veh		28.0			54.0			30.1			25.0	
Approach LOS		C			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.5	41.5		36.5	15.0	40.0		36.5
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	12.0	35.0		33.0	16.0	35.0		33.0
Max Q Clear Time (g_c+I1), s	7.9	17.3		22.5	11.9	13.6		35.0
Green Ext Time (p_c), s	0.1	8.2		2.3	0.2	7.2		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	31.8
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	27	149	149	76	165	115	117	618	88	103	570	47
Future Volume (veh/h)	27	149	149	76	165	115	117	618	88	103	570	47
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	1	0	0	1	0	0	1	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	30	164	117	84	181	108	129	679	86	113	626	45
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	76	285	184	134	245	130	189	1387	175	225	1624	726
Arrive On Green	0.29	0.29	0.29	0.29	0.29	0.29	0.11	0.44	0.44	0.13	0.46	0.46
Sat Flow, veh/h	93	970	641	275	836	453	1774	3159	400	1774	3539	1583
Grp Volume(v), veh/h	311	0	0	373	0	0	129	380	385	113	626	45
Grp Sat Flow(s),veh/h/ln	1703	0	0	1564	0	0	1774	1770	1789	1774	1770	1583
Q Serve(g_s), s	0.0	0.0	0.0	5.2	0.0	0.0	5.6	12.2	12.3	4.7	9.3	1.3
Cycle Q Clear(g_c), s	12.4	0.0	0.0	17.6	0.0	0.0	5.6	12.2	12.3	4.7	9.3	1.3
Prop In Lane	0.10		0.38	0.23		0.29	1.00		0.22	1.00		1.00
Lane Grp Cap(c), veh/h	545	0	0	511	0	0	189	776	785	225	1624	726
V/C Ratio(X)	0.57	0.00	0.00	0.73	0.00	0.00	0.68	0.49	0.49	0.50	0.39	0.06
Avail Cap(c_a), veh/h	745	0	0	698	0	0	356	777	785	267	1625	727
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.5	0.0	0.0	26.1	0.0	0.0	34.4	16.1	16.1	32.5	14.2	12.0
Incr Delay (d2), s/veh	0.9	0.0	0.0	2.5	0.0	0.0	4.3	2.2	2.2	1.7	0.7	0.2
Initial Q Delay(d3),s/veh	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.1	0.0	0.0	8.1	0.0	0.0	3.0	6.5	6.5	2.4	4.7	0.6
LnGrp Delay(d),s/veh	25.5	0.0	0.0	28.8	0.0	0.0	38.7	18.3	18.3	34.3	14.9	12.2
LnGrp LOS	C			C			D	B	B	C	B	B
Approach Vol, veh/h		311			373			894			784	
Approach Delay, s/veh		25.5			28.8			21.2			17.5	
Approach LOS		C			C			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.1	40.0		26.6	11.5	41.6		26.6
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	12.0	35.0		33.0	16.0	35.0		33.0
Max Q Clear Time (g_c+I1), s	6.7	14.3		14.4	7.6	11.3		19.6
Green Ext Time (p_c), s	0.1	9.0		1.9	0.2	8.0		2.1

Intersection Summary	
HCM 2010 Ctrl Delay	21.8
HCM 2010 LOS	C

Appendix C

Signal Warrant and Proportional Share

Warrant 3: Peak-Hour Volumes and Delay

Fifth Street West & West MacArthur Street
City of Sonoma

Project Name: 853 Fourth Street West Project

Intersection: 1

	Major Street	Minor Street
Street Name	Fifth Street West	West MacArthur Street
Direction	N-S	E-W
Number of Lanes	2	1
Approach Speed	30	25

Population less than 10,000? No
Date of Count: General Plan Projections
Scenario: AM Future Volumes

Warrant 3 Met?: Met when either Condition A or B is met — **Yes**

Condition A: Met when conditions A1, A2, and A3 are met — Not Met

Condition A1 — Not Met

The total delay experienced by traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one lane approach, or five vehicle-hours for a two-lane approach

Minor Approach Delay: 1.08 vehicle-hours

Condition A2 — Met

The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic of 150 vph for two moving lanes

Minor Approach Volume: 267 vph

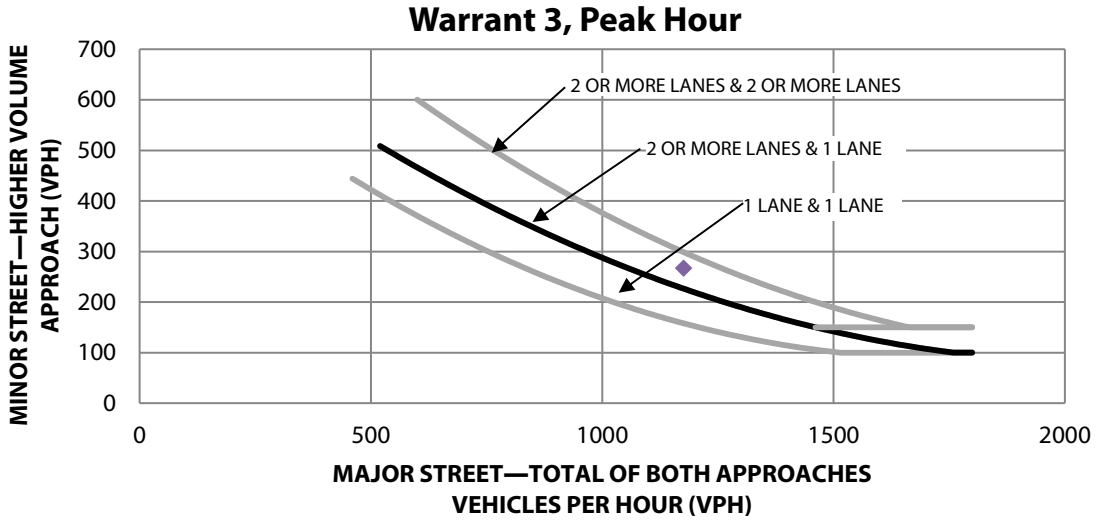
Condition A3 — Met

The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more appraches or 650 vph for intersections with three approaches

Total Entering Volume: 1509 vph

Condition B — Met

The plotted point falls above the curve



Equitable Share Calculations
853 Fourth Street East Project

	PM	Total Volume Entering the Intersection of Fifth Street West and West MacArthur Stree	PM
		Existing	1055
Project Trips (T)	8	Future Year	1509

Description of Project Improvement:

Installation of a traffic signal.

Calculation of Project Share

P = T / (TB - TE)
where:
P = Equitable Share
T = Project trips during the affected peak hour
TB = Build-out volumes
TE = Existing volumes

T	8
TB	1509
TE	1055
P	**1.8**

Total Estimated Cost of Improvements $500,000

Equitable Share Contribution **$9,000**

Equitable Share (per Caltrans "Guide for the Preparation of Traffic Impact Studies")

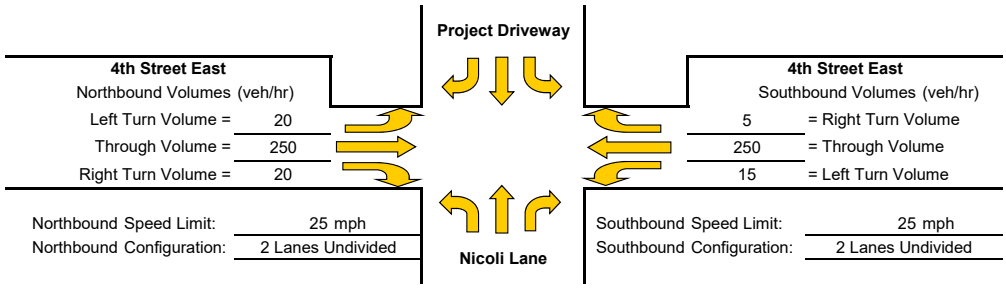
Appendix D

Turn Lane Warrant Calculations

Turn Lane Warrant Analysis - 4 Legged Intersections

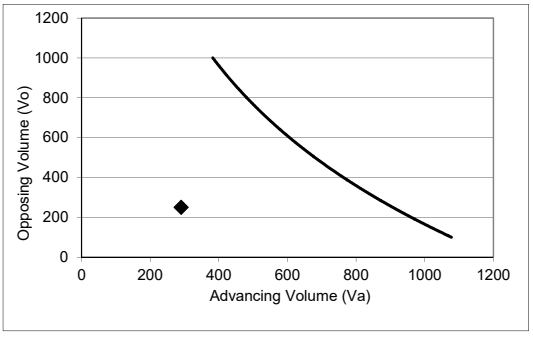
Study Intersection: 4th Street West and Project Driveway
Study Scenario: PM plus Project

Direction of Analysis Street: North/South



Northbound Left Turn Lane Warrants

Percentage Left Turns %lt 6.9 %
Advancing Volume Threshold AV 907 veh/hr
If AV<Va then warrant is met

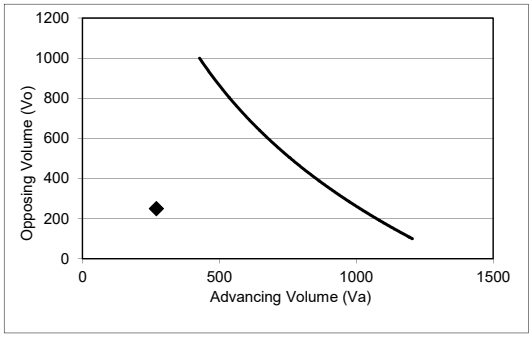


◆ Study Intersection
Two lane roadway warrant threshold for: 25 mph
Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: **NO**

Southbound Left Turn Lane Warrants

Percentage Left Turns %lt 5.6 %
Advancing Volume Threshold AV 1014 veh/hr
If AV<Va then warrant is met



◆ Study Intersection
Two lane roadway warrant threshold for: 25 mph
Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: **NO**

Note: If one direction has a left turn lane warranted, a left turn lane should be installed on the other side as well

Northbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold: AV = -
Advancing Volume Va = 290
If AV<Va then warrant is met No

Right Turn Lane Warranted: **NO**

Southbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold: AV = 1012.6
Advancing Volume Va = 270
If AV<Va then warrant is met No

Right Turn Lane Warranted: **NO**

Northbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 40 vehicles

2. Check advance volume threshold criteria for taper

Advancing Volume Threshold AV = 666.7
Advancing Volume Va = 290
If AV<Va then warrant is met No

Right Turn Taper Warranted: **NO**

Southbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

2. Check advance volume threshold criteria for taper

Advancing Volume Threshold AV = -
Advancing Volume Va = 270
If AV<Va then warrant is met -

Right Turn Taper Warranted: **NO**

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