TRAFFIC IMPACT ASSESSMENT

351 SUMMER STREET SOMERVILLE, MA

JUNE, 2010

Prepared for

Strategic Capital Partners, LLC

Prepared by

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Executive Summary

This report assesses the traffic impacts associated with the proposed development of 31 residential condominiums to be located at 351 Summer Street in Somerville, MA. The report evaluates the projects traffic impacts on the following study area intersections:

- Summer Street/Site Driveways
- Summer Street/Cutter Avenue
- Summer Street/Willow Avenue
- Willow Avenue/Highland Avenue

The study includes an inventory and analysis of existing conditions, an estimation of site generated traffic and an evaluation of future 2014 design year 'No-Build' and 'Build' conditions at the studied intersections.

The proposed development will generate 20 vehicle trips in the AM peak hour, 22 in the PM peak hour and 225 trips daily. This includes trips generated by the potential office use for the space vacated by the Dilboy Post at 361 Summer Street. The peak hour trips have been distributed onto the study area based upon existing peak hour travel patterns and the desire to reach surrounding major routes.

The relatively low volumes generated by the proposed development during the peak hours will have little measureable impacts on traffic flows along Summer Street and the surrounding roadways. No changes in Level of Service will occur at the study area intersections. Analysis shows that the increase in average delays will be one second or less for all traffic movements.

Peak hour directional site traffic (12 vehicles per hour) will amount to approximately one vehicle every five minutes along Summer Street for the proposed residential use. It should also be noted that these peak hour site trips are expected to be reduced due to the nearby MBTA Red Line station at Davis Square that will encourage both residents and workers at the site to use transit for their commute trips.

1.0 Introduction

This report assesses the traffic impacts associated with the proposed development of 31 residential condominiums to be located at 351 Summer Street in Somerville, MA (see Figure 1 - Locus Plan). Institute of Transportation Engineers (ITE) trip generation rates and standard traffic engineering practice and procedures have been utilized in this traffic impact study.

2.0 Methodology

This traffic assessment has been prepared in accordance with the ITE's Traffic Impact Analyses for Site Development. (An ITE recommended practice).

The study includes the following:

- An inventory and analysis of existing conditions for the study area intersections
- An estimation of daily and peak hour trips generated by the proposed development
- The distribution of AM and PM peak hour site generated traffic at the study area intersections
- An evaluation of future 2014 'No-Build' and 'Build' conditions at the study area intersections

3.0 Proposed Development

The project proponent proposes to construct 31 residential condominiums located on the north side of Summer Street, east of Cutter Avenue in Somerville, MA. (See Figure 1 – Locus Map). The development site consists of two lots. The new development will be constructed on the west lot that is currently used for parking by the George Dilboy VFW Post (at adjacent 371 Summer Street). Development on the east lot (currently vacant) will include a new parking area and building for the relocated George Dilboy VFW Post. It is therefore expected that current activities for the parking lot in relation to the surrounding street network will remain unchanged.

The proposed development plan provides for three separate curb cuts onto Summer Street as follows:

- ➤ West Driveway accessing underground resident parking a total of 45 parking stalls.
- ➤ East Driveway accessing rear surface parking on the west lot a total of 44 parking spaces (for combined Dilboy Post, commercial users and resident visitors) and accessing 19 parking spaces for the new Dilboy Post building on the east lot.

11 80000 Highland Ave Highland Ave DAVIS SQUARE Hawmone St Windsor Rd Charmond Ra Summer St SOMERVILLE (1) (3) Mean St Design Consultants, Inc. Consulting Engineers and Surveyors LOCUS PLAN 351 SUMMER ST DESIGN CONSULTANTS BUILDING 265 MEDFORD STREET SOMERVILLE, MA 02143 (617) 776-3350 SOMERVILLE, MA FIGURE 1

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The post runs approximately 170 events per year in their hall (which translates to an average of 14 events per month). These events range from community service fundraisers (like Habitat for Humanity and Avon walk for cancer) to birthday parties, christenings, communions, graduations, reunions, and funerals to a once a year beer and honk festival. The hall is also a polling station. Except for very few annually scheduled events, the rest are all booked on a first-come-first serve basis, a few weeks or a few days in advance. The great majority of event have no more than 80 guests, but they range from 20 to over 100 guests. The Post also runs a club where members gather for cards and other games. The club is frequented every day almost without exception by small gatherings. They have a license to serve liquor.

Closing time is 1 AM, but most often they close earlier.

Parking for the existing Dilboy Post is provided on the west lot with entries/exits via the existing 2 driveways off Summer Street. The relocated facility will continue to have access off Summer Street only.

4.0 Study Area

The study area for this traffic assessment includes the following intersections:

- Summer Street/Site Driveways
- Summer Street/Cutter Avenue
- Summer Street/Willow Street
- Willow Street/Highland Avenue

The Summer Street/Site Driveway intersections are unsignalized while the three off-site locations are traffic signal controlled. See Figure 2 for study area intersections.

5.0 Roadway Network

<u>Highland Avenue</u> is a two-lane undivided minor arterial with on-street parking that provides an east-west connection through the City of Somerville between Davis Square and Route 28/McGrath Highway. In Davis Square, Highland Avenue is one-way westbound, beginning at its intersection with Cutter Avenue.

<u>Elm Street</u> is a two-lane undivided major collector roadway with on-street parking that extends southeast from Davis Square connecting to Somerville Avenue, a distance of about one mile. The street is also one-way in Davis Square, allowing for southeast movements to its intersection with Cutter Avenue.

<u>Cutter Avenue</u> is a one-way collector roadway that provides for northbound traffic circulation between Elm Street and Highland Avenue, as well as metered parking on both sides of the street (due to the proximity of Davis Square).

<u>Willow Avenue</u> is a one-way collector roadway that similarly provides for northbound traffic circulation between Elm Street and Highland Avenue, as well as residential parking on both sides of the street. Willow Avenue extends north as a two-way collector, connecting to Broadway.

Summer Street is a collector street that extends easterly as a one-way street from Elm Street to Willow Avenue, with metered parking on both sides. East of Willow Avenue Summer Street extends as a two-way local/collector, connecting to Bow Street in Union Square, as distance of about 1 ¼ miles. At the project site, Summer Street is 29 feet wide with 7 to 8 foot wide sidewalks on both sides. The posted speed limit is 25 mph.

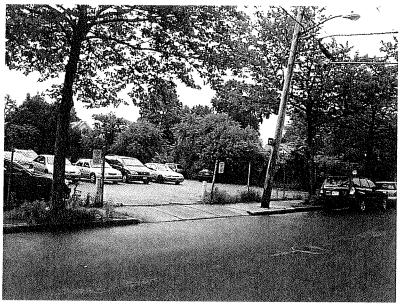
All of the above-noted streets are under the jurisdiction of the City of Somerville.



Existing West Site Driveway

Approximately 225 feet east of the proposed access to the project site is the Summer Street/Cutter Avenue intersection. This 4-legged intersection of two one-way streets is traffic signal controlled. Summer Street is 24 feet wide west of the intersection, providing for a separate left turn movement onto Cutter Avenue. The Cutter Avenue approach is 27 feet wide, allowing for separate through and right turn movements. Signal phasing is two phase for vehicles and an exclusive pedestrian crossing phase. Abutting land uses are mixed with a pizza outlet on the southeast corner, bank on the northeast corner, a proposed mixed use site on the northwest corner and a municipal parking lot (metered) on the southwest corner. The signal timing is pre-timed and interconnected with the nearby traffic signal at Elm and Cutter Avenue.

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Existing East Site Driveway

Approximately 500 feet east of the proposed east site drive is the Summer Street/Willow Avenue intersection. This 4-legged intersection is traffic signal controlled. Signal phasing is two phase (pre-timed) for vehicles and an exclusive pedestrian crossing phase. The eastbound Summer Street approach is 30 feet wide, allowing for a separate through and left turn lane. The Willow Avenue approach is 33 feet wide, providing for a single approach and departure lane with parking on both sides. The Summer Street westbound approach allows for right turns only. Land use is the vicinity is residential.



Summer Street @ Cutter Avenue

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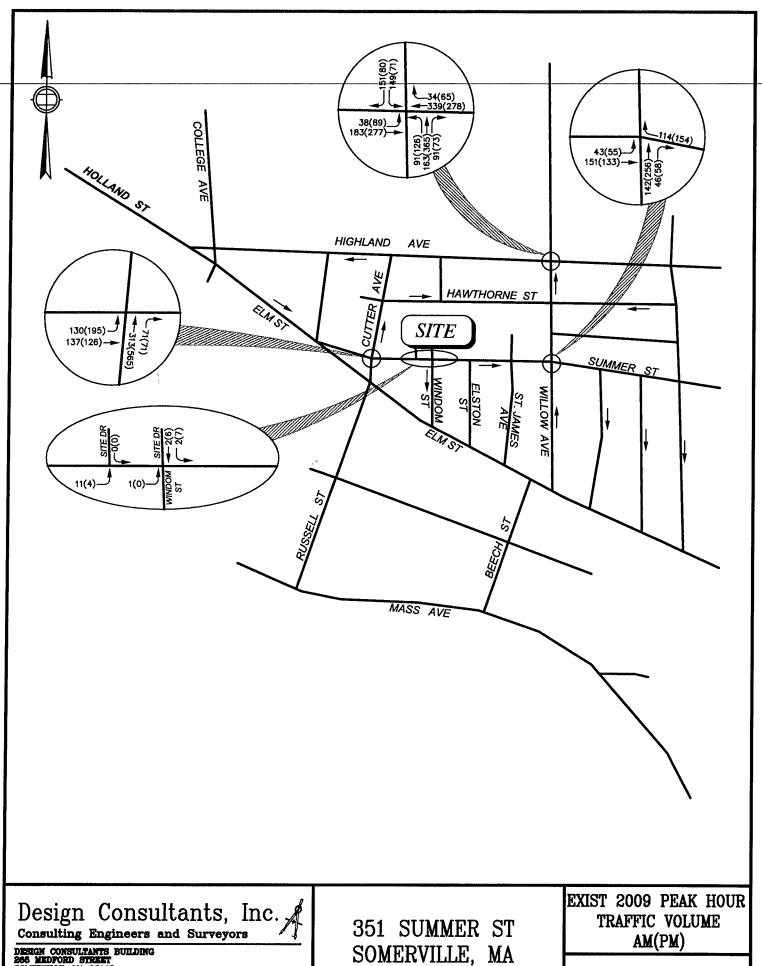
Approximately 400 feet north of the Summer Street/Willow Avenue intersection is the intersection of Willow Avenue with Highland Avenue. This 4-way intersection is signalized and provides for one general purpose lane for the northbound Willow Avenue approach due to adjacent curbed parking near the intersection. Each of the Highland Street approaches similarly allow for a single general-purpose lane. The southbound Willow Avenue approach is a single lane allowing left or right turn movements. Signal phasing is two phase (actuated) for vehicles and an exclusive pedestrian crossing phase. Land use along Highland Street is mainly commercial while Willow Avenue is residential.

6.0 Traffic Volumes

Traffic volumes were recorded at the study area intersections from 7-9 AM and 4-6 PM on typical weekdays during the month of July, 2009. Verification counts were undertaken in February, 2010, as well as supplemental bicycle/pedestrian counts in June, 2010. This count data is provided in Appendix A.

The recorded summer peak hour volumes were adjusted for the peak fall season when students (as well as most workers) are in the city. The resulting 2009 peak hour volumes are shown in Figure 2. They reflect a 10% increase over the summer season counts for the Summer Street intersections and the higher February, 2010 count for the intersection of Willow and Highland Avenue. This represents a conservative 'worst case' for analysis as requested by the Somerville Traffic and Parking Department.

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7.0 Existing Traffic Operations

DCI has performed capacity analyses to determine traffic operations (Levels-of-Service) at the study area intersections under existing 2009 peak hour conditions. Level-of-Service (LOS) is the standard technique used in traffic engineering to measure traffic flows and delays at intersections. Levels-of-Service are given letter designations with 'A' at best, with little or no delays to 'F' at worst, with forced flow conditions. Levels-of-Service were determined by performing capacity analyses utilizing SYNCHRO and HCS analysis software.

Definitions of Levels-of-Service at signalized and unsignalized intersections are presented in the 2000 Highway Capacity Manual and the following tables define the relationship between Level-of-Service and control delay.

Level of Service Criteria for Signalized Intersections

Level of Service	Control Delay per Vehicle (sec)		
Α	≤ 10	Good progression, few stops and short cycle lengths.	
В	> 10-20	Good progression and/or short cycle lengths; more vehicle stops.	
С	> 20-35	Fair progression and/or longer cycle lengths; some cycle failures; significant portion of vehicles must stop.	
D	> 35-55	Congestion becomes noticeable; high-volume-to-capacity ratio; longer delays; noticeable cycle failures.	
E	> 55-80	At or beyond limit of acceptable delay; poor progression; long cycles; high volumes; long queues.	
F	> 80	Unacceptable to drivers. Arrival volumes greater than discharge capacity; long cycle lengths; unstable-unpredictable flows.	

SOURCE: Transportation Research Board 2000.

Level of Service Criteria for Unsignalized Intersections

Level of Service Average Control Delay per Vehicle (sec)		Impact on Minor Street Traffic
Α	≤10	Little or no delay
В	> 10-15	Short traffic delays
C	> 15-25	Average traffic delays
D	> 25-35	Long traffic delays
E	> 35-50	Very long traffic delays
F	> 50	Unacceptable traffic delays to most drivers

SOURCE: Transportation Research Board 2000.

Delays and Levels-of-Service for study area intersections are in the following Table 'A'.

		*

TABLE A EXISTING CONDITIONS

UNSI	GNALI	ZED I	NTER	SEC	TIONS		
Location/Movement		Existing Condition					
	A	M Peak			P	M Peak	Hour
	Dela	ıy	LOS	(3)	Dela	у	LOS
	(2))					
Summer/West Site Dr			···				
Driveway exit	10.0)_	<u>A</u>		9.7		A
Summer/East Site Dr							
Driveway exit	9.8		A		9.9		A
SIG	NALIZ				.,	T	1
	V/C	Delay	y L	OS_	V/C	Delay	LOS
Summer/Cutter							
Summer EB Left/Thru	.33	31.8		<u>C</u>	.36	31.5	C
Cutter NB Thru/Right	.28	8.0		<u>A</u>	.51	10.5	В
OVERALL	.29	17.8		В	.45	17.6	В
Summer/Willow							
Summer EB Left/Thru	.21	7.4		A	.18	7.2	A
Summer WB Right	.15	19.0		В	.24	19.0	В
Willow NB Thru/Right	.27	8.1		A	.45	9.7	A
OVERALL	.24	10.3		В	.32	11.2	В
Willow/Highland							
Highland EB Left/Thru	.46	14.2		В	.82	29.9	С
Highland WB LTR	.68	18.0		В	.58	14.4	В
Willow NB LTR	.44	7.8	4	A	.72	15.3	В
Willow SB Left/Right	.43	5.8	1	A	.24	4.6	A
OVERALL	.52	10.5]	В	.76	15.0	В

- (1) Volume/Capacity Ratio
- (2) Control Delay in Seconds
- (3) Level-of-Service

As indicated in Table A, the unsignalized site drive intersections on Summer Street operate at a Level-of-Service 'A' in the AM and PM peak hours.

At the signalized intersections within the study area, all traffic movements are LOS 'B' or better with the exception of the following approach locations/peak hour time periods:

• The eastbound approach along Summer Street at Cutter Avenue operates at LOS 'C' during the AM and PM peak hours.

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The eastbound approach along Highland Avenue at Willow Avenue operates at LOS 'C' during the PM peak hour.

8.0 Accident Data

Accident data for the 3-year period from 07/13/2006 to 07/13/2009 was obtained from the Somerville Police Department as follows:

<u>Location</u>	No. of Accidents	Crash Rate ¹
Summer St./Cutter Ave.	0	0.00
Summer St./Willow Ave.	2	0.28
Willow Ave./Highland Ave.	6	0.40

The MHD crash rate formula was used to calculate crash rates for the study area intersections. This crash rate is expressed in Million Entering Vehicles, which is standard to the Traffic Engineering profession. The District 4 average crash rate for signalized intersections is 0.88 and 0.63 for unsignalized locations. The crash rates for the study area intersections are lower than average and therefore do not indicate a safety concern.

9.0 Future Traffic Volumes

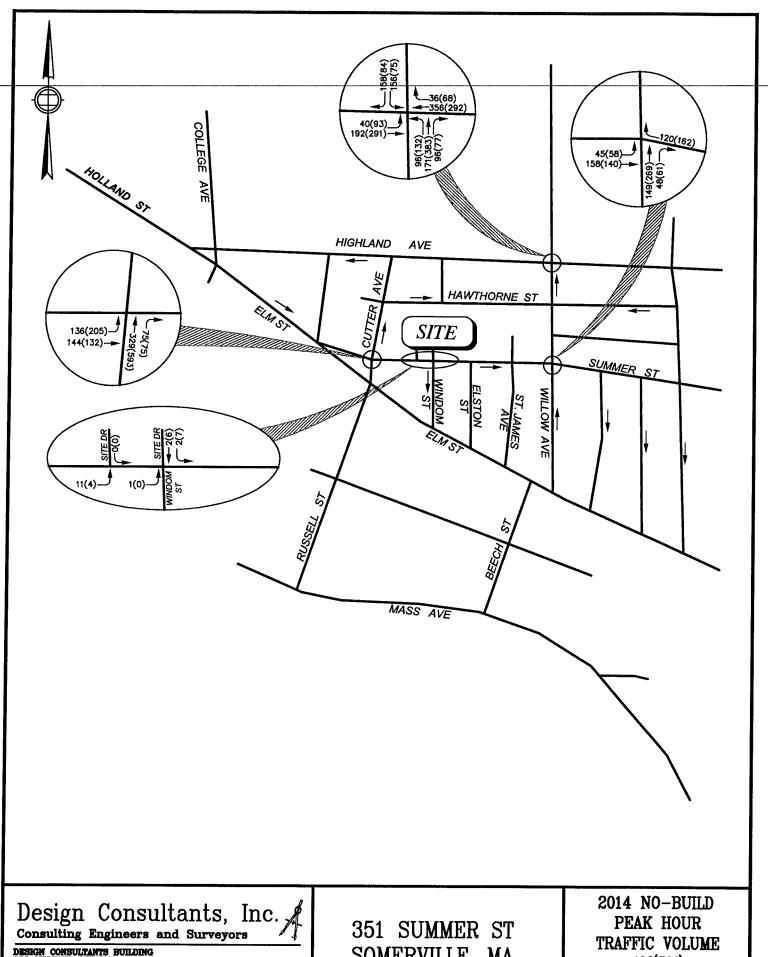
The existing 2009 study area peak hour volumes have been increased by an annual growth factor of 1% per year to account for general background traffic growth to develop future 2014 peak hour volumes (five-year projection). This conservative assumption accounts for the peak hour traffic volumes generated by the nearby 16,000 SF mixed-use development at the northwest corner of Summer Street and Cutter Avenue. No other planned developments were identified for the study area. The projected 2014 'No-Build' condition is shown on Figure 3.

10.0 Trip Generation and Distribution

DCI has estimated the daily and peak hour site generated trips based upon trip rates presented in the Institute of Transportation Engineers (ITE) Trip Generation Manual – 8th Edition. The information in this document has been obtained from the research and experiences of transportation engineering and planning professionals. The data is based on more than 4,800 trip generation studies submitted to ITE by public agencies; consulting firms; universities and colleges; developers; associations; and local sections, districts and student chapters of ITE. The published rates are intended for planners, transportation professionals, zoning boards and others who are interested in estimated the number of vehicle trips generated by a proposed development.

¹ Based on peak hour count and 3 year crash data.

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SOMERVILLE, MA

AM(PM)

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For a specific land use, the Trip Generation Manual provides trip generation rates and equations for daily and peak hour time periods for the generator and the traditional commuting peak hours of the adjacent street traffic (that is, 7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM on weekdays). The average trips generation rates represent weighed averages from studies conducted throughout the United States and Canada since the 1960's. Data was primarily collected at suburban locations having little or no transit service, nearby pedestrian amenities, or travel demand management (TDM) programs. The rates may be modified to reflect the presence of public transportation service, ridesharing, or other TDM measures; enhanced pedestrian and bicycle trip-making opportunities; or other special characteristics of the site or surrounding area.

For this residential project, ITE Land Use 230 for Residential Condominium/Townhouse was used. The data is a combination of condominiums/townhouses that are low-rise or high-rise development. The number of dwelling uses is the independent variable of choice because it is readily available, easy to project and has a high correlation with average weekday vehicle trip ends. The peak hour of the generator typically coincides with the peak hour of the adjacent street traffic. The ITE data was based on surveys between the mid-1970s and the 2000s throughout the United States and Canada.

The following table identifies the trip generation for the proposed 31 residential condominium units. The data reflects use of the average rate versus a fitted curve equation. The fitted curve equation is typically applied for larger size developments (the average size of development for Land Use 230 is 179 dwelling units for weekday trips, higher for peak hour trips).

31 Units Residential Condominium/Townhouse						
	Land Use 230					
Daily	AM Peak Hour	PM Peak Hour				
In – 91	In – 2	In – 11				
Out – 91	Out – 12	Out – 5				
Total – 182	Total – 14	Total – 16				

The development plan calls for relocation of the existing Dilboy Post that currently occupies approximately 3,911 GSF of space at 361 Summer Street. Since this area has the potential of being occupied as office space within current zoning, the future development condition has considered this additional component. If needed, parking for this use would use designated Dilboy stalls under the proposed development plan that would be available for daytime use. The following tables identify the Trip Generation for this future potential use (ITE Land Use 710) and the total development scenario.

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Potential Future Use 3,911 SF General Office Building Land Use 710				
Daily	AM Peak Hour	PM Peak Hour		
In – 22	In – 5	In - 1		
Out – 21	Out – 1	Out – 5		
Total – 43	Total – 6	Total – 6		

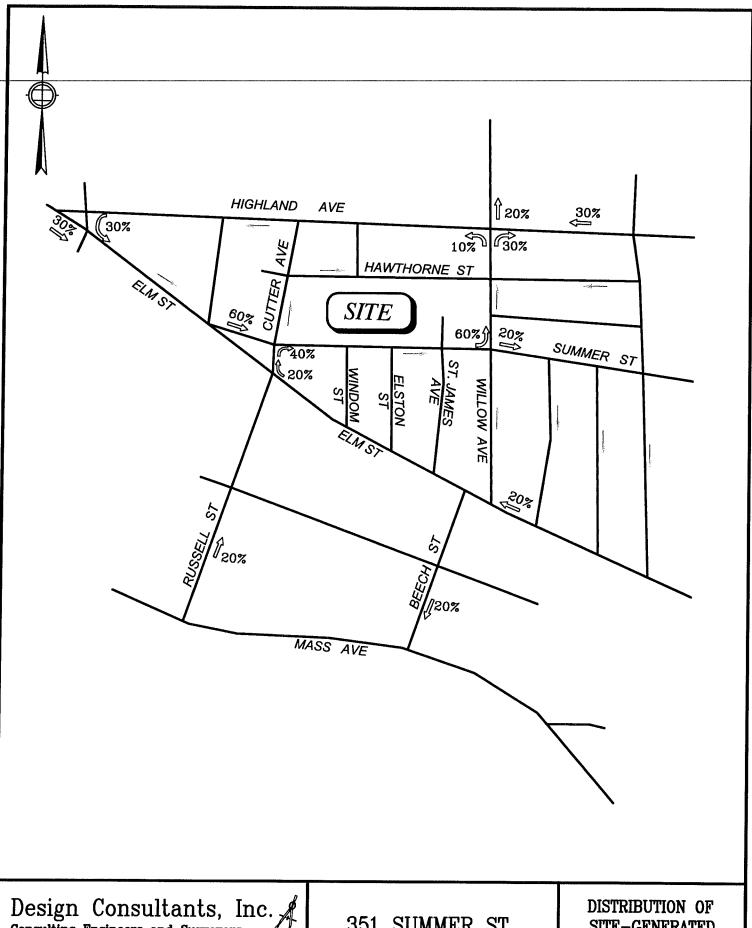
TOTAL SITE 31 Residential Units and 3,911 SF Office					
Daily	AM Peak Hour	PM Peak Hour			
In – 113	In – 7	In – 12			
Out -112	Out – 13	Out – 10			
Total – 225	Total – 20	Total – 22			

The site-generated trips have not been reduced due to other modes of transportation (such as walking, transit or bicycling) in order to present a conservative analysis for potential traffic impact. Otherwise, a reduction would be appropriate due to the proximity of Davis Square and the MBTA Red Line Station.

The site generated peak hour trips have been distributed on the study area intersections based upon existing travel patterns within the study area and routes to major arterials in the area (see Figure 4). The site generated peak hour trips are shown in Figure 5. The site generated peak hour trips have been added to the 2014 No-Build volumes and the resulting 2014 Build peak hour volumes are shown in Figure 6.

11.0 Traffic Impacts

In order to evaluate the traffic impacts associated with the proposed development, it is necessary to compute and compare delays and Levels-of-Service for 2012 'No-Build' and 'Build' scenarios. This is shown on the following Table B.



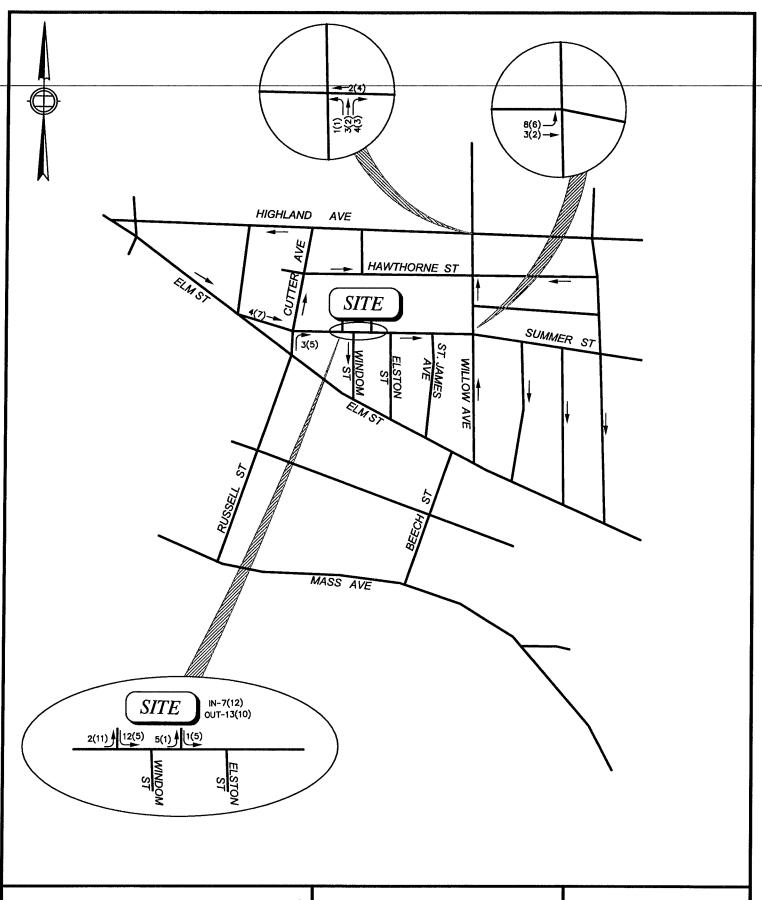
Consulting Engineers and Surveyors

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351 SUMMER ST SOMERVILLE, MA

SITE-GENERATED TRIPS

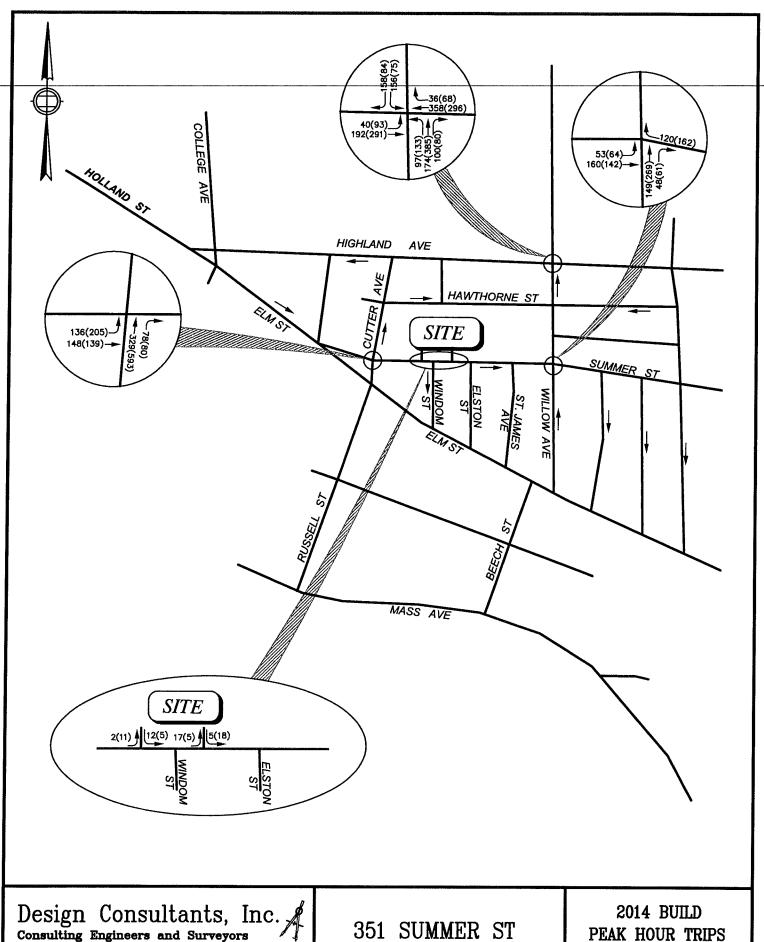
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SITE-GENERATED
PEAK HOUR TRIPS
AM(PM)



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SOMERVILLE, MA

PEAK HOUR TRIPS AM(PM)

FIGURE 6

TABLE B

LEVEL OF SERVICE UNSIGNALIZED INTERSECTIONS

Location/ Movement		2014 Build						
	AM Pe	ak Hour	PM Pea	ak Hour	AM Pe	ak Hour	PM Pea	k Hour
	Delay (2)	LOS (3)	Delay	LOS	Delay	LOS	Delay	LOS
Summer/West Dr					,			
Driveway exit	9.9	A	9.7	A	9.9	A	10.0-	A
Summer/East Dr								
Driveway exit	10.0+	В	10.0+	В	10.1	В	9.8	A

	SIGNALIZED INTERSECTIONS											
	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
Summer/Cutter												
Summer EB	.34	32.0	С	.37	31.6	С	.35	32.1	С	.37	31.8	C
Cutter NB	.30	8.2	A	.54	10.9	В	.30	8.1	Α	.54	10.9	В
OVERALL	.31	17.9	В	.47	17.8	В	.31	18.0	В	.48	17.9	В
Summer/Willow												
Summer EB	.22	7.5	Α	.19	7.3	Α	.22	7.5	Α	.20	7.3	A
Summer WB	.16	19.0	В	.26	19.0	В	.16	19.0	В	.26	19.0	В
Willow NB	.28	8.2	A	.47	10.0	Α	.28	8.2	Α	.47	10.0	A
OVERALL	.25	10.4	В	.33	11.3	В	.25	10.3	В	.33	11.3	В
Willow/Highland												
Highland EB	.50	14.8	В	.87	34.5		.50	14.8	В	.87	34.9	С
						C						
Highland WB	.70	18.7	В	.59	14.7	В	.70	18.7	В	.60	14.8	В
Willow NB	.47	8.4	A	.76	17.6	В	.47	8.4	A	.78	18.3	В
Willow SB	.46	6.3	A	.25	4.7	A	.46	6.3	A	.25	4.8	A
OVERALL	.55	10.9	В	.80	16.9	В	.55	11.0	В	.81	17.2	В

⁽¹⁾ Volume/Capacity Ratio

As seen on Table B, no changes in Level-of-Service occur at the study intersections from No-Build to Build conditions. The results show that the increase in average delays will be one second or less for all traffic movements.

⁽²⁾ Control Delay in Seconds

⁽³⁾ Level-of-Service

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12.0 Sight Distance

Sight distances along Summer Street at the proposed site drive intersection were field measured to and from the point where vehicles will stop prior to entering the Summer Street traffic flows. Safe stopping distance enables a driver on the major road to perceive and react accordingly to a vehicle moving from the minor road to the major road. The values are based upon driver perception and reaction time and the braking distance for wet level pavement. Stopping sight distance is measured from an eye height of 3.5 feet to an object (vehicle) in the roadway. The AASHTO (1) safe stopping distance requirement is 150 feet for the 25 mph operating speed along Summer Street.

Sight distance at both site driveways will be well in excess of the minimum 150 foot stopping sight distance for Summer Street. This is due to the straight horizontal and relatively flat vertical alignment of Summer Street along the site frontage, combined with the 10 foot setback of the proposed residential building from the back of sidewalk.

13.0 Conclusions

The proposed residential site development, combined with the potential future office use at 361 Summer Street will generate 20 vehicle trips in the AM peak hour, 22 trips in the PM peak hour and 225 trips per day.

The low volumes generated by the proposed development during the peak hours will have little measureable impacts on traffic flows along Summer Street and the surrounding roadways. Peak hour directional site traffic (12 vehicles per hour) will amount to approximately one vehicle every five minutes at the residential driveway connecting to the underground garage. It should also be noted that these peak hour site trips are expected to be reduced due to the nearby MBTA Red Line station at Davis Square that will encourage both residents and workers at the site to use transit for their work commute.

Trip generation studies published by ITE show that peak hour rates for residential and office development coincide with the peak commute periods of adjacent traffic from 7:00 to 9:00 AM and 4:00 to 6:00 PM. Site traffic during off-peak periods will therefore be somewhat lower throughout the day and also reflect the lower traffic volumes on the adjacent roadways (typically about one half of peak hour activity).

The Dilboy Post will continue activities at its new location along Summer Street, with peak traffic activity occurring during off-peak hours that can be well accommodated by the surrounding street network.

(1) American Association of State and Highway Transportation Officials

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APPENDIX

- A Traffic Count Data
- B Synchro Analysis
 - 2009 Existing Conditions
 2014 No-Build Conditions

 - 3. 2014 Build Conditions
- C HCS Unsignalized Analysis
- D MHD Crash Rate Sheets
- E Trip Generation

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Design Consultants, Inc.

Consulting Engineers and Surveyors

265 MEDFORD ST · SOMERVILLE, ME 02147 · (617) 776-3350

LOCATION:	Summer St /	Cutter Ave

PROJ NO.: 2008-038

TIME: 7am - 9am

SHEET NO: 5

DATE: 7/7/2009, *6/3/2010

CALCULATED BY: S.Wen, S. Kenney

WEATHER: Cloudy

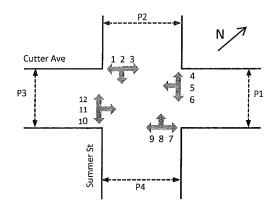
Peak Hour

NOTES:

TIME	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
7:15 AM	0	14	19	0	0	0	0	0	0	5	37	0	75
7:30 AM	0	19	22	0	0	0	0	0	0	6	41	0	88
7:45 AM	0	11	25	0	0	0	0	0	0	7	51	0	94
8:00 AM	0	22	29	0	0	0	0	0	0	10	51	0	112
8:15 AM	0	17	27	0	0	0	0	0	0	18	51	0	113
8:30 AM	0	26	28	0	0	0	0	0	0	14	79	0	147
8:45 AM	0	28	28	0	0	0	0	0	0	13	83	0	152
9:00 AM	0	34	35	0	0	0	0	0	0	13	72	0	154

(8:00am - 9:00am)

0



105 | 118

	*Pedestrians	*Bicycles
P1	9	16
P2	12	0
 Р3	41	1
P4	16	3

285

265 MEDFORD ST · SOMERVILLE, ME 02147 · (617) 776-3350

LOCATION:	Summer St / Cutter Ave

PROJ NO.: 2008-038

TIME: 4pm - 6pm

SHEET NO: 6

DATE: 7/7/2009, *6/3/2010

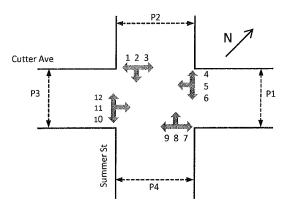
CALCULATED BY: S.Wen, S. Kenney

WEATHER: Cloudy

NOTES:

	TIME	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
4:1	15 PM	0	20	31	0	0	0	0	0	0	16	108	0	175
4:3	30 PM	0	21	53	0	0	0	0	0	0	26	104	0	204
4:4	45 PM	0	26	41	0	0	0	0	0	0	22	119	0	208
5:0	00 PM	0	19	28	0	0	0	0	0	0	20	133	0	200
5:1	15 PM	0	28	51	0	0	0	0	0	0	17	136	0	232
5:3	30 PM	0	22	41	0	0	0	0	0	0	17	128	0	208
5:4	15 PM	0	28	44	0	0	0	0	0	0	17	122	0	211
6:0	00 PM	0	30	41	0	0	0	0	0	0	14	128	0	213

Peak Hour 108 177 (5:00pm - 6:00pm)



	*Pedestrians	*Bicycles
P1	65	0
P2	11	8
Р3	18	39
P4	12	3

514

265 MEDFORD ST · SOMERVILLE, ME 02147 · (617) 776-3350

LOCATION:	Summer St / Willow Ave

PROJ NO.:

2008-038

TIME:

7am - 9am

SHEET NO:

DATE:

7/14/2009

CALCULATED BY:

129

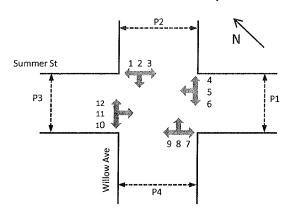
M.Buono

WEATHER: Clear 70°

NOTES:

TIME	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
7:15 AM	0	0	0	11	0	0	10	17	0	0	14	1	53
7:30 AM	0	0	0	6	0	0	17	27	0	0	24	0	74
7:45 AM	0	0	0	15	0	0	16	31	0	0	22	5	89
8:00 AM	0	0	0	28	0	0	13	36	0	0	35	10	122
8:15 AM	0	0	0	21	0	0	11	29	0	0	29	4	94
8:30 AM	0	0	0	19	0	0	6	24	0	0	28	7	84
8:45 AM	0	0	0	26	0	0	16	39	0	0	43	11	135
9:00 AM	0	0	0	38	0	0	9	37	0	0	37	17	138

42 Peak Hour 104 (8:00am - 9:00am)



		Pedestrians	Bicycles
	P1	38	10
ĺ	P2	19	2
	Р3	29	13
	P4	20	5

137

265 MEDFORD ST · SOMERVILLE, ME 02147 · (617) 776-3350

LOCATION: _	Summer St / Willow Ave	PROJ NO.
TIME:	4pm - 6pm	SHEET NO

DATE: 7/14/2009

WEATHER: Clear 70° 2008-038

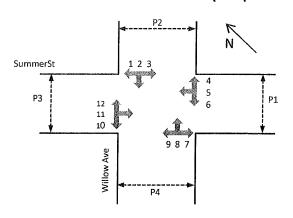
2

CALCULATED BY: M.Buono

NOTES:

TIME	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
4:15 PM	0	0	0	31	0	0	14	56	0	0	35	15	151
4:30 PM	0	0	0	32	0	0	13	62	0	0	30	13	150
4:45 PM	0	0	0	32	0	0	15	46	0	0	37	11	141
5:00 PM	0	0	0	20	0	0	13	39	0	0	36	13	121
5:15 PM	0	0	0	40	0	0	12	72	0	0	35	12	171
5:30 PM	0	0	0	48	0	0	13	76	0	0	13	14	164
5:45 PM	0	0	0	15	0	0	12	57	0	0	43	8	135
6:00 PM	0	0	0	17	0	0	13	54	0	0	33	11	128

Peak Hour 140 233 121 597 (4:30pm - 5:30pm)



	Pedestrians	Bicycles
P1	19	33
P2	13	2
P3	18	5
P4	7	5

265 MEDFORD ST · SOMERVILLE, ME 02147 · (617) 776-3350

LOCATION:	Highland Ave/ Willow Ave

PROJ NO.:

2008-038

TIME:

7am - 9am

SHEET NO:

DATE:

7/14/2009, *6/2/2010

CALCULATED BY: M.Buono, S. Wen, S. Kenney

Peak Hour

WEATHER: Clear 70°, Cloudy 70°

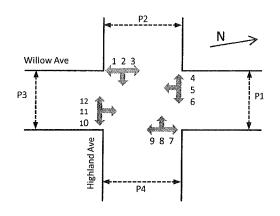
NOTES:

TIME	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
7:15 AM	0	22	3	13	0	19	1	54	0	10	17	15	154
7:30 AM	0	27	5	19	0	28	7	56	0	12	20	24	198
7:45 AM	0	35	4	27	0	31	5	84	0	24	25	30	265
8:00 AM	0	31	6	30	0	18	5	71	0	20	31	17	229
8:15 AM	0	40	7	24	0	28	8	71	0	15	25	16	234
8:30 AM	0	34	7	29	0	31	8	67	0	20	43	26	265
8:45 AM	0	26	13	33	0	28	8	76	0	15	42	24	265
9:00 AM	0	45	11	22	0	27	1	55	0	20	33	18	232

(8:00am - 9:00am)

114 25

269



145

38

108

	*Pedestrians	*Bicycles
P1	39	30
P2	12	. 1
P3	28	14
P4	27	14

143

Design Consultants, Inc.

Consulting Engineers and Surveyors

265 MEDFORD ST · SOMERVILLE, ME 02147 · (617) 776-3350

LOCATION:	Highland Ave/	Willow Ave

PROJ NO.:

2008-038

TIME:

4pm - 6pm

SHEET NO:

DATE: 7/14/2009, *6/2/2010

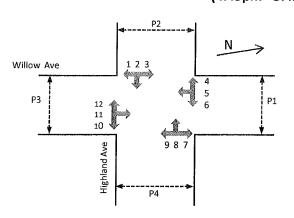
CALCULATED BY: M.Buono, S. Wen, S. Kenney

WEATHER: Clear 70°, Cloudy 70°

NOTES:

TIME	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
4:15 PM	0	47	14	12	0	1	8	76	0	8	67	18	251
4:30 PM	0	44	20	12	0	12	17	61	0	13	71	28	278
4:45 PM	0	42	9	7	0	13	6	77	0	9	65	16	244
5:00 PM	0	43	19	10	0	18	13	53	0	18	62	24	260
5:15 PM	0	54	15	8	0	13	20	54	0	14	78	28	284
5:30 PM	0	73	26	6	0	17	11	70	0	21	85	29	338
5:45 PM	0	62	27	22	0	11	22	119	0	8	38	28	337
6:00 PM	0	39	22	16	0	13	12	58	0	7	52	27	246

Peak Hour 232 87 46 59 66 296 263 109 1219 (4:45pm - 5:45pm)



	*Pedestrians	*Bicycles
P1	47	72
P2	42	7
Р3	42	12
P4	23	12

Design Consultants, Inc.

265 MEDFORD ST · SOMERVILLE, ME 02147 · (617) 776-3350

LOCATION: WILLOW AVENUE AT SUMMER ST

PROJ NO.: 2008-038.20

7:AM-7:45AM TIME: _____

SHEET NO: 1 of 2

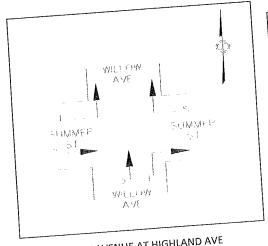
2/3/2010 DATE:

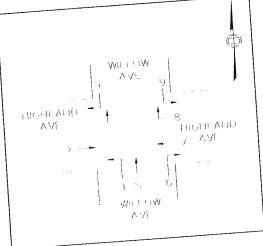
CALCULATED BY: SMK NOTES:

WEATHER: ___

25°, LIGHT SNC)W			_			
	1 1	2	3	4	5	TOTAL	
TIME	-	14	18	3	20	57	
7:00 AM		1B					
7:15 AM	1			0	20	61	İ

	. 1 I	4 1					i
TIME			10	3	20	57	١
7:00 AM	2	14	18			37	
7:15 AM		1B		8	20	61	1
7:15 AM	1	0	32	1		01	
1	1	\	18	-	+		٦
7:30 AM	4	14	35	8	17	78	1
7:30 AM	∥ →	-	1		\	┦	4
7:45 AM	الـ			1	TOTA	L 196	
				!			
		1	1				





LOCATION: WILLOW AVENUE AT HIGHLAND AVE

TIME: 8:00AM-9:00AM

DATE: 2/3/2010

WEATHER: 28°, LIGHT SNOW

THER:	28°, LIC	HT SNO	W				<u></u> T	7 [8	9	TOTAL	
		1	2	3	4	5	6		16	44	268	
	TIME	35	4	45	18	46	18	86	10		200	
	8:00 AM	33							8	40	301	
	8:15 AM	32	10	56	34	47	26	88	ľ		301	
	8:15 AM	32					1-12	75	5	35	244	
	8:30 AM	43	14	42	17	36	12	\ '			1	
1	8:30 AM 8:45 AM				1-22	34	16	90	5	30	258	
	8:45 AM	41	10	40	22				-	TOTA	L 1,071	
	9:00 AM									1017	<u>L</u> <u>1</u>	J
L												

265 MEDFORD ST · SOMERVILLE, ME 02147 · (617) 776-3350

LOCATION: WILLOW AVENUE AT SUMMER ST

TIME: 4:00PM-4:45PM

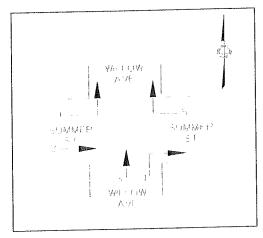
DATE: 2/2/2010 WEATHER: 30°, PARTLY CLOUDY PROJ NO.: 2008-038.20

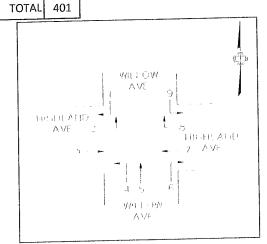
SHEET NO: 2 of 2

CALCULATED BY: SMK

NOTES:

1	2	3	4	5	TOTAL
6	29	68	21	37	124
	18				
14	3 3	75	15	34	137
7	40	80	13	26	140
	<u> </u>				
		6 29 18	6 29 68 18 14 33 75	6 29 68 21 18 75 15	6 29 68 21 37 18 75 15 34





LOCATION: WILLOW AVENUE AT HIGHLAND AVE

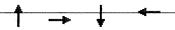
TIME: 5:00PM-6:00PM
DATE: 2/2/2010

WEATHER: 30°, PARTLY CLOUDY

TIAAF	II 1	2	3	4	5	6	7	8	9	TOTAL
TIME									1	
5:00 PM	19	23	61	31	77	19	72	11	15	313
5:15 PM			2B				1B			
	20	19	65	31	94	14	67	19	13	329
5:15 PM	20	1.5			•		1B			329
5:30 PM	1		1B							
5:30 PM	15	23	50	30	93	16	72	18	17	317
5:45 PM	1	1	1B				18			
	1-30	24	71	34	101	24	67	17	26	201
5:45 PM	26	24	/ 1]]-	101	-			1 1	364
6:00 PM					<u> </u>		1B			<u> </u>
								i	TOTAL	1,323

		4	-+		
				¥	
Lane Group	EBT	WBT	NBT	SBT	
Lane Group Flow (vph)	240	405	375	326	
v/c Ratio	0.46	0.68	0.44	0.43	
Control Delay	14.2	18.0	7.8	5.8	
Queue Delay	0.0	0.0	0.0	0.0	
Total Delay	14.2	18.0	7.8	5.8	
Queue Length 50th (ft)	43	76	39	19	
Queue Length 95th (ft)	87	143	100	65	
nternal Link Dist (ft)	730	1353	144	546	
Turn Bay Length (ft)					
Base Capacity (vph)	671	767	846	751	
Starvation Cap Reductn	0	0	0	0	. Takoko eta estreta beri kila arban, and te Maza Kabakatepa kaphidos hilmeratura ili ostatura el Mantapishidos data
Spillback Cap Reductn	0	100	0	0	
Storage Cap Reductn	0	0	0	0	takin da sa sa manangan manangan manangan sa manangan talah sa sa sa manangan kanangan sa manangan sa Talah sa
Reduced v/c Ratio	0.36	0.53	0.44	0.43	

	<u>_</u>	manus Maria			4							_/
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	, NBR	SBL	SBT	SBR
Lane Configurations	LUL	<u> </u>	LUIN	TIDL	<u>11011</u> }	TIDIX	INDL	- NOI	NDIN	OUL	<u>- 301</u> ∰	nae
Volume (vph)	38	183	0	0	339	34	91	163	91	149	0	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	1000	3.0	7000	1000	3.0	1000	1000	3.0	1000	1300	3.0	1000
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt Service State of the Company		1.00			0.99			0.96			0.93	
Flt Protected		0.99			1.00			0.99			0.98	and all the parties of the state of
Satd. Flow (prot)		1847			1840			1773			1694	rial laws
Flt Permitted		0.87			1.00			0.85			0.73	en jackenske st
Satd. Flow (perm)		1624			1840	Sar Va		1533			1267	
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	199	0	0	368	37	99	177	99	162	0	164
RTOR Reduction (vph)	0	0	0	0	9	0	0	26	0	0	73	0
Lane Group Flow (vph)	0	240	0	0	396	0	0	349	0	0	253	0
Turn Type	Perm	***************************************					Perm			Perm		***************************************
Protected Phases		4			8		Esperastya	2	Narijestinava		6	
Permitted Phases	4						2			6		
Actuated Green, G (s)		13.2			13.2			22.1			22.1	
Effective Green, g (s)		13.2			13.2			22.1			22.1	
Actuated g/C Ratio		0.32			0.32			0.54			0.54	
Clearance Time (s)		3.0			3.0			3.0			3.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	-
Lane Grp Cap (vph)		519			588			820			678	
v/s Ratio Prot					c0.22							
v/s Ratio Perm		0.15						c0.23			0.20	
v/c Ratio		0.46			0.67			0.43			0.37	
Uniform Delay, d1		11.2			12.2			5.8			5.6	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.7			3.0			1.6			1.6	
Delay (s)		11.9			15.2			7.4			7.1	
Level of Service		В			B			_ A			Α	
Approach Delay (s)		11.9			15.2			7.4			7.1	
Approach LOS		В			В			Α			Α	
Intersection Summary												
HCM Average Control Delay			10.5	Н	CM Level	of Servic	е		В			
HCM Volume to Capacity ratio			0.52									
Actuated Cycle Length (s)			41.3	St	ım of lost	time (s)			6.0			
Intersection Capacity Utilization			73.3%	IC	U Level o	of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												



Phase Number	2	4	6	8	
Movement	NBTL	EBTL	SBTL	WBT	
Lead/Lag					
Lead-Lag Optimize					
Recall Mode	Max	None	Max	None	
Maximum Split (s)	25	20	25	20	
Maximum Split (%)	55.6%	44.4%	55.6%	44.4%	
Minimum Split (s)	17	9	17	9	
Yellow Time (s)	2	2	2	2	
All-Red Time (s)	1	1	1	1	
Minimum Initial (s)	4	4	4	4	一口,注意的自己的数据自己的数据 医皮肤的 医多元的 建物的复数橡胶物物的
Vehicle Extension (s)	3	3	3	3	
Minimum Gap (s)	3	3	3	3	
Time Before Reduce (s)	0	0	0	0	
Time To Reduce (s)	0	0	0	0	
Walk Time (s)					
Flash Dont Walk (s)		PAPAR DE YERS			
Dual Entry	Yes	Yes	Yes	Yes	
Inhibit Max	Yes	Yes	Yes	Yes	
Start Time (s)	0	25	0	25	
End Time (s)	25	0	25	0	
Yield/Force Off (s)	22	42	22	42	
Yield/Force Off 170(s)	22	42	22	42	
Local Start Time (s)	0	25	0	25	
Local Yield (s)	22	42	22	42	
Local Yield 170(s)	22	42	22	42	
Intersection Summary					

Cycle Length 45
Control Type Actuated-Uncoordinated
Natural Cycle 40

Splits and Phases: 3: HIGHLAND & WILLOW

↑ ø2	— ▶ ø4
25 \$	20 s
↓ ø6	⋖
25 s	20 s



Lane Group	EBL	EBT	WBR	NBT	
Lane Group Flow (vph)	47	164	124	204	
v/c Ratio	0.06	0.21	0.15	0.27	
Control Delay	6.9	7.9	0.4	8.4	
Queue Delay	0.0	0.0	0.0	0.0	
Total Delay	6.9	7.9	0.4	8.4	
Queue Length 50th (ft)	5	20	0	26	
Queue Length 95th (ft)	17	44	0	54	
Internal Link Dist (ft)		537		508	
Turn Bay Length (ft)	100				
Base Capacity (vph)	745	784	815	758	
Starvation Cap Reductn	0	0	0	0	
Spillback Cap Reductn	0	0	10	0	
Storage Cap Reductn	0	0	0	0	
Reduced v/c Ratio	0.06	0.21	0.15	0.27	
Intersection Summary					

				_	4-	4	-	+	_	<u> </u>		_
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	下 下	<u></u>	LUIT	WUL	1101	7 7	1100	A A	HOIS		<u> </u>	<u> </u>
Volume (vph)	43	151	0	0	0	114	0	142	46	. : : : <u>:</u> : <u>0</u>	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	,000			4.0		3.0	age a fi		Vestina.	
Lane Util. Factor	1.00	1.00				1.00		1.00				
Frt Santana	1.00	1.00			1000	0.86		0.97				
FIt Protected	0.95	1.00				1.00		1.00				
Satd. Flow (prot)	1770	1863				1611		1801				
Flt Permitted	0.95	1.00				1.00		1.00				
Satd. Flow (perm)	1770	1863				1611		1801				
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)	47	164	0	0	0	124	0	154	50	0		0
RTOR Reduction (vph)	0	0	0	0	0	124	0	0	0	0	0	0
Lane Group Flow (vph)	47	164	0	0	0	0	0	204	0	0	30386 0 3	0
Turn Type	Perm					NA	**. ***. * **. ***.					······································
Protected Phases		4						2				
Permitted Phases	4	·										
Actuated Green, G (s)	16.0	16.0				0.0		16.0				
Effective Green, g (s)	16.0	16.0				0.0		16.0				
Actuated g/C Ratio	0.42	0.42				0.00		0.42				
Clearance Time (s)	3.0	3.0						3.0				
Lane Grp Cap (vph)	745	784				0	1 1971	758				
v/s Ratio Prot		c0.09						c0.11				
v/s Ratio Perm	0.03											
v/c Ratio	0.06	0.21				0.00		0.27				
Uniform Delay, d1	6.5	7.0				19.0		7.2				
Progression Factor	1.00	1.00				1.00		1.00				
Incremental Delay, d2	0.2	0.6				0.0		0.9				
Delay (s)	6.7	7.6				19.0		8.1				
Level of Service	A	Α				В		Α				
Approach Delay (s)		7.4			19.0			8.1			0.0	
Approach LOS		Α			В						 	
Intersection Summary												
HCM Average Control Dela	av V		10.3	Н	CM Level	of Service		120(4)(3)	В			Attach:
HCM Volume to Capacity r	•		0.24									
Actuated Cycle Length (s)			38.0	Sı	um of lost	time (s)			6.0			
Intersection Capacity Utiliz	ation		30.7%		U Level o				Α			
Analysis Period (min)			15									
c Critical Lane Group												

Phase Number 2	4				
Movement NBT	EBTL				
Lead/Lag					
Lead-Lag Optimize	5 7/ 4 4 .		and the second second second		
Recall Mode Max					
Maximum Split (s) 19 Maximum Split (%) 50.0%	19 50.0%				
Minimum Split (s) 19	19				
Yellow Time (s) 2				a gada n kabupatèn	us I Takang na Satat na malina
All-Red Time (s)	1				en plesen enjagtan an een min en en ee
Minimum Initial (s)	345 1				
Vehicle Extension (s) 3	3				
	3 1				
Time Before Reduce (s) 0	0				
Time To Reduce (s) 0 Walk Time (s) 5	0 5				
` '					Andrewski i i i i i i i i i i i i i i i i i i
Dual Entry Yes	Yes				> - CAR DELIXE A CREEK PER CARE
Inhibit Max Yes	Yes		n Augusta and Augusta		
Start Time (s) 0	19				
End Time (s) 19	0				
Yield/Force Off (s) 16	35			erana erre erre erre erre erre erre erre	ar extra a samular samular sam
Yield/Force Off 170(s) 5 Local Start Time (s) 0	24 19				
Local Yield (s) 16	35				
Local Yield 170(s) 5	24				
` '					
Intersection Summary Cycle Length		38			
Control Type	Dr.	etimed			
Natural Cycle	. 1 10	40			
Offset: 0 (0%), Referenced to phase 2	:NBT and 6				
Splits and Phases: 6: SUMMER & V	VILLOW		·····	<u> </u>	
↓ ₀₄		†	ø2		
19 s		198	P.		

		-		1	
Lane Group	EBL	EBT	NET	NER	
Lane Group Flow (vph)	141	149	340	77	
v/c Ratio	0.26	0.33	0.28	0.07	
Control Delay	6.7	34.0	8.5	1.7	
Queue Delay	0.0	0.0	0.0	0.0	一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个
Total Delay	6.7	34.0	8.5	1.7	
Queue Length 50th (ft)	0	80	87	0	
Queue Length 95th (ft)	47	136	130	15	
Internal Link Dist (ft)		92	704		
Turn Bay Length (ft)					
Base Capacity (vph)	540	457	1205	1051	
Starvation Cap Reductn	0	0	0	0	
Spillback Cap Reductn	0	0	0.	0	
Storage Cap Reductn	0	0	0	0	
Reduced v/c Ratio	0.26	0.33	0.28	0.07	en en la participa de la parti
Intersection Summary					

			7		4		**	1	<i></i>		*	*
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	Ps.	^						†	7*	-		
Volume (vph)	130	137	0	0	S-10	0	0	313	71	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	5.5						5.5	5.5			
Lane Util. Factor	1.00	1.00						1.00	1.00			
Frt ANDREAS (FILE)	1.00	1.00						1.00	0.85		334/1881	
Flt Protected	0.95	1.00						1.00	1.00			
Satd. Flow (prot)	1770	1863						1863	1583			
FIt Permitted	0.95	1.00						1.00	1.00			
Satd. Flow (perm)	1770	1863						1863	1583		an Palisha	
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)	141	149	0	0	0	0	0	340	77	0	0	0
RTOR Reduction (vph)	106	0	0	0	0	0	0	0	27	0	0	0
Lane Group Flow (vph)	35	149	0	0	0	0	0	340	50	0.0	0	0
Turn Type	Perm								Perm	******************************		
Protected Phases		4						2	o Pirangana	osastorasta	lakinyésaniput	
Permitted Phases	4								2			
Actuated Green, G (s)	25.0	25.0						66.0	66.0			
Effective Green, g (s)	25.0	25.0						66.0	66.0			
Actuated g/C Ratio	0.25	0.25						0.65	0.65			
Clearance Time (s)	5.5	5.5						5.5	5.5			
Lane Grp Cap (vph)	434	457						1205	1024			
v/s Ratio Prot		c0.08						c0.18				
v/s Ratio Perm	0.02								0.03			
v/c Ratio	0.08	0.33						0.28	0.05			
Uniform Delay, d1	29.6	31.6						7.8	6.6			
Progression Factor	1.00	1.00						1.00	1.00			
Incremental Delay, d2	0.4	1.9						0.6	0.1			
Delay (s)	30.0	33.5						8.4	6.6			
Level of Service	С	С						Α	Α			
Approach Delay (s)		31.8			0.0			8.0			0.0	
Approach LOS		С			Α			Α			. Α	
Intersection Summary												
HCM Average Control Delay			17.8	Н	CM Level	of Service)		В			
HCM Volume to Capacity rati	io		0.29									
Actuated Cycle Length (s)			102.0	St	um of lost	time (s)			11.0			
Intersection Capacity Utilizati	on		32.9%	IC	:U Level o	f Service			Α			
Analysis Period (min)			15									
c Critical Lane Group												

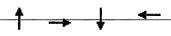
Phase Number	2	4	
Movement	NET	EBTL	
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	Max	Max	
Maximum Split (s)	71.5	30.5	
Maximum Split (%)	70.1%	29.9%	
Minimum Split (s)	25	21.5	The second secon
Yellow Time (s)	3.5	3.5	。
All-Red Time (s)	2 4	2	
Minimum Initial (s) Vehicle Extension (s)	3	3	
Minimum Gap (s)	3	3	
Time Before Reduce (s)	0	0	
Time To Reduce (s)	Ŏ	ŏ	
Walk Time (s)	5	5	
Flash Dont Walk (s)	11	11	
Dual Entry	Yes	Yes	
Inhibit Max	Yes	Yes	atomaka a \$ 1 1 1 1 1 1 1 1 1 1
Start Time (s)	0	71.5	
End Time (s)	71.5	0	
Yield/Force Off (s)	66	96.5	
Yield/Force Off 170(s)	55	85.5	
Local Start Time (s)	0	71.5	
Local Yield (s)	66	96.5	
Local Yield 170(s)	55	85.5	
Intersection Summary			
Cycle Length			102
Control Type		F	Pretimed Pretimed
Natural Cycle			50
Offset: 0 (0%), Reference	d to phase 2:	NET and	6:, Start of Green
Culiforand Discours 4.4		01 144C-0	
Splits and Phases: 14:	SUMMER &	JUITER	



Lane Group	EBT	WBT	NBT	SBT	
Lane Group Flow (vph)	398	373	613	164	
v/c Ratio	0.82	0.58	0.72	0.24	
Control Delay	29.9	14.4	15.3	4.6	
Queue Delay	0.0	0.0	0.0	0.0	
Total Delay	29.9	14.4	15.3	4.6	
Queue Length 50th (ft)	85	65	110	10	
Queue Length 95th (ft)	#204	125	#267	33	
Internal Link Dist (ft)	730	1353	144	546	
Turn Bay Length (ft)					
Base Capacity (vph)	557	739	856	692	
Starvation Cap Reductn	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	
Storage Cap Reductn	0	0	0	0	The state of the s
Reduced v/c Ratio	0.71	0.50	0.72	0.24	
Intersection Summary					

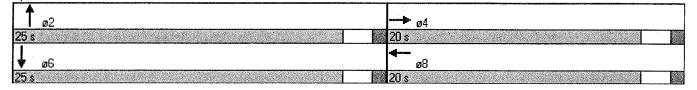
^{# 95}th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

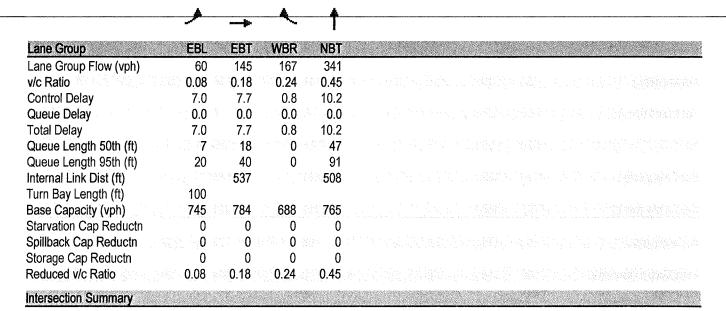
				-	A				
	Y	Y	-	1		/		¥	
Movement EBL EBT	EBR	WBL WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		f *		400	- € }-	70		43-	Surrection on
Volume (vph) 89 277	0	0 278	65	126	365	73	71	0	80
Ideal Flow (vphpl) 1900 1900	1900	1900 1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s) 3.0		3.0			3.0			3.0	
Lane Util. Factor 1.00		1.00			1.00			1.00	
Frt		0.97		AN OF LAME	0.98			0.93	
Flt Protected 0.99		1.00			0.99			0.98	
Satd. Flow (prot) 1840		1815			1810			1690	
FIt Permitted 0.75		1.00			0.90			0.73	de sier da
Satd. Flow (perm) 1401		1815	<u> </u>		1642			1265	
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) 97 301	0	0 302	71	137	397	79	77	0	87
RTOR Reduction (vph) 0 0	0	0 20	0	0	11	0	0	42	0
Lane Group Flow (vph) 0 398	0	0 353	0	0	602	0	0	122	0
Turn Type Perm				Perm			Perm		
Protected Phases 4		8 / 18 / 18 / 18 / 18			2			6	
Permitted Phases 4				2			6		
Actuated Green, G (s) 14.8		14.8			22.1			22.1	
Effective Green, g (s) 14.8		14.8			22.1			22.1	
Actuated g/C Ratio 0.34		0.34			0.52			0.52	
Clearance Time (s) 3.0		3.0			3.0			3.0	
Vehicle Extension (s) 3.0		3.0	Y.	200	3.0	ŧ, '	198.94	3.0	Majakitataa m
Lane Grp Cap (vph) 483		626			846			652	
v/s Ratio Prot		0.19							
v/s Ratio Perm c0.28				(0.37			0:10	
v/c Ratio 0.82		0.56			0.71			0.19	
Uniform Delay, d1 12.9		11.4			8.0			5.6	
Progression Factor 1.00		1.00			1.00			1.00	
Incremental Delay, d2 10.9		1.2			5.0			0.6	
Delay (s) 23.8		12.6			13.0			6.2	
Level of Service C		В			В			Α	
Approach Delay (s) 23.8		12.6			13.0			6.2	
Approach LOS C		В			В			Α	
Intersection Summary									
HCM Average Control Delay	15.0	HCM Leve	el of Servic	е		В			
HCM Volume to Capacity ratio	0.76	jardi rejak — Best							
Actuated Cycle Length (s)	42.9	Sum of los	st time (s)			6.0			
Intersection Capacity Utilization	80.7%	ICU Level				D			
Analysis Period (min)	15								
c Critical Lane Group									



Phase Number	2	4	6	8	The state of the s
Movement	NBTL	EBTL	SBTL	WBT	
Lead/Lag			i de la composição de la c		
Lead-Lag Optimize					
Recall Mode	Max	None	Max	None	
Maximum Split (s)	25	20	25	20	
Maximum Split (%)	55.6%	44.4%	55.6%	44.4%	建筑中的设计的设计设计的 中国的自由的 电双线电影电影
Minimum Split (s)	17	9	17	9	
Yellow Time (s)	2	2	2	2	2000年中国中国中国中国共和国共和国中国中国中国中国中国中国中国中国中国中国中国中国中国
All-Red Time (s) Minimum Initial (s)	 	4	1 4	1	and services the comment of the comment of the property of the comment of the com
Vehicle Extension (s)	3	3	3	3	
Minimum Gap (s)	3 3	3	•	3	
Time Before Reduce (s)	n	0	0	0	2. 1985 1. 1 1. 1 1. 1 1. 1 1. 1 1. 1 1. 1 1.
Time To Reduce (s)	adi kaca o a	0	0	Ő	where the production of the pr
Walk Time (s)	National Contract	September 1997	alaan Soor Jo	ra ir. i sul t u	的现在分词 "我们就是我们的,我们就是我们的人,我们就是我们的人,我们就是我们的人,我们就是我们的人,我们就是我们的人,我们就是我们的人,我们就是我们的人,我们 "我们就是我们的人,我们就是我们的人,我们就是我们的人,我们就是我们的人,我们就是我们的人,我们就是我们的人,我们就是我们的人,我们就是我们的人,我们就是我们的
Flash Dont Walk (s)					
Dual Entry	Yes	Yes	Yes	Yes	
Inhibit Max	Yes	Yes	Yes	Yes	
Start Time (s)	0	25	0	25	
End Time (s)	25	0	25	0	
Yield/Force Off (s)	22	42	22	42	
Yield/Force Off 170(s)	22	42	22	42	
Local Start Time (s)	0	25	0	25	
Local Yield (s)	22	42	22	42	
Local Yield 170(s)	22	42	22	42	
Intersection Summary					1000
Cycle Length			45		
Control Type	Actuate	d-Uncoo	rdinated		
Natural Cycle			45		

3: HIGHLAND & WILLOW Splits and Phases:





			->	_	4	4	-		-		+	4
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ች	<u> </u>	LDIT	1100	1101	**	1100	<u> </u>	34014	UUL	00,	0011
Volume (vph)	55	133	0 44,00	0	0.0	154	0	256	58	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	1000	1000	1000	4.0		3.0		1000		1000
Lane Util. Factor	1.00	1.00				1.00		1.00				
Frt 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.00	1.00				0.86		0.98				
Flt Protected	0.95	1.00				1.00		1.00		818/128	est est in entire to the con-	
Satd. Flow (prot)	1770	1863				1611		1816				
Flt Permitted	0.95	1.00				1.00		1.00				att extension
Satd. Flow (perm)	1770	1863				1611		1816				Barbilo (a)
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)	60	145	0	0	0	167	0	278	63			0
RTOR Reduction (vph)	0	0	0	0	0	167	0	0	0	0	0	0
Lane Group Flow (vph)	60	145	0	0	10.0		0		0	0	April 1984 11 12 13	0
Turn Type	Perm					NA	7		***************			
Protected Phases	ing phagainth	4					\$100 \$100 \$100 \$100 \$100 \$100 \$100 \$100	2		Sign by using the		
Permitted Phases	4											
Actuated Green, G (s)	16.0	16.0				0.0		16.0				
Effective Green, g (s)	16.0	16.0				0.0		16.0				
Actuated g/C Ratio	0.42	0.42				0.00		0.42				
Clearance Time (s)	3.0	3.0						3.0				
Lane Grp Cap (vph)	745	784				0	***	765				
v/s Ratio Prot		c0.08						c0.19				
v/s Ratio Perm	0.03											
v/c Ratio	0.08	0.18				0.00		0.45				
Uniform Delay, d1	6.6	6.9				19.0		7.8				
Progression Factor	1.00	1.00				1.00		1.00				
Incremental Delay, d2	0.2	0.5				0.0		1.9				
Delay (s)	6.8	7.4				19.0		9.7				
Level of Service	Α	Α				В		Α				
Approach Delay (s)		7.2			19.0			9.7			0.0	
Approach LOS		Α			В			Α			Α	
Intersection Summary												
HCM Average Control De	lay		11.2	Н	CM Level o	f Servi	ce		В			
HCM Volume to Capacity	ratio		0.32									
Actuated Cycle Length (s			38.0	S	um of lost ti	me (s)			6.0			
Intersection Capacity Utili	zation		39.9%	IC	CU Level of	Service	Э		Α			
Analysis Period (min)			15									
 c Critical Lane Group 												

General Informat	ion		Sita In	formation		######################################	
ochorar mnormat	IOH		***************************************		144	·· 5 · /6	
Analyst	DI		Intersed Jurisdic	The second secon	West S Somerv	ite Drive/S	ummer .
Agency/Co.	DCI		Analysi	A CONTRACT OF THE PARTY OF THE	2014	'IIIe	***
Date Performed	6/7/2010)		5 Teal		mmer Stre	ot -
Analysis Time Period	PM Peal		Project	ID		ad 2014 Bi	
	-				Conditio	nditions	
East/West Street: Su			North/So	outh Street: 1	Nest Site Drive		
ntersection Orientatio	n: <i>East-West</i>			eriod (hrs): 0	THE RESERVE OF THE PERSON NAMED IN COLUMN 2 IS NOT THE OWNER.		
/ehicle Volumes	and Adjustm	ents					
/lajor Street		Eastbound			Westbo	ound	
/lovement	1	2	3	4	5		6
	L	Τ	R	L	T		R
/olume	11	213	0	0	0		0
eak-Hour Factor, PH		0.90	1.00	1.00	1.00	***************************************	1.00
lourly Flow Rate, HFF		236	0	0	0		0
ercent Heavy Vehicle	s 1			0			
ledian Type			THE PERSON NAMED IN COLUMN	Jndivided		ananan kanan k	William Company
T Channelized			0				0
anes	0	1	0	0	0		0
onfiguration	LT						
pstream Signal		1			<u> </u>		
linor Street		Northbound	70 TOWN STATE OF THE PERSON STATE OF THE PERSO		and the second s	Southbound	
ovement	7	8	9	10	11		12
		T	R	L	T		R
olume	0	0	0	5	0		0
eak-Hour Factor, PHF ourly Flow Rate, HFR	CONTRACTOR OF THE PROPERTY OF	1.00	1.00	0.90	Name and Address of the Owner, which the Party of the Owner, which the Own		1.00
ercent Heavy Vehicles	and the second s	0	0	5	0		0
ercent Grade (%)	5 <i>U</i>		0	0	0		0
		0			0		
ared Approach		N			N		
Storage	wal or the second	0			0		
Γ Channelized			0				0
ines	0	0	0	0	1		0
onfiguration				<u>LT</u>			
elay, Queue Length,	and Level of Se	ervice				APP - 100 -	
proach	EB	WB	No	rthbound		Southbour	ıd
ovement	1	4	7	8	9 10	11	12
ne Configuration	LT	THE STATE OF THE S			LT	***************************************	*
vph)	12				5	***************************************	1
	1630				728		†
(m) (vph)	0.01				0.01		-
% queue length	0.02				0.02		
ntrol Delay	7.2				10.0-		
S	A A					***************	
				<u> </u>	A	100	<u></u>
proach Delay	1					10.0-	

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	TV	O-WAY STO	P CONTR	ROL S	UMMAR	Y	BANGURAN SANTAN SAN		
General Informat	ion		Site	Infori	nation	**************************************	***************************************		
·				ection		West S	ite Drive/S	Summer St	
Analyst	DI			diction	Constitution of the second	Somerv		diffillior Ot	
Agency/Co.	DCI			sis Ye	ar	2014			
Date Performed	6/7/201	OF COMPANY OF THE PARTY OF THE		THE REPORT OF THE PARTY OF THE			nmer Stre	et -	
Analysis Time Period	AM Pea	k	Proje	ct ID		Projecte	Projected 2014 Build		
						Conditio	Conditions		
East/West Street: Su			North/	South	Street: W	est Site Drive	ite Drive		
Intersection Orientation	n: East-West		Study	Period	(hrs): 0.2	25			
Vehicle Volumes	and Adjustm	nents	and the first of the second second second		Security of the second security of	and the second of the second o		tari da mangan da ili da babanan	
Major Street		Eastbound		gradient stranschaft and		Westbo	ound		
Movement	1	2	3		4	5		6	
	L	T	R		L	T		R	
Volume	2	221	0		0	0		0	
Peak-Hour Factor, PH		0.90	1.00)	1.00	1.00		1.00	
Hourly Flow Rate, HFF		245	0	***************************************	0	0		0	
Percent Heavy Vehicle	s 1			11!	0 .idad				
Median Type RT Channelized				Undi	/iaea	······································		^	
Lanes	0	1	0		^			0	
Configuration	LT		0	***************************************	0	0		0	
Upstream Signal	<u> </u>	1				0		or only the contract of	
Minor Street		Northbound	Market State			Contract to the contract to th		engle to the State of the State	
Movement	7	8	1 9		10	Southbo	ouna	12	
MOVEMEN	Ĺ	T T	R	***************************************	L	T		- 12 R	
Volume	0	<i>i</i>	1 0	***************************************	12	<u> </u>		0	
Peak-Hour Factor, PHF		1.00	1.00)	0.90	0.90		1.00	
Hourly Flow Rate, HFR		0	0		13	0.00		0	
Percent Heavy Vehicles		0	0	***************************************	0	0	**************************************	0	
Percent Grade (%)		0	Control on the Control of the Contro		THE PERSON NAMED IN COLUMN TWO	0	***************************************	***********	
Flared Approach		N				l N		NAME OF THE OWNER OF THE OWNER, T	
Storage		0				0			
RT Channelized			0					0	
Lanes	0	0	0		0	1		0	
Configuration					LT		***************************************	V	
Delay, Queue Length,	and Level of S			<u> </u>					
Approach	EB	WB	N.	Vorthbo	und		Southbour	nd	
Movement	1	4 4	7	8	9				
Lane Configuration	LT	*-j	/	O	9	10	11	12	
	**************************************					LT			
v (vph)	2					13			
C (m) (vph)	1630	AND A COLUMN TO SERVICE AND A SECURE ASSESSMENT AND A SECURE ASSESSMENT ASSES		oooosaanoenaana		743			
v/c	0.00					0.02	***************************************		
95% queue length	0.00			management of the contract of	******	0.05			
Control Delay	7.2					9.9			
LOS	Α					A			
Approach Delay	Par 100						9.9		
Approach LOS			Ургания в портого в поставления в поставлени		Weilers of rober to company years to		Α		
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HCS2000[™]

General Informat	ion		Site Inf	ormation				
Analyst	[D]		Intersect	on	Fast Si	te Drive/S	ummer S	
Agency/Co.	DI DCI		Jurisdicti	White the same of	Somen	TOTAL CONTRACTOR OF THE PARTY O	annior C	
Date Performed	6/7/201	10	Analysis	Year	2014	With the second state of the second		
Analysis Time Period	PM Pe		Project II)	351 Su	mmer Stre	et - Proje	
					2014 N	o-Build Co	onditions	
East/West Street: Su			North/Sou	ıth Street: <i>East</i>	Site Drive	ite Drive		
Intersection Orientatio	and the state of t		Study Per	iod (hrs): 0.25				
Vehicle Volumes	and Adjustr							
Major Street		Eastbound	THE RESERVE THE PARTY OF THE PA		Westbo	ound		
Movement	1	2	3	4	5		6	
Volume	L L	T	R	L	Т		R	
Peak-Hour Factor, PH	0 F 0.90	181 0.90	20	0	0		0	
lourly Flow Rate, HFF		201	1.00 20	1.00	1.00		1.00	
Percent Heavy Vehicle			20	0	0		0	
Median Type				ndivided				
RT Channelized			1 0	I			0	
anes.	0	1	0	0	0		0	
Configuration	LTR						***************************************	
Jpstream Signal		1			0	****		
/linor Street		Northbound			Southbo	Southbound		
/lovement	7	8	9	10	11		12	
	L	Т	R	L	Т		R	
olume	0	0	0	7	6		0	
eak-Hour Factor, PHF	COLUMN TO THE OWNER OF THE OWNER O	1.00	1.00	0.90	0.90		1.00	
lourly Flow Rate, HFR		0	0	7	6		0	
ercent Heavy Vehicles	3 0	0	1 0	0	0		0	
ercent Grade (%)		0			0	***************************************		
lared Approach		N			N			
Storage		0			0			
T Channelized			0				0	
anes	0	0	0	0	1		0	
onfiguration				<u>LT</u>				
elay, Queue Length,	The second second second second second	The state of the s						
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ion		Site	nform	ation				
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	TV	VO-WAY STO	P CONT	ROL S	UMMARY			
General Informat	ion		Site	Inform	nation			
			Intersection			East Site Drive/Summer St		
Analyst Agency/Co.	DI DCI	BOOMS and a standard books are a standard and a second	Jurisdiction		iii ta'an maata sa ba'a ba'a ah	Somerville		
Date Performed		6/7/2010		Analysis Year		2014		
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		^		:C(1D		2014 Bu	ıild Condit	ions
East/West Street: Su					Street: <i>East</i>	Site Drive		
Intersection Orientatio			Study	Period	(hrs): 0.25		The second secon	
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Major Street		Eastbound				Westbound		
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Volume	17	210	F 0		<u>L</u> 0	T 0		R 0
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Median Type		Undivided						
RT Channelized						1 0		0
Lanes	0	1	0		0	0		
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Upstream Signal		1				0		
Minor Street		Northbound				Southbound		
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	L	Т	R		L	Т		R
Volume	0	0	0		5	0 0		
Peak-Hour Factor, PHF		1.00	1.00		0.90	0.90 1.00		
Hourly Flow Rate, HFR		0	0		5	-	0 0	
Percent Heavy Vehicles	s 0	0	0		0			0
Percent Grade (%)		0		<u> </u>		0		
Flared Approach		N N				N		
Storage		0				0		*****************************
RT Channelized			0	****	namaphy victora so palental transmission scools com-			0
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Approach	EB	WB	Northb				Southbound	
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT			0.000 Marian		LT		
v (vph)	18			****		5	***************************************	
C (m) (vph)	1630					717		
v/c	0.01			22240247247277**************************		0.01		
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