

**CONLEY**  
**ASSOCIATES**

**Memorandum**

To: Town of Wellesley Planning Board  
From: Ms. Jennifer Conley, P.E, AICP, PTOE  
CC: Mr. Mark Paris, Mr. Jack O'Neill, Mr. Bob Davis, Mr. Peter Tamm  
Date: December 7, 2007  
Re: Additional Information Requested by BETA

Conley Associates, Inc. attended a meeting on October 12, 2007 with project team members as well as Town of Wellesley officials and their consultant, the BETA Group (BETA). During the meeting, BETA requested particular information at certain intersections that were not originally included in the study area or information for other peak periods than are not typically studied. Conley Associates, Inc. has investigated each of these items and provides the information below.

**Analysis at the Intersection of Walnut Street at River Street and Cedar Street**

BETA requested that Conley Associates, Inc. conduct analysis at the intersection of Walnut Street at River Street and Cedar Street with the indication that BETA would provide the appropriate peak hour traffic volume data. Conley Associates, Inc. received 2005 weekday AM and weekday PM peak hour Turning Movement Count (TMC) traffic volumes from BETA on Friday, November 16, 2007.

Although the project is only expected to send six vehicle trips (or less) onto River Street during the peak hours analyzed, Conley Associates, Inc. conducted intersection analysis at the intersection of Walnut Street at River Street and Cedar Street. Conley Associates, Inc. conducted a field visit to the intersection in November of 2007 to review the existing conditions at the intersection.

The intersection of Walnut Street at River Street and Cedar Street is a four way, signalized intersection. Walnut Street approaches the intersection from the north and the south, River Street approaches the intersection from the west, and Cedar Street approaches the intersection from the east. The northbound and southbound approaches of Walnut Street as well as the eastbound approach of River Street each consist of a single, all-purpose lane. The westbound approach of Cedar Street consists of a shared left and through lane as well as a dedicated right turn only lane. A concrete island separates eastbound and westbound traffic on Cedar Street. Crosswalks are located on each leg of the intersection.

The 2005 weekday AM and weekday PM peak hour traffic volumes were adjusted to a 2007 Existing condition (increased one percent per year and balanced to the traffic volumes collected at the intersection of Washington Street at River Street) and then projected for a five year horizon to a 2012 No Build and Build condition following the same steps as outlined in the

*No Shift Count?*  
*Cedar St. add.*  
*Walnut St. add.*  
*not add.*  
*done*  
*SAC/HR*

November 2007 Traffic Impact Study for this project. Intersection operational analysis was conducted at the intersection of Walnut Street at River Street and Cedar Street for the peak periods which TMC data was supplied by BETA. The analysis results are shown in Table 1 below.

**Table 1: Intersection Operations Analysis Summary**

Location/Peak Hour	2007 Existing		2012 No Build		2012 Build	
	LOS <sup>1</sup>	Delay <sup>2</sup>	LOS	Delay	LOS	Delay
<b>Walnut Street at River Street and Cedar Street</b>						
Weekday AM Peak Hour	B	17.3	B	18.3	B	18.4
Weekday PM Peak Hour	D	37.7	D	41.6	D	41.8

As shown, the proposed redevelopment is expected to have an unperceivable impact on the intersection of Walnut Street at River Street and Cedar Street. This intersection is currently operating at LOS D or better during the weekday peak periods and is expected to continue to operate at the same LOS during the respective peak periods.

**Washington Street at Concord Street and Washington Street at Grove Street**

During the meeting, BETA requested that Conley Associates, Inc. review the queuing along Washington Street in the vicinity of Concord Street, although this intersection is located in the City of Newton. This review was sought to understand how any future signalization of intersections in the corridor might affect queue lengths at these intersections.

Conley Associates, Inc. reviewed queuing on Washington Street westbound between Concord Street and Grove Street during the weekday AM, weekday PM, and Saturday midday peak periods. Washington Street westbound consists of two lanes between Grove Street and Concord Street and then transitions to one through lane west of River Street. Washington Street eastbound consists two through lanes between Concord Street and Grove Street, however as it approaches Concord Street it consists of a through lane and a dedicated left turn lane (for turns onto Concord Street). Washington Street has two lanes in both the eastbound and westbound direction east of Grove Street (towards I-95/Route 128).

*day of week?*

*striped as single lane west of Concord*

Conley Associates, Inc. observed the length of the westbound queue along Washington Street, noted if the queue extended past Grove Street, and also noted whether the queue was able to clear out after one cycle or not. The queue lengths were noted approximately once per minute during the weekday AM, weekday PM, and Saturday midday peak periods.

During the weekday AM peak period, Washington Street westbound at the Concord Street intersection had an average queue of five vehicles with a maximum queue of 13 vehicles. The queue of vehicles on Washington Street westbound was observed to extend past Grove Street approximately 10 times (only eight percent of the time) over the course of the weekday AM peak period. The backups past Grove Street were generally caused by a large number of turns into and out of a Starbucks located directly across from Grove Street.

During the weekday PM peak period Washington Street westbound had an average queue of eight vehicles with a maximum queue of 22 vehicles. It was observed that the queue on Washington Street westbound generally extended past Grove Street between 5:30 PM and 6:00 PM. It was observed that operationally, the signal at Concord Street was performing adequately, however the backups were caused by the transition of two through lanes to one through lane, which occurs west of Concord Street. As mentioned above, Washington Street westbound transitions from two through lanes to just one through lane west of Concord Street. In addition, vehicles on Washington Street westbound (west of Concord Street) also queue up to turn left onto River Street, which further complicates the transition (in the westbound direction, the intersection of Washington Street at River Street operates as one through lane a separate left turn lane). Because of these maneuvers, vehicles on Washington Street westbound would back up through the signal at Concord Street and consequently, vehicles queued east of Concord Street were not able to get through the signal in one cycle. *contradicting*

During the Saturday midday peak period, the average queue on Washington Street westbound was three vehicles and the maximum queue was 12 vehicles. The westbound queue on Washington Street did not extend past Grove Street at all during this time period.

Overall, there were not extensive backups on Washington Street westbound during the weekday AM and Saturday midday peak periods. During the weekday PM peak hour, the backups on Washington Street westbound were primarily due to the transition of two through lanes to one through lane west of Concord Street (and the left turns from Washington Street westbound onto River Street southbound).

The proposed mitigation discussed in the November 2007 Traffic Impact Study includes the signalization of the intersection of Washington Street at River Street. The main benefit of this signalization is the reduction of delays and queue lengths on River Street approaching Washington Street. However, the coordination of the two signalized intersection will also optimize the traffic flow along Washington Street in this vicinity. Therefore, it is expected that during the weekday PM peak hour the westbound traffic volume is expected to be able to move more efficiently through the corridor. *NOT!* →

### **Data Collection at the intersections of Washington Street at Ledyard Street and Washington Street at Columbia Street During the School Peak Hour**

St. John the Evangelist School is located between the intersections of Washington Street at Ledyard Street and Washington Street at Columbia Street. St. John School teaches classes for kindergarten through sixth grade. Dismissal occurs at 2:15 PM on Tuesdays and Thursdays and at 11:30 on Wednesdays.

Although Conley Associates, Inc. included the intersections of Washington Street at Ledyard Street and Washington Street at Columbia Street in our study area; BETA requested that additional traffic volume data be collected at these intersections during the afternoon school peak. Therefore, Conley Associates, Inc. collected turning movement data on Ledyard Street and Columbia Street between 2:00 PM and 3:30 PM on Thursday, November 8, 2007 and Thursday, November 15, 2007. Conley Associates, Inc. monitored all pick-up activity, pedestrian activity, and bus activity during this time period. *NOTED*

The majority of students were picked up after school (parents have to turn into the school via Columbia Street, line up in the parking lot to wait for students, and exit the lot via Ledyard Street). However, the school also had one bus that took students home and approximately eight students were observed walking home.

The school crossing guard arrived at the school parking lot slightly before 2:15 PM. The school had one bus picking up students at about 2:15 PM. At 2:20 PM, the crossing guard crossed approximately seven students on Washington Street. Between 2:21 PM and 2:22 PM the crossing guard stopped vehicular traffic in both directions along Washington Street to allow approximately 40 vehicles to exit the school lot and turn onto Washington Street (the crossing guard allowed approximately 20 vehicles out at a time between 2:21 PM and 2:22 PM). The crossing guard left the school at 2:26 PM. Only one other pedestrian was observed walking on Ledyard Street between 2:27 PM and 3:30 PM. Between 2:41 PM and 2:57 PM approximately eight cars left the school parking lot, turned onto Ledyard Street, and then turned either left or right onto Washington Street. These vehicles did not experience any significant delays or backups during this time period.

● Overall, the backups on Washington Street at this time were a direct result of the crossing guard stopping traffic to allow vehicles to exit the St. John school between 2:21 PM and 2:22 PM. By approximately 2:28 PM, traffic was flowing freely along Washington Street. The traffic volumes turning onto and off of Ledyard Street and Columbia Streets during the school peak hour were lower than those counted during the weekday AM peak hour. Therefore, Conley Associates, Inc. does not believe that additional analysis at these intersections is necessary at this time.

### **Pedestrian Crosswalks**

Conley Associates, Inc. conducted pedestrian counts within the study area. Counts were conducted during the weekday PM peak period (4:00 PM to 6:00 PM) between Tuesday, November 6, 2007 and Thursday, November 8, 2007. Pedestrian crossings were located along Washington Street near Mica Lane, between Ledyard Street and Glen Road, between Crescent Street and Orchard Street, and near Walnut Street.

*via ped  
between  
Bay  
State Rd  
&  
Hillside  
Rd*

The crosswalk at Mica Lane was the busiest crossing with a peak hour volume of 40 pedestrians between 5:00 PM and 6:00 PM. The crosswalk between Ledyard Street and Glen Road had a peak hour crossing volume of 10 pedestrians (between 4:00 PM and 5:00 PM). The crosswalk between Crescent Street and Orchard Street had no pedestrians between 4:00 PM and 6:00 PM and the crosswalk at Walnut Street only had one pedestrian crossing between 4:00 PM and 6:00 PM. All of the pedestrian crossings along Washington Street in the study area appeared to operate safely during the weekday PM peak period.

### **Sidewalk Survey**

Conley Associates, Inc. inventoried the existing sidewalk network within approximately 600 feet of the site located at 27 Washington Street and along study area roadways. The results of this survey are included as part of the PSI submission in a separate memorandum dated December 1, 2007 entitled, "Pedestrian and Bicycle Safety".

Conley Associates, Inc. attended a meeting on October 12, 2007 with project team members as well as Town of Wellesley officials and their consultant, the BETA Group (BETA). During the meeting, BETA requested additional information that had not been included in the preliminary Traffic Impact Study. As shown, Conley Associates, Inc. has adequately addressed each of these additional traffic items that were raised.

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50	50	50	50		50	50	
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988				0.850		0.951			0.993	
Flt Protected		0.992			0.990			0.996			0.961	
Satd. Flow (prot)	0	1826	0	0	1844	1583	0	1764	0	0	1778	0
Flt Permitted		0.928			0.916			0.953			0.445	
Satd. Flow (perm)	0	1708	0	0	1706	1583	0	1688	0	0	823	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7				568		60			6	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		775			810			500			499	
Travel Time (s)		17.6			18.4			11.4			11.3	
Volume (vph)	18	89	11	58	234	668	39	284	183	287	52	18
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	19	92	11	60	241	689	40	293	189	296	54	19
Lane Group Flow (vph)	0	122	0	0	301	689	0	522	0	0	369	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Detector Phases	4	4		8	8	8	2	2		6	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Minimum Split (s)	22.0	22.0		22.0	22.0	22.0	22.0	22.0		22.0	22.0	
Total Split (s)	30.0	30.0	0.0	30.0	30.0	30.0	50.0	50.0	0.0	50.0	50.0	0.0
Total Split (%)	37.5%	37.5%	0.0%	37.5%	37.5%	37.5%	62.5%	62.5%	0.0%	62.5%	62.5%	0.0%
Maximum Green (s)	24.0	24.0		24.0	24.0	24.0	44.0	44.0		44.0	44.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Recall Mode	None	None		None	None	None	Max	Max		Max	Max	
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0	11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	
Act Effct Green (s)		19.5			19.5	19.5		46.3			46.3	
Actuated g/C Ratio		0.26			0.26	0.26		0.63			0.63	
v/c Ratio		0.27			0.67	0.82		0.48			0.71	
Control Delay		21.1			31.7	14.4		9.2			21.1	
Queue Delay		0.0			0.0	0.0		0.0			0.0	
Total Delay		21.1			31.7	14.4		9.2			21.1	
LOS		C			C	B		A			C	
Approach Delay		21.1			19.6			9.2			21.1	
Approach LOS		C			B			A			C	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)		41			122	44		98			100	
Queue Length 95th (ft)		81			200	183		207			#301	
Internal Link Dist (ft)		695			730			420			419	
Turn Bay Length (ft)												
Base Capacity (vph)		560			554	898		1080			518	
Starvation Cap Reductn		0			0	0		0			0	
Spillback Cap Reductn		0			0	0		0			0	
Storage Cap Reductn		0			0	0		0			0	
Reduced v/c Ratio		0.22			0.54	0.77		0.48			0.71	

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 73.8

Natural Cycle: 60

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.82

Intersection Signal Delay: 17.3

Intersection LOS: B

Intersection Capacity Utilization 85.3%

ICU Level of Service E

Analysis Period (min) 15

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: River St & Walnut Street

	ø2			ø4
50 s			30 s	
	ø6			ø8
50 s			30 s	

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50	50	50	50		50	50	
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frnt		0.988				0.850		0.951			0.993	
Flt Protected		0.992			0.990			0.996			0.961	
Satd. Flow (prot)	0	1826	0	0	1844	1583	0	1764	0	0	1778	0
Flt Permitted		0.928			0.916			0.951			0.439	
Satd. Flow (perm)	0	1708	0	0	1706	1583	0	1685	0	0	812	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6				560		60			6	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		775			810			500			499	
Travel Time (s)		17.6			18.4			11.4			11.3	
Volume (vph)	18	91	11	59	239	681	40	290	187	293	53	18
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	19	94	11	61	246	702	41	299	193	302	55	19
Lane Group Flow (vph)	0	124	0	0	307	702	0	533	0	0	376	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Detector Phases	4	4		8	8	8	2	2		6	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Minimum Split (s)	22.0	22.0		22.0	22.0	22.0	22.0	22.0		22.0	22.0	
Total Split (s)	30.0	30.0	0.0	30.0	30.0	30.0	50.0	50.0	0.0	50.0	50.0	0.0
Total Split (%)	37.5%	37.5%	0.0%	37.5%	37.5%	37.5%	62.5%	62.5%	0.0%	62.5%	62.5%	0.0%
Maximum Green (s)	24.0	24.0		24.0	24.0	24.0	44.0	44.0		44.0	44.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Recall Mode	None	None		None	None	None	Max	Max		Max	Max	
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0	11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	
Act Effct Green (s)		19.9			19.9	19.9		46.2			46.2	
Actuated g/C Ratio		0.27			0.27	0.27		0.62			0.62	
v/c Ratio		0.27			0.67	0.84		0.50			0.74	
Control Delay		21.2			31.7	16.0		9.6			23.2	
Queue Delay		0.0			0.0	0.0		0.0			0.0	
Total Delay		21.2			31.7	16.0		9.6			23.2	
LOS		C			C	B		A			C	
Approach Delay		21.2			20.8			9.6			23.2	
Approach LOS		C			C			A			C	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)		42			125	52		104			107	
Queue Length 95th (ft)		82			204	#208		214			#313	
Internal Link Dist (ft)		695			730			420			419	
Turn Bay Length (ft)												
Base Capacity (vph)		559			554	892		1073			508	
Starvation Cap Reductn		0			0	0		0			0	
Spillback Cap Reductn		0			0	0		0			0	
Storage Cap Reductn		0			0	0		0			0	
Reduced v/c Ratio		0.22			0.55	0.79		0.50			0.74	

Intersection Summary

Area Type: Other  
 Cycle Length: 80  
 Actuated Cycle Length: 74.2  
 Natural Cycle: 60  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.84  
 Intersection Signal Delay: 18.3  
 Intersection Capacity Utilization 86.8%  
 Analysis Period (min) 15  
 Intersection LOS: B  
 ICU Level of Service E  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 1: River St & Walnut Street

↑ ø2	→ ø4
50 s	30 s
↓ ø6	← ø8
50 s	30 s

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50	50	50	50		50	50	
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr't		0.988				0.850		0.951			0.993	
Flt Protected		0.993			0.990			0.996			0.961	
Satd. Flow (prot)	0	1828	0	0	1844	1583	0	1764	0	0	1778	0
Flt Permitted		0.930			0.916			0.951			0.439	
Satd. Flow (perm)	0	1712	0	0	1706	1583	0	1685	0	0	812	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6				560		60			6	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		775			810			500			499	
Travel Time (s)		17.6			18.4			11.4			11.3	
Volume (vph)	18	94	11	59	241	681	40	290	187	293	53	18
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	19	97	11	61	248	702	41	299	193	302	55	19
Lane Group Flow (vph)	0	127	0	0	309	702	0	533	0	0	376	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Detector Phases	4	4		8	8	8	2	2		6	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Minimum Split (s)	22.0	22.0		22.0	22.0	22.0	22.0	22.0		22.0	22.0	
Total Split (s)	30.0	30.0	0.0	30.0	30.0	30.0	50.0	50.0	0.0	50.0	50.0	0.0
Total Split (%)	37.5%	37.5%	0.0%	37.5%	37.5%	37.5%	62.5%	62.5%	0.0%	62.5%	62.5%	0.0%
Maximum Green (s)	24.0	24.0		24.0	24.0	24.0	44.0	44.0		44.0	44.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Recall Mode	None	None		None	None	None	Max	Max		Max	Max	
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0	11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	
Act Effct Green (s)		20.0			20.0	20.0		46.3			46.3	
Actuated g/C Ratio		0.27			0.27	0.27		0.62			0.62	
v/c Ratio		0.27			0.67	0.84		0.50			0.74	
Control Delay		21.3			31.8	16.0		9.6			23.2	
Queue Delay		0.0			0.0	0.0		0.0			0.0	
Total Delay		21.3			31.8	16.0		9.6			23.2	
LOS		C			C	B		A			C	
Approach Delay		21.3			20.8			9.6			23.2	
Approach LOS		C			C			A			C	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)		43			126	52		104			107	
Queue Length 95th (ft)		84			206	#208		214			#313	
Internal Link Dist (ft)		695			730			420			419	
Turn Bay Length (ft)												
Base Capacity (vph)		560			554	892		1072			508	
Starvation Cap Reductn		0			0	0		0			0	
Spillback Cap Reductn		0			0	0		0			0	
Storage Cap Reductn		0			0	0		0			0	
Reduced v/c Ratio		0.23			0.56	0.79		0.50			0.74	

Intersection Summary

Area Type: Other  
 Cycle Length: 80  
 Actuated Cycle Length: 74.3  
 Natural Cycle: 60  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.84  
 Intersection Signal Delay: 18.4  
 Intersection Capacity Utilization 86.9%  
 Analysis Period (min) 15  
 Intersection LOS: B  
 ICU Level of Service E  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 1: River St & Walnut Street

↑ 2	→ 4
50 s	30 s
↓ 6	← 8
50 s	30 s

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50	50	50	50		50	50	
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.980				0.850		0.940			0.995	
Flt Protected		0.997			0.985			0.997			0.959	
Satd. Flow (prot)	0	1820	0	0	1835	1583	0	1746	0	0	1777	0
Flt Permitted		0.978			0.746			0.960			0.671	
Satd. Flow (perm)	0	1785	0	0	1390	1583	0	1681	0	0	1244	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9				320		58			5	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		775			810			500			499	
Travel Time (s)		17.6			18.4			11.4			11.3	
Volume (vph)	13	166	31	40	91	310	7	63	56	767	106	33
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	13	171	32	41	94	320	7	65	58	791	109	34
Lane Group Flow (vph)	0	216	0	0	135	320	0	130	0	0	934	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Detector Phases	4	4		8	8	8	2	2		6	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Minimum Split (s)	22.0	22.0		22.0	22.0	22.0	22.0	22.0		22.0	22.0	
Total Split (s)	22.0	22.0	0.0	22.0	22.0	22.0	68.0	68.0	0.0	68.0	68.0	0.0
Total Split (%)	24.4%	24.4%	0.0%	24.4%	24.4%	24.4%	75.6%	75.6%	0.0%	75.6%	75.6%	0.0%
Maximum Green (s)	16.0	16.0		16.0	16.0	16.0	62.0	62.0		62.0	62.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Recall Mode	None	None		None	None	None	Max	Max		Max	Max	
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0	11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	
Act Effct Green (s)		15.2			15.2	15.2		64.1			64.1	
Actuated g/C Ratio		0.17			0.17	0.17		0.73			0.73	
v/c Ratio		0.68			0.56	0.59		0.10			1.02	
Control Delay		43.5			42.2	8.8		2.5			50.6	
Queue Delay		0.0			0.0	0.0		0.0			0.0	
Total Delay		43.5			42.2	8.8		2.5			50.6	
LOS		D			D	A		A			D	
Approach Delay		43.5			18.7			2.5			50.6	
Approach LOS		D			B			A			D	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)		108			69	0		10			~568	
Queue Length 95th (ft)		182			126	68		26			#823	
Internal Link Dist (ft)		695			730			420			419	
Turn Bay Length (ft)												
Base Capacity (vph)		364			278	573		1249			914	
Starvation Cap Reductn		0			0	0		0			0	
Spillback Cap Reductn		0			0	0		0			0	
Storage Cap Reductn		0			0	0		0			0	
Reduced v/c Ratio		0.59			0.49	0.56		0.10			1.02	

Intersection Summary

Area Type: Other  
 Cycle Length: 90  
 Actuated Cycle Length: 87.3  
 Natural Cycle: 100  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 1.02  
 Intersection Signal Delay: 37.7  
 Intersection Capacity Utilization 82.8%  
 Analysis Period (min) 15  
 ~ Volume exceeds capacity, queue is theoretically infinite.  
 Queue shown is maximum after two cycles.  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 1: River St & Walnut Street

↑ φ2 68 s		→ φ4 22 s	
↓ φ6 68 s		← φ8 22 s	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50	50	50	50		50	50	
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.980				0.850		0.940			0.995	
Flt Protected		0.997			0.985			0.997			0.959	
Satd. Flow (prot)	0	1820	0	0	1835	1583	0	1746	0	0	1777	0
Flt Permitted		0.978			0.735			0.960			0.670	
Satd. Flow (perm)	0	1785	0	0	1369	1583	0	1681	0	0	1242	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9				326		59			5	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		775			810			500			499	
Travel Time (s)		17.6			18.4			11.4			11.3	
Volume (vph)	13	169	32	41	93	316	7	64	57	782	108	34
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	13	174	33	42	96	326	7	66	59	806	111	35
Lane Group Flow (vph)	0	220	0	0	138	326	0	132	0	0	952	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Detector Phases	4	4		8	8	8	2	2		6	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Minimum Split (s)	22.0	22.0		22.0	22.0	22.0	22.0	22.0		22.0	22.0	
Total Split (s)	22.0	22.0	0.0	22.0	22.0	22.0	68.0	68.0	0.0	68.0	68.0	0.0
Total Split (%)	24.4%	24.4%	0.0%	24.4%	24.4%	24.4%	75.6%	75.6%	0.0%	75.6%	75.6%	0.0%
Maximum Green (s)	16.0	16.0		16.0	16.0	16.0	62.0	62.0		62.0	62.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Recall Mode	None	None		None	None	None	Max	Max		Max	Max	
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0	11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	
Act Effct Green (s)		15.3			15.3	15.3		64.0			64.0	
Actuated g/C Ratio		0.18			0.18	0.18		0.73			0.73	
v/c Ratio		0.69			0.57	0.60		0.11			1.04	
Control Delay		43.9			43.0	8.8		2.5			57.6	
Queue Delay		0.0			0.0	0.0		0.0			0.0	
Total Delay		43.9			43.0	8.8		2.5			57.6	
LOS		D			D	A		A			E	
Approach Delay		43.9			19.0			2.5			57.6	
Approach LOS		D			B			A			E	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)		110			70	0		10			~594	
Queue Length 95th (ft)		185			129	70		26			#847	
Internal Link Dist (ft)		695			730			420			419	
Turn Bay Length (ft)												
Base Capacity (vph)		364			274	577		1247			912	
Starvation Cap Reductn		0			0	0		0			0	
Spillback Cap Reductn		0			0	0		0			0	
Storage Cap Reductn		0			0	0		0			0	
Reduced v/c Ratio		0.60			0.50	0.56		0.11			1.04	

Intersection Summary

Area Type: Other  
 Cycle Length: 90  
 Actuated Cycle Length: 87.4  
 Natural Cycle: 110  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 1.04  
 Intersection Signal Delay: 41.6  
 Intersection Capacity Utilization 88.3%  
 Analysis Period (min) 15

Intersection LOS: D  
 ICU Level of Service E

- ~ Volume exceeds capacity, queue is theoretically infinite.  
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

Splits and Phases: 1: River St & Walnut Street

↑ ø2	→ ø4
68 s	22 s
↓ ø6	← ø8
68 s	22 s

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50	50	50	50		50	50	
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.980				0.850		0.940			0.995	
Flt Protected		0.997			0.985			0.997			0.959	
Satd. Flow (prot)	0	1820	0	0	1835	1583	0	1746	0	0	1777	0
Flt Permitted		0.978			0.734			0.960			0.670	
Satd. Flow (perm)	0	1785	0	0	1367	1583	0	1681	0	0	1242	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9				326		59			5	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		775			810			500			499	
Travel Time (s)		17.6			18.4			11.4			11.3	
Volume (vph)	13	172	32	41	96	316	7	64	57	782	108	34
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	13	177	33	42	99	326	7	66	59	806	111	35
Lane Group Flow (vph)	0	223	0	0	141	326	0	132	0	0	952	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Detector Phases	4	4		8	8	8	2	2		6	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Minimum Split (s)	22.0	22.0		22.0	22.0	22.0	22.0	22.0		22.0	22.0	
Total Split (s)	22.0	22.0	0.0	22.0	22.0	22.0	68.0	68.0	0.0	68.0	68.0	0.0
Total Split (%)	24.4%	24.4%	0.0%	24.4%	24.4%	24.4%	75.6%	75.6%	0.0%	75.6%	75.6%	0.0%
Maximum Green (s)	16.0	16.0		16.0	16.0	16.0	62.0	62.0		62.0	62.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Recall Mode	None	None		None	None	None	Max	Max		Max	Max	
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0	11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	
Act Effct Green (s)		15.4			15.4	15.4		64.1			64.1	
Actuated g/C Ratio		0.18			0.18	0.18		0.73			0.73	
v/c Ratio		0.69			0.59	0.60		0.11			1.05	
Control Delay		44.3			43.5	8.8		2.5			57.8	
Queue Delay		0.0			0.0	0.0		0.0			0.0	
Total Delay		44.3			43.5	8.8		2.5			57.8	
LOS		D			D	A		A			E	
Approach Delay		44.3			19.2			2.5			57.8	
Approach LOS		D			B			A			E	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)		112			72	0		10			~596	
Queue Length 95th (ft)		187			133	70		26			#847	
Internal Link Dist (ft)		695			730			420			419	
Turn Bay Length (ft)												
Base Capacity (vph)		364			273	577		1247			911	
Starvation Cap Reductn		0			0	0		0			0	
Spillback Cap Reductn		0			0	0		0			0	
Storage Cap Reductn		0			0	0		0			0	
Reduced v/c Ratio		0.61			0.52	0.56		0.11			1.05	

Intersection Summary

Area Type: Other  
 Cycle Length: 90  
 Actuated Cycle Length: 87.5  
 Natural Cycle: 110  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 1.05  
 Intersection Signal Delay: 41.8  
 Intersection Capacity Utilization 88.6%  
 Analysis Period (min) 15  
 Intersection LOS: D  
 ICU Level of Service E

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

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

Splits and Phases: 1: River St & Walnut Street

 02	 04
68 s	22 s
 06	 08
68 s	22 s