Traffic Impact Study

Crestline Piggly Wiggly

Mountain Brook, Alabama

Prepared for:

Goodwyn, Mills and Cawood, Inc.
Birmingham, Alabama

SKIPPER CONSULTING INC.

September 2014
Revision 1 October 2014

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Introduction

This report documents a traffic impact study performed for a proposed grocery store to be located on Vine Street between Dexter Avenue and West Jackson Boulevard in Mountain Brook, Alabama. The location of the site with respect to the area roadway network is shown in Figure 1.

The proposed development will be constructed in a single phase. The buildout of the site will include a grocery store of approximately ~~27,932~~ 29,540 square feet of retail ~~s~~pace ~~and a Girl Scout meeting facility of 1,760 square feet~~. The proposed development will occupy land which currently contains a daycare facility, an invitation printing business, a Girl Scout meeting facility, and a vacant lot. For the purposes of this study, an analysis year of 2019 was selected. The proposed development is to be accessed by driveways on Vine Street, on the alley between Vine Street and Church Street, and an access to Church Street at the location of an existing access to Regions Bank. The proposed site plan is included in Appendix A.

The purposes of this study are to:

- Analyze the existing traffic conditions on the roadways in the vicinity of the proposed development;
- Determine the projected growth in traffic to the year 2019;
- Analyze background traffic conditions without the proposed development for 2019 conditions on the roadways in the vicinity of the proposed development;
- Estimate the trip generation of the proposed development;
- Estimate the directional distribution of traffic generated by the proposed development;
- Assign site-generated traffic to the area roadway network and analyze the resultant traffic operations;
- Determine whether a right turn lane will be warranted on Church Street at the site access point;
- Estimate the queue lengths of turning traffic at the intersection of Church Street at the site access with the proposed development in place;
- Develop recommendations for site access and roadway improvements required to support the proposed development for buildout traffic conditions;

- Study Intersection

North
Scale: n.t.s

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Figure 1 - Site Location Map

Crestline Piggly Wiggly - Mountain Brook, Alabama

September 2014

- Analyze truck routes for delivery to the proposed development;
- Analyze pedestrian routes for the proposed development; and
- Develop specific site traffic circulation recommendations related to the interrelationship between the proposed development and Crestline Elementary School.

Sources of information used in this report included Goodwyn, Mills, and Cawood, Inc., the City of Mountain Brook, Mountain Brook City Schools, the Regional Planning Commission of Greater Birmingham, the Institute of Transportation Engineers, the Transportation Research Board, the National Cooperative Highway Research Program, and office files and field reconnaissance efforts of Skipper Consulting, Inc.

Background Information

Study Area and Intersections

The study area determined for the preparation of the traffic impact study includes the following intersections:

- Montevallo Road at Church Street/Montrose Road
- Church Street at West Jackson Boulevard
- The three driveways on Church Street between Regions Bank and CVS
- Church Street at Dexter Avenue
- Dexter Avenue at Vine Street

The locations of the study intersections are depicted in Figure 1.

Study Area Roadways

Montevallo Road. In the vicinity of the site, Montevallo Road is a two lane classified minor arterial roadway with a posted speed limit of 30 miles per hour. The intersection of Montevallo Road at Church Street/Montrose Road is controlled by a traffic signal.

Church Street. In the vicinity of the site, Church Street is a three lane local roadway with a posted speed limit of 20 miles per hour.

Vine Street. In the vicinity of the site, Vine Street is a two lane local roadway with a posted speed limit of 20 miles per hour. Vine Street is one way westbound from West Jackson Boulevard to Dexter Avenue during the hours of 7:20 a.m. to 4:00 p.m. to account for traffic operations of Crestline Elementary School.

Dexter Avenue. In the vicinity of the site, Dexter Avenue is a two lane local roadway with a posted speed limit of 20 miles per hour.

West Jackson Boulevard. In the vicinity of the site, West Jackson Boulevard is a three lane local roadway with no posted speed limit. West Jackson Boulevard is one way northbound from Church Street to Vine Street during the hours of 7:20 a.m. to 4:00 p.m. to account for traffic operations of Crestline Elementary School. West Jackson Boulevard serves as a primary pick-up and drop-off area for Crestline Elementary School.

Existing Intersection Turning Movement Traffic Counts

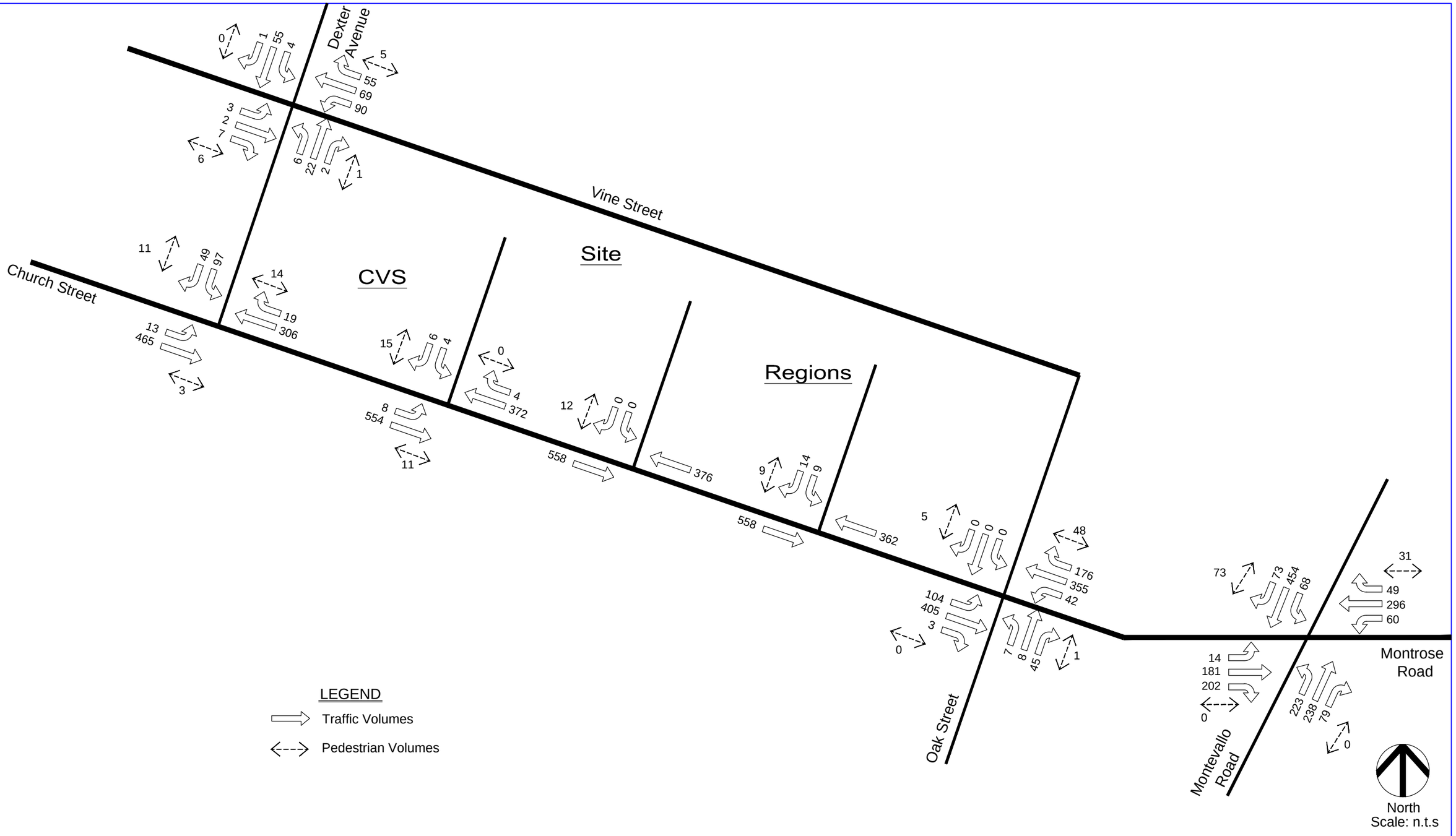
Existing intersection turning movement traffic counts were performed at the study area intersections on typical weekdays between Wednesday, May 14, 2014 and Wednesday, May 21, 2014 from 7:00 to 9:00 a.m., 2:30 to 3:30 p.m., and 4:00 to 6:00 p.m. by Traffic Data, LLC, on behalf of Skipper Consulting, Inc. The existing traffic counts are included in Appendix B. Existing a.m., afternoon school, and p.m. peak hour traffic counts were calculated using the traffic count data included in Appendix B. The existing a.m., afternoon school, and p.m. peak hour traffic volumes are included in Figures 2, 3, and 4.

Historical Traffic Growth

Existing average daily traffic counts were obtained from the Regional Planning Commission of Greater Birmingham for Montevallo Road in the vicinity of the site for various years between 1987 and 1999. An analysis was performed to determine the rate of historical traffic growth on Montevallo Road. The traffic counts and growth analysis are shown in Table 1. For the purposes of projecting background traffic volumes for the year 2019, a growth rate of +3.0% per year was applied to the existing traffic counts. The background 2019 a.m., afternoon school, and p.m. peak hour traffic volumes are included in Figures 5, 6, and 7.

Table 1
Historical Traffic Growth

Year	*Daily Traffic Count*	*Per Year Growth*
1987	9,500	--
1988	12,100	+27.3%
1993	11,400	-5.8%
1994	12,440	+9.1%
1999	13,000	+0.9%
Overall Growth 1987-1999: +3.0% per year		



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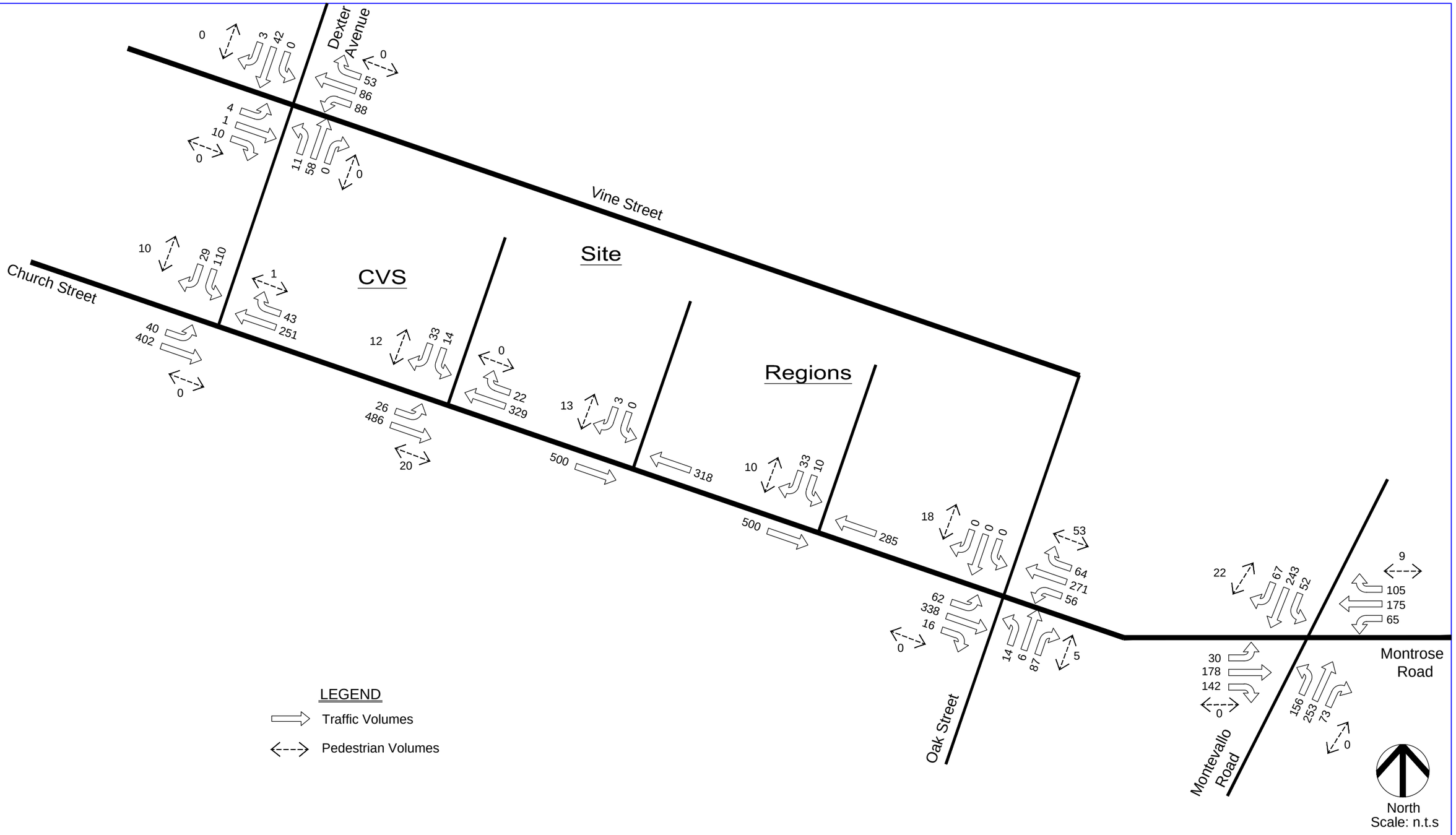
Existing Turning Movement Traffic Volumes A.M. Peak Hour

Crestline Piggly Wiggly - Mountain Brook, Alabama Sept 2014

2 Figure



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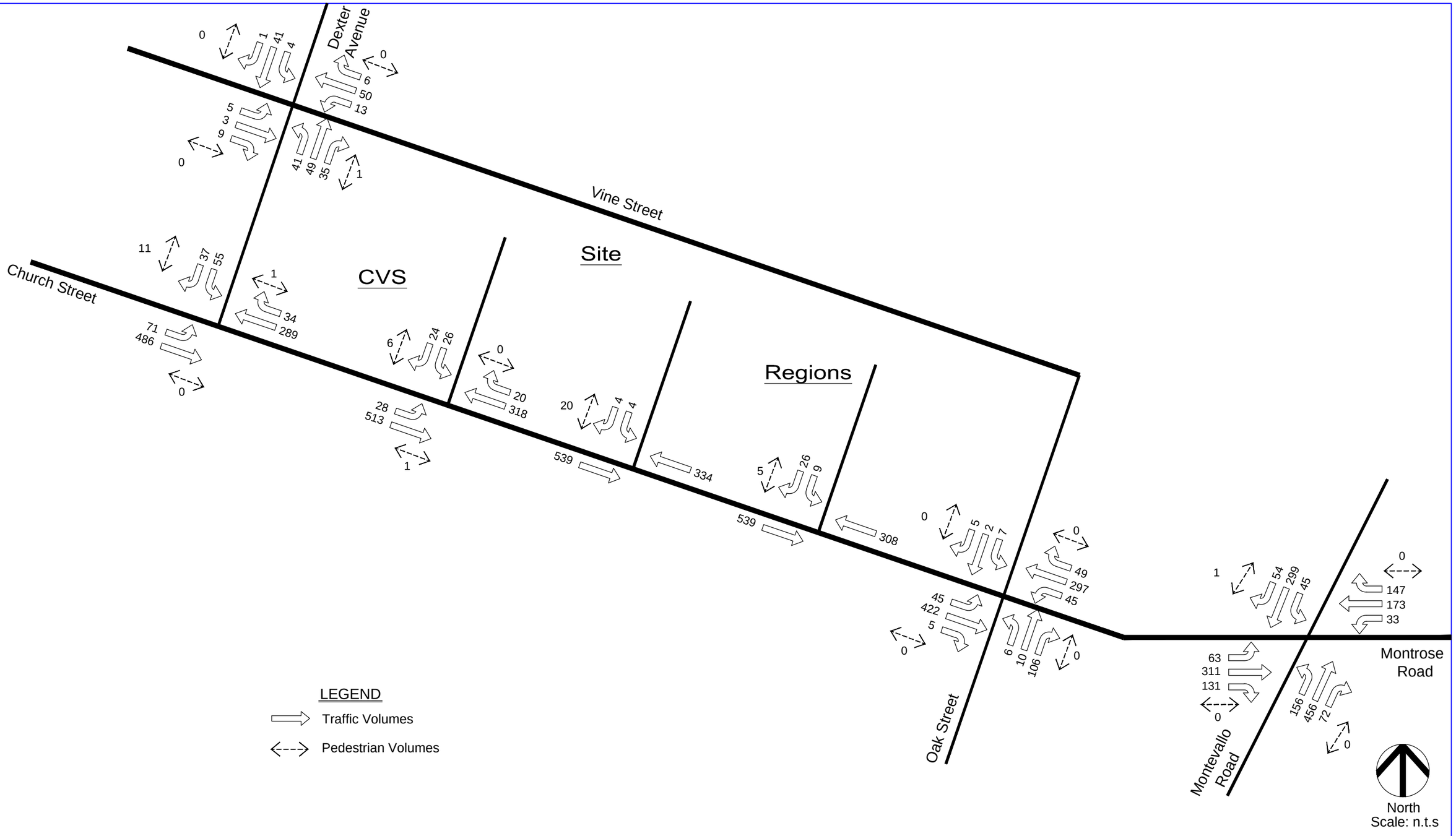
Existing Turning Movement Traffic Volumes Afternoon School Peak Hour

Crestline Piggly Wiggly - Mountain Brook, Alabama Sept 2014

3 Figure



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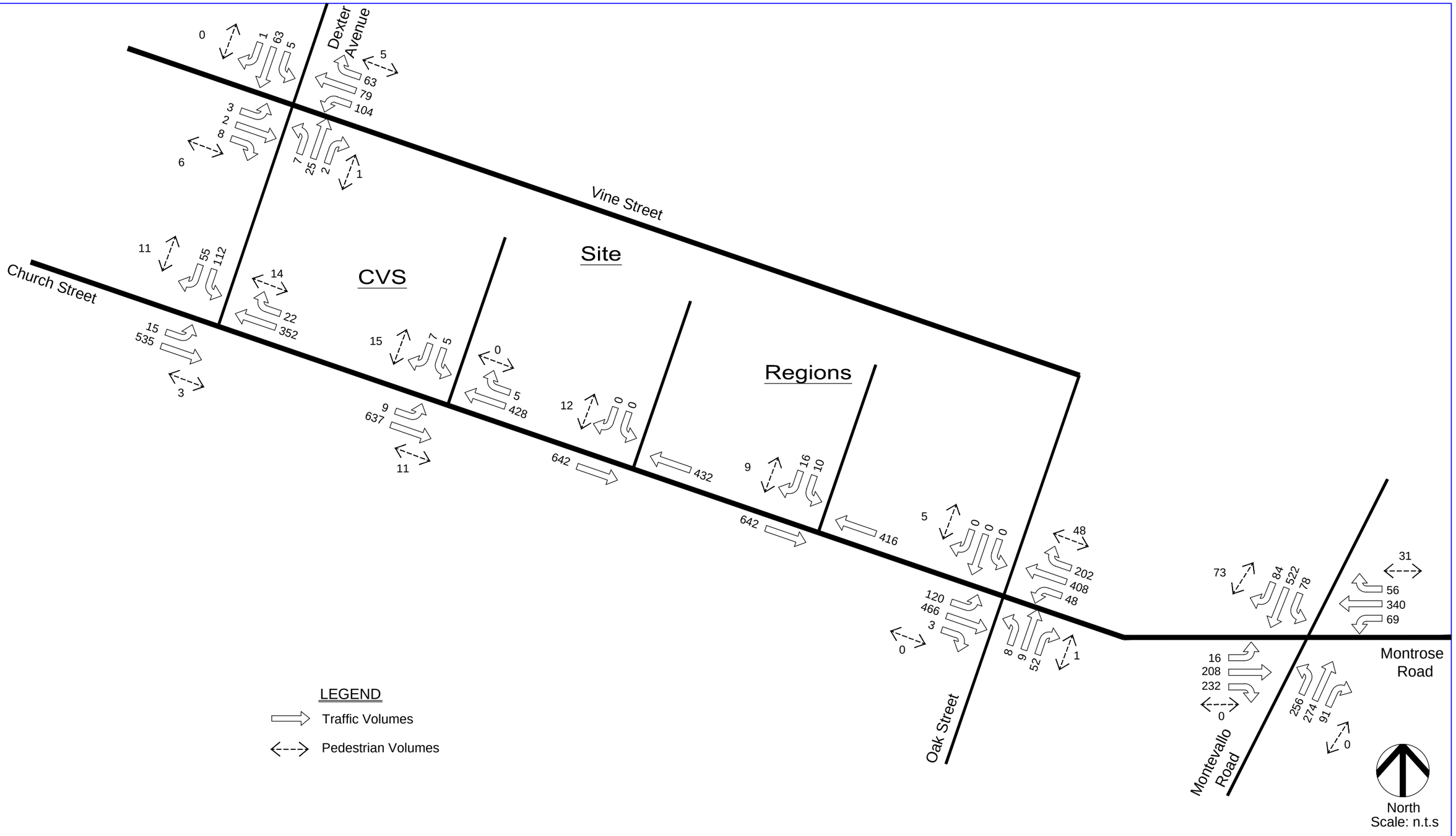
Existing Turning Movement Traffic Volumes P.M. Peak Hour

Figure 4

Crestline Piggly Wiggly - Mountain Brook, Alabama Sept 2014



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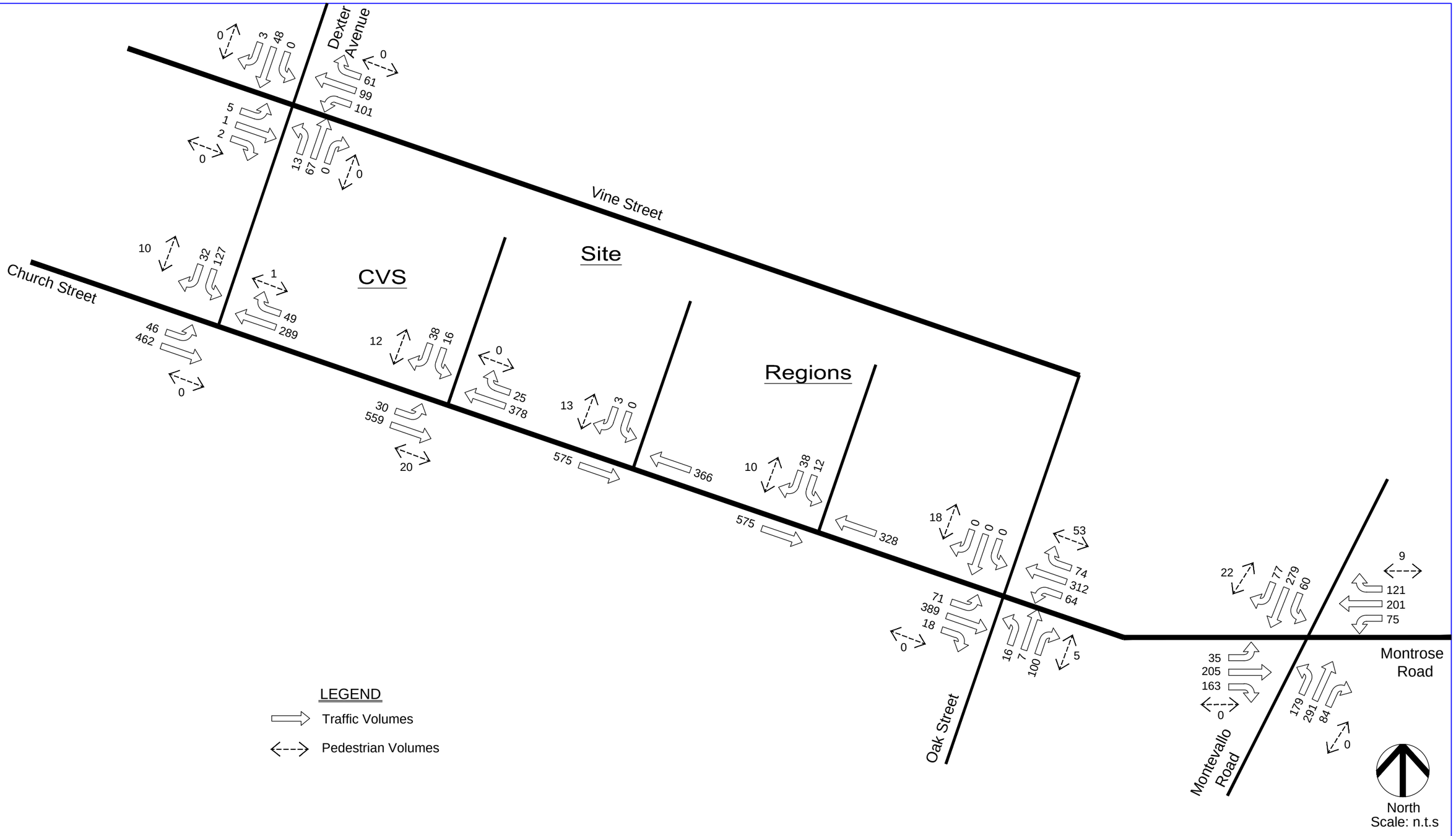
Background 2019 Turning Movement Traffic Volumes A.M. Peak Hour

Crestline Piggly Wiggly - Mountain Brook, Alabama Sept 2014

5 Figure



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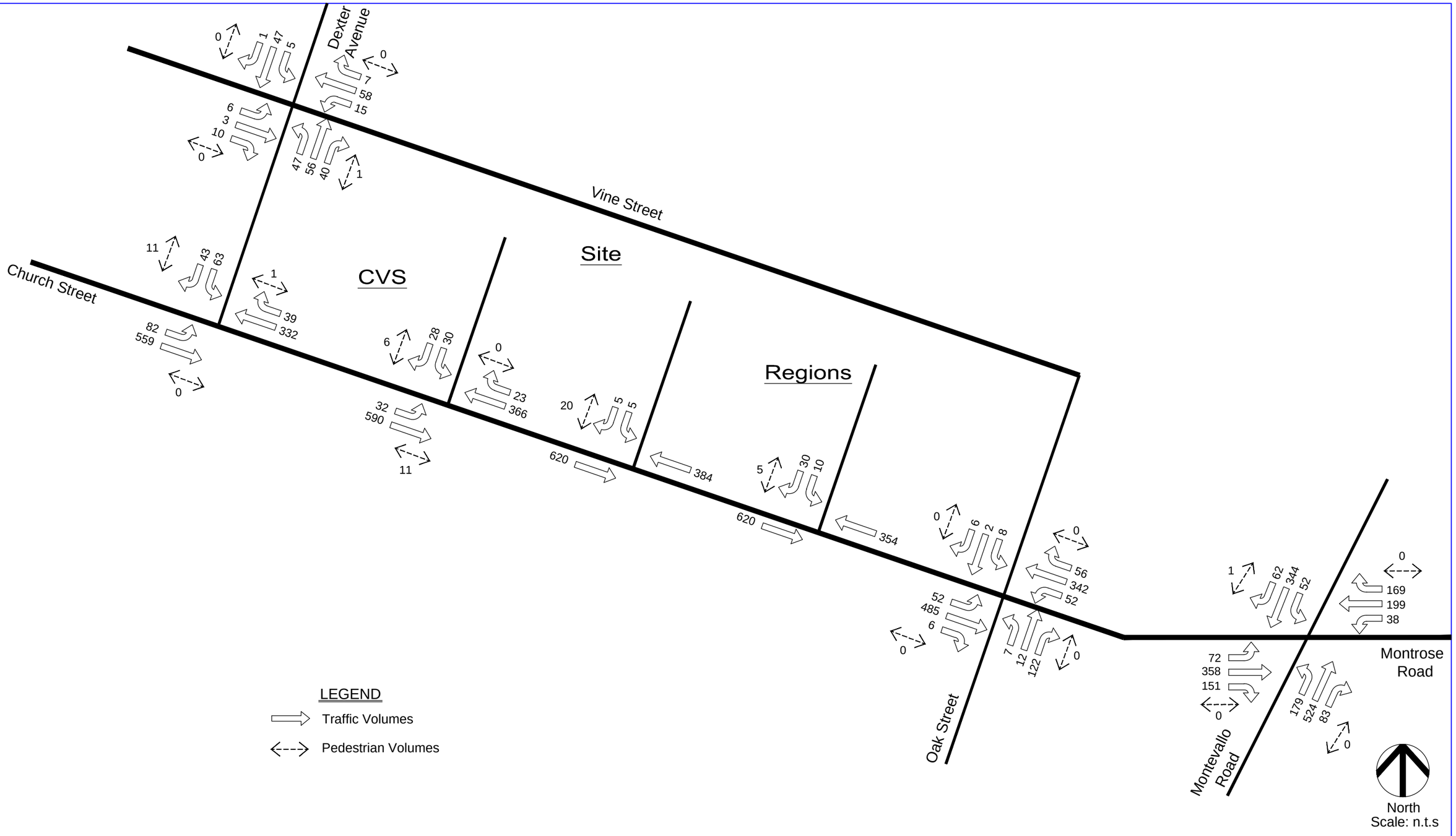
Background 2019 Turning Movement Traffic Volumes Afternoon School Peak Hour

Crestline Piggly Wiggly - Mountain Brook, Alabama Sept 2014

Figure 6



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Background 2019 Turning Movement Traffic Volumes P.M. Peak Hour

Crestline Piggly Wiggly - Mountain Brook, Alabama Sept 2014

Figure 7

Analysis

Existing Intersection Capacity Analysis

Existing a.m., afternoon school, and p.m. peak hour intersection capacity analyses were performed for the study intersections using the method of analysis included in the 2010 *Highway Capacity Manual*, published by the Transportation Research Board. Capacities are expressed as levels of service, and range from a level of service "A" (highest quality of service) to a level of service "F" (jammed conditions). As a general rule, operation at a level of service "C" or better is desirable, with a level of service "D" considered acceptable during peak hours of traffic flow. The existing a.m., afternoon school, and p.m. peak hour intersection capacity analysis worksheets are included in Appendix C and are summarized in Table 2.

Background 2019 Intersection Capacity Analysis

Background 2019 (without the proposed development) a.m., afternoon school, and p.m. peak hour intersection capacity analyses were performed for the study intersections using the method of analysis included in the 2010 *Highway Capacity Manual*, published by the Transportation Research Board. Capacities are expressed as levels of service, and range from a level of service "A" (highest quality of service) to a level of service "F" (jammed conditions). As a general rule, operation at a level of service "C" or better is desirable, with a level of service "D" considered acceptable during peak hours of traffic flow. The background 2019 a.m., afternoon school, and p.m. peak hour intersection capacity analysis worksheets are included in Appendix D and are summarized in Table 3.

Table 2
Existing Intersection Capacity Analysis

Intersection	*Approach*	*Movement*	*Level of Service*		
			AM	*Aft. School*	*PM*
Montevallo Road at Church Street/ Montrose Road	Church Street Eastbound	Left	C	C	C
		Through-Right	F	D	F
		Overall approach	*F*	*D*	*F*
	Montrose Road Westbound	Left	C	C	C
		Through-Right	D	D	E
		Overall approach	*D*	*D*	*E*
	Montevallo Road Northbound	Left	F	D	D
		Through-Right	C	C	E
		Overall approach	*F*	*C*	*E*
	Montevallo Road Southbound	Left-Through-Right	F	D	F
		Overall intersection	***F***	***D***	***F***
Church Street at West Jackson Boulevard	Church Street Eastbound	Left	B	A	A
	Church Street Westbound	Left	A	A	A
	West Jackson Boulevard Northbound	Left-Through-Right	E	C	C
	West Jackson Boulevard Southbound	Left-Through-Right	n/a	n/a	D
Church Street at Regions Bank	Regions Bank Driveway Southbound	Left	D	C	C
		Right	B	B	B
		Overall approach	*C*	*B*	*B*
Church Street at Site Access (Center Driveway)	Site Access Southbound	Left-Right	A	B	B
Church Street at CVS Driveway	Church Street Eastbound	Left	A	A	A
	CVS Driveway Southbound	Left-Right	C	C	C
Church Street at Dexter Avenue	Church Street Eastbound	Left	A	A	A
	Dexter Avenue Southbound	Left-Right	F	E	C
Dexter Avenue at Vine Street*	Vine Street Eastbound	Left-Through-Right	B	B	B
	Vine Street Westbound	Left-Through-Right	B	C	B
	Dexter Avenue Northbound	Left-Through-Right	A	A	A
	Dexter Avenue Southbound	Left-Through-Right	A	A	A

* See the detailed discussion concerning the capacity of intersection of Dexter Avenue at Vine Street beginning on page 26 of this report. The actual traffic conditions are not accurately reflected in the results of the capacity analysis.

Table 3
Background 2019 Intersection Capacity Analysis

Intersection	*Approach*	*Movement*	*Level of Service*		
			AM	*Aft. School*	*PM*
Montevallo Road at Church Street/ Montrose Road	Church Street Eastbound	Left	C	C	C
		Through-Right	F	E	F
		Overall approach	*F*	*D*	*F*
	Montrose Road Westbound	Left	C	C	C
		Through-Right	E	E	F
		Overall approach	*E*	*D*	*E*
	Montevallo Road Northbound	Left	F	F	F
		Through-Right	C	D	F
		Overall approach	*F*	*E*	*F*
	Montevallo Road Southbound	Left-Through-Right	F	F	F
		Overall intersection	***F***	***F***	***F***
Church Street at West Jackson Boulevard	Church Street Eastbound	Left	B	A	A
	Church Street Westbound	Left	A	A	A
	West Jackson Boulevard Northbound	Left-Through-Right	F	D	C
	West Jackson Boulevard Southbound	Left-Through-Right	n/a	n/a	E
Church Street at Regions Bank	Regions Bank Driveway Southbound	Left	D	C	C
		Right	B	B	B
		Overall approach	*C*	*B*	*B*
Church Street at Site Access (Center Driveway)	Site Access Southbound	Left-Right	A	B	C
Church Street at CVS Driveway	Church Street Eastbound	Left	A	A	A
	CVS Driveway Southbound	Left-Right	C	C	C
Church Street at Dexter Avenue	Church Street Eastbound	Left	A	A	A
	Dexter Avenue Southbound	Left-Right	F	F	D
Dexter Avenue at Vine Street*	Vine Street Eastbound	Left-Through-Right	B	C	B
	Vine Street Westbound	Left-Through-Right	B	D	B
	Dexter Avenue Northbound	Left-Through-Right	A	A	A
	Dexter Avenue Southbound	Left-Through-Right	A	A	A

* See the detailed discussion concerning the capacity of intersection of Dexter Avenue at Vine Street beginning on page 26 of this report. The projected traffic conditions are not accurately reflected in the results of the capacity analysis.

Trip Generation

The trip generation of the proposed development for buildout traffic conditions was calculated based on information contained in the Institute of Transportation Engineers' publication *Trip Generation, Ninth Edition*. Trip generation calculations were performed for an average weekday and for the a.m., afternoon school, and p.m. peak hours of traffic flow. ITE Land Use code 850, "Supermarket" was used for the trip generation analysis.

A portion of the trips generated by the proposed development will be intercepted trips. Intercepted trips are those trips which are made by vehicles already on the adjacent roadway for another purpose, but stop at the site while enroute to their final destination. The intercept rate for this development, calculated using an Institute of Transportation Engineers' formula, is 36%.

It should be noted that the proposed land use displaces existing land uses. The Girl Scout building is being replaced in the proposed development. Traffic generated by the other two land uses being displaced (the invitation printing company and the daycare) are not subtracted from the trip generation of the proposed development.

The trip generation calculations for the proposed development are shown in Table 4.

Table 4
Trip Generation

Total Trips											
Daily			***A.M. Peak Hour***			***Afternoon School Peak***			***P.M. Peak Hour***		
In	***Out***	***Total***	***In***	***Out***	***Total***	***In***	***Out***	***Total***	***In***	***Out***	***Total***
1,631	1,631	3,262	59	36	95	143	147	290	155	148	303
Intercept Trips											
Daily			***A.M. Peak Hour***			***Afternoon School Peak***			***P.M. Peak Hour***		
In	***Out***	***Total***	***In***	***Out***	***Total***	***In***	***Out***	***Total***	***In***	***Out***	***Total***
587	587	1,174	21	13	44	51	53	104	56	53	109

Directional Distribution

The directional distribution of traffic generated by the proposed development was estimated based on traffic flow patterns on roadways within the vicinity of the site. The directional distribution is shown in Figure 8.

Traffic Assignment

Traffic generated by the proposed development for buildout conditions for the a.m., afternoon school, and p.m. peak hours of traffic flow was assigned to the study intersections based on the directional distribution and access usage assumptions. The resultant future 2019 traffic volumes are shown in Figures 9, 10, and 11.

Future 2019 Intersection Capacity Analysis

Future 2019 (with the proposed development) a.m., afternoon school, and p.m. peak hour intersection capacity analyses were performed for the study intersections using the method of analysis included in the 2010 *Highway Capacity Manual*, published by the Transportation Research Board. Capacities are expressed as levels of service, and range from a level of service "A" (highest quality of service) to a level of service "F" (jammed conditions). As a general rule, operation at a level of service "C" or better is desirable, with a level of service "D" considered acceptable during peak hours of traffic flow. The future 2019 a.m., afternoon school, and p.m. peak hour intersection capacity analysis worksheets are included in Appendix E and are summarized in Table 5.

North
Scale: n.t.s

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Figure 8 - Directional Distribution

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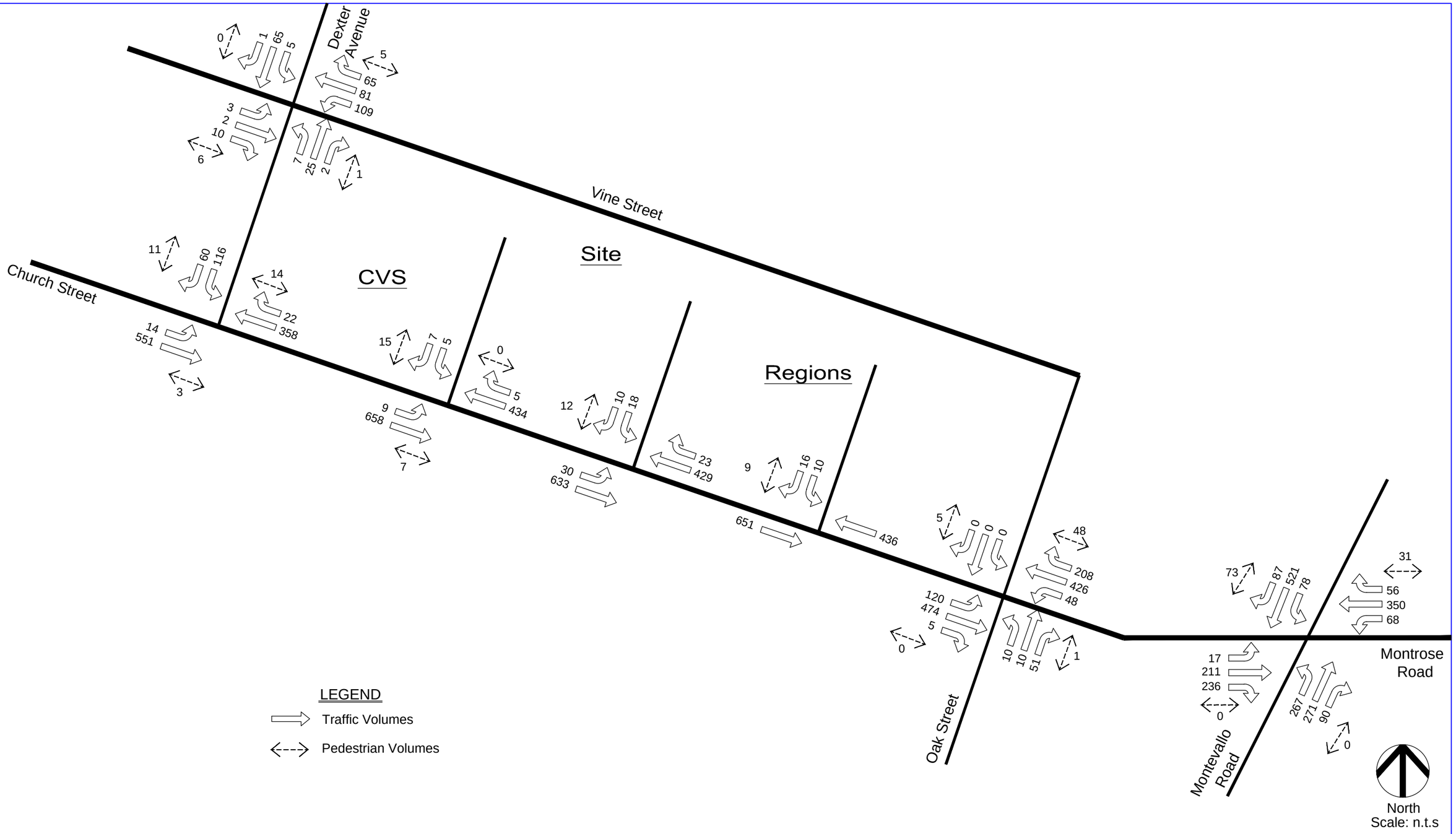
September 2014



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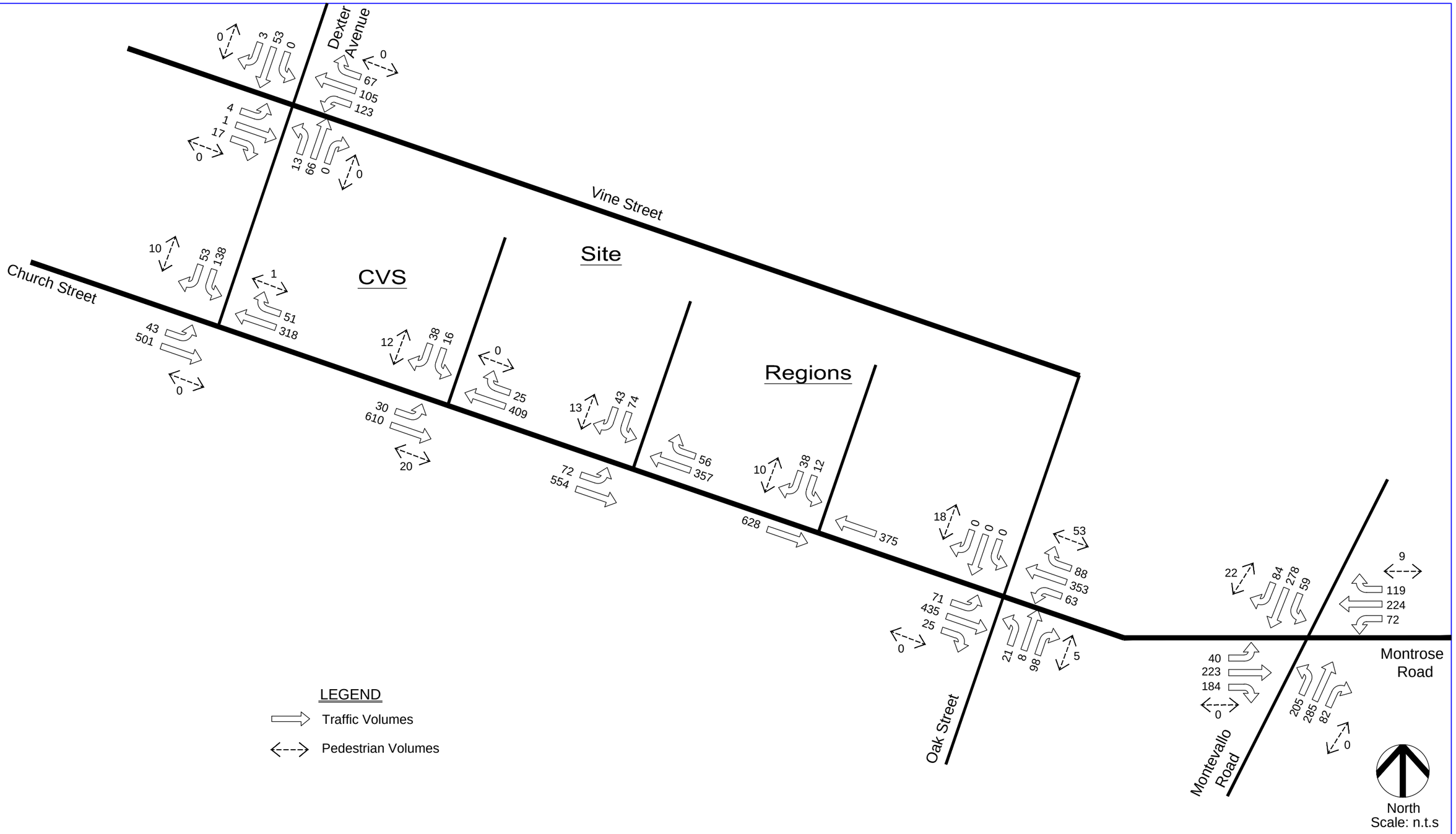
Future 2019 Turning Movement Traffic Volumes A.M. Peak Hour

Crestline Piggly Wiggly - Mountain Brook, Alabama Sept 2014

9 Figure



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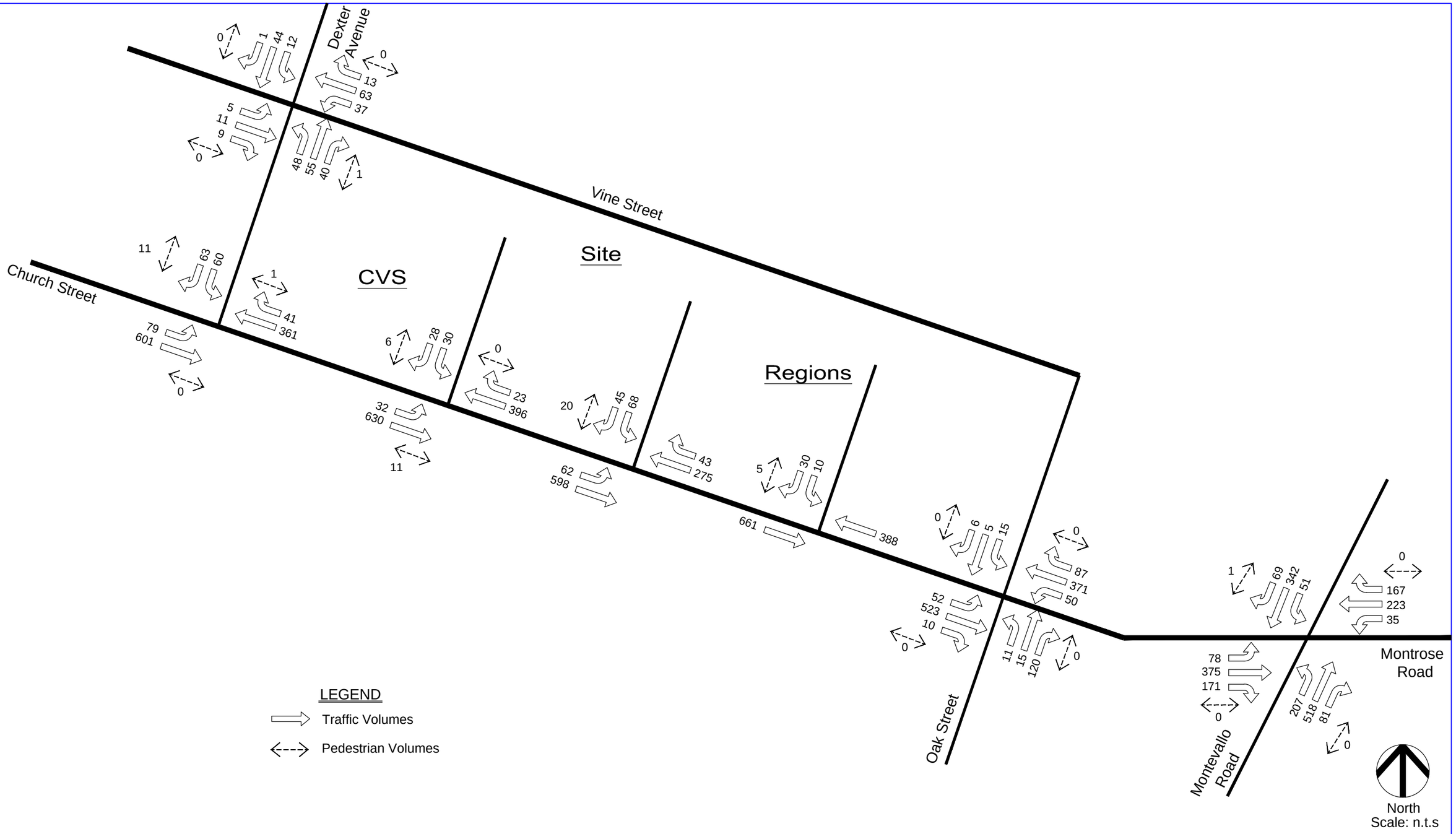
Future 2019 Turning Movement Traffic Volumes Afternoon School Peak Hour

Crestline Piggly Wiggly - Mountain Brook, Alabama Sept 2014

10 Figure



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Future 2019 Turning Movement Traffic Volumes P.M. Peak Hour

11 Figure

Crestline Piggly Wiggly - Mountain Brook, Alabama Sept 2014

Table 5
Future 2019 Intersection Capacity Analysis

Intersection	*Approach*	*Movement*	*Level of Service*		
			AM	*Aft. School*	*PM*
Montevallo Road at Church Street/ Montrose Road	Church Street Eastbound	Left	C	C	C
		Through-Right	F	F	F
		Overall approach	*F*	*E*	*F*
	Montrose Road Westbound	Left	C	C	C
		Through-Right	F	E	F
		Overall approach	*E*	*E*	*F*
	Montevallo Road Northbound	Left	F	F	F
		Through-Right	C	D	F
		Overall approach	*F*	*F*	*F*
	Montevallo Road Southbound	Left-Through-Right	F	F	F
		Overall intersection	***F***	***F***	***F***
Church Street at West Jackson Boulevard	Church Street Eastbound	Left	B	A	A
	Church Street Westbound	Left	A	A	A
	West Jackson Boulevard Northbound	Left-Through-Right	F	E	D
	West Jackson Boulevard Southbound	Left-Through-Right	n/a	n/a	F
Church Street at Regions Bank	Regions Bank Driveway Southbound	Left	E	C	C
		Right	B	B	B
		Overall approach	*C*	*B*	*B*
Church Street at Site Access (Center Driveway)	Church Street Eastbound	Left	A	A	A
	Site Access Southbound	Left-Right	D	E	D
Church Street at CVS Driveway	Church Street Eastbound	Left	A	A	A
	CVS Driveway Southbound	Left-Right	C	C	C
Church Street at Dexter Avenue	Church Street Eastbound	Left	A	A	A
	Dexter Avenue Southbound	Left-Right	F	F	E
Dexter Avenue at Vine Street*	Vine Street Eastbound	Left-Through-Right	B	B	B
	Vine Street Westbound	Left-Through-Right	C	F	B
	Dexter Avenue Northbound	Left-Through-Right	A	A	A
	Dexter Avenue Southbound	Left-Through-Right	A	A	A

* See the detailed discussion concerning the capacity of intersection of Dexter Avenue at Vine Street beginning on page 26 of this report. The projected traffic conditions are not accurately reflected in the results of the capacity analysis.

Future 2019 Turn Lane Warrant Analysis

The warranting of a right turn lane on Church Street westbound at the site access point was performed using the methodology contained in the National Cooperative Highway Research Program Report 457 *Evaluating Intersection Improvements*. Turn lane warrants are based on future 2019 peak hour traffic volumes. The right turn warrant analysis worksheets are included in Appendix F and are summarized in Table 6.

Table 6
Future 2019 Right Turn Lane Warrant Analysis
Church Street Westbound at Site Access

Peak Hour	*Movement*	*Volume*
A.M. Peak Hour	Advancing Volume	452 vph
	Right Turning Volume	23 vph
	Right Turn Lane is Not Warranted	
Afternoon School Peak Hour	Advancing Volume	413 vph
	Right Turning Volume	56 vph
	Right Turn Lane is Not Warranted	
PM Peak Hour	Advancing Volume	418 vph
	Right Turning Volume	43 vph
	Right Turn Lane is Not Warranted	

Future 2019 Queue Analysis

95th percentile queue lengths at the intersection of Church Street at the site access were evaluated using Synchro software and are included in the capacity analysis worksheets in Appendix E. Future 2019 a.m., afternoon school, and p.m. peak hour 95th percentile queue lengths are summarized in Table 7. The results of the queue analysis show that the left turn from Church Street into the site access will be accommodated within the center left turn lane without interfering with left turns into the CVS driveway. Also, the queue exiting the site access driveway will not extend past the end of the parking bay into the alley.

Table 7
Future 2019 Queue Analysis

Intersection	*Approach*	*Movement*	*Queue Length*		
			AM	*Aft. School*	*PM*
Church Street at Site Access	Church Street Eastbound	Left	0'	25'	25'
	Site Access Southbound	Left-Right	25'	85'	65'

Traffic Impacts of the Proposed Development

Montevallo Road at Church Street/Montrose Road

The intersection of Montevallo Road at Church Street/Montrose Road currently experiences inadequate levels of service during the a.m. and p.m. peak hours of traffic flow. With growth through the year 2019, the inadequate levels of service continue to decline and the afternoon school peak hour also begins to experience inadequate levels of service. The analyses indicate that the additional traffic generated by the proposed development will increase the average delay experienced by each vehicle by 4 to 11 seconds, dependent upon the hour of the day.

Church Street at West Jackson Street

The proposed development has negative traffic impacts to the intersection of Church Street at West Jackson Boulevard. During the a.m. peak hour, the northbound movement on West Jackson Boulevard is projected to operate at a level of service "F" for background 2019 conditions. The addition of site-generated traffic will significantly increase the delay on this movement. During the afternoon school peak hour, the additional site-generated traffic is projected to cause the level of service on the West Jackson Boulevard northbound approach to decline from a level of service "D" to a level of service "E". During the p.m. peak hour the additional site-generated traffic is projected to cause the level of service on the West Jackson Boulevard southbound approach to decline from a level of service "E" to a level of service "F". There are no reasonable improvements to mitigate these traffic impacts.

Church Street at Regions Driveway

During the a.m. peak hour the additional site-generated traffic is projected to cause the level of service on the left turn movement from the Regions driveway to decline from a level of service "D" to a level of service "E". There are no reasonable improvements to mitigate these traffic impacts.

Church Street at Site Access

During the afternoon school peak hour, the site access driveway is projected to experience a level of service "E". Altering the approach to have exclusive left and right turn lanes does not improve this deficiency. There are no reasonable improvements which would yield an acceptable level of service. Traffic signalization is not warranted for the intersection.

Church Street at CVS Access

All movements at the intersection of Church Street at the CVS access are projected to operate at acceptable levels of service for future 2019 traffic conditions.

Church Street at Dexter Avenue

The intersection of Church Street at Dexter Avenue currently operates with inadequate levels of service during the a.m. and afternoon school peak hours. Background traffic growth through the year 2019 increases the delay on Dexter Avenue, and the addition of site-generated traffic causes further increase in delay. Based on the limited traffic counts conducted, it appears that a traffic signal is warranted today. It is recommended that a traffic signal be installed at this intersection to correct existing deficiencies and mitigate the impacts of site-generated traffic. The future 2019 intersection capacity analysis for this intersection with traffic signalization is included in Appendix G and summarized in Table 8.

Table 8
Future 2019 Intersection Capacity Analysis with Improvements
Church Street at Dexter Avenue

Approach	***Movement***	***Level of Service***		
		Signalized		
		AM Peak	***Afternoon School***	***PM Peak***
Church Street Eastbound	Left	A	A	A
	Through	B	B	A
	Overall approach	*B*	*B*	*A*
Church Street Westbound	Through-Right	A	A	A
Dexter Avenue Southbound	Left-Right	C	B	B
	Overall intersection	***B***	***B***	***A***

Dexter Avenue at Vine Street

The traffic conditions at the intersection of Dexter Avenue at Vine Street are abnormally influenced by the traffic pattern of Crestline Elementary School. The results of the existing intersection capacity analyses for the a.m. and afternoon school peak periods do not appear to accurately reflect traffic conditions at the intersection. Observations of traffic during these two peak periods indicate queues and delays which are significantly in excess of what is predicted by the capacity analysis methodology. This is likely due to the high degree of traffic attempting to exit onto Dexter Avenue in a very short amount of time. It is assumed that this same deficiency also predicts a better level of service for the Vine Street westbound movement for background 2019 and future 2019 conditions than will actually be present. Based on this, additional analyses were performed for future 2019 traffic conditions at the intersection of Dexter Street using a microsimulation model for the peak 15 minutes of traffic flow during the a.m. and afternoon school peak periods. The microsimulation model was calibrated to existing conditions based on observed queue lengths, and then projected forward to future 2019 conditions, including background traffic growth and traffic generated by the proposed development.

This microsimulation model was then used to determine the appropriate traffic control measure to apply at the intersection based on average queue lengths on each approach. Options which were evaluated included:

- The existing orientation of the stop signs on Vine Street and no stop signs on Dexter Avenue

- Reversing the position of the stops signs, such that Dexter Avenue has stop signs and Vine Street does not have stop signs
- Installing additional stop signs on Dexter Avenue to make the intersection a four-way stop
- Installing a traffic signal at the intersection

The results of these alternative analyses are documented in Table 9. As shown, the only viable options for appropriate traffic control which will minimize queues are Option 2 – Dexter Avenue Stop and Option 4 – Traffic Signal. Both the current configuration (Option 1) of the intersection and a four-way stop configuration (Option 3) yield extensive queues on Vine Street westbound. Based on the traffic flow characteristics, it is recommended that the intersection initially be configured as Option 2 – Dexter Avenue Stop. In the future, the City may wish to consider installation of a traffic signal at the intersection based on actual traffic volumes and crash experience.

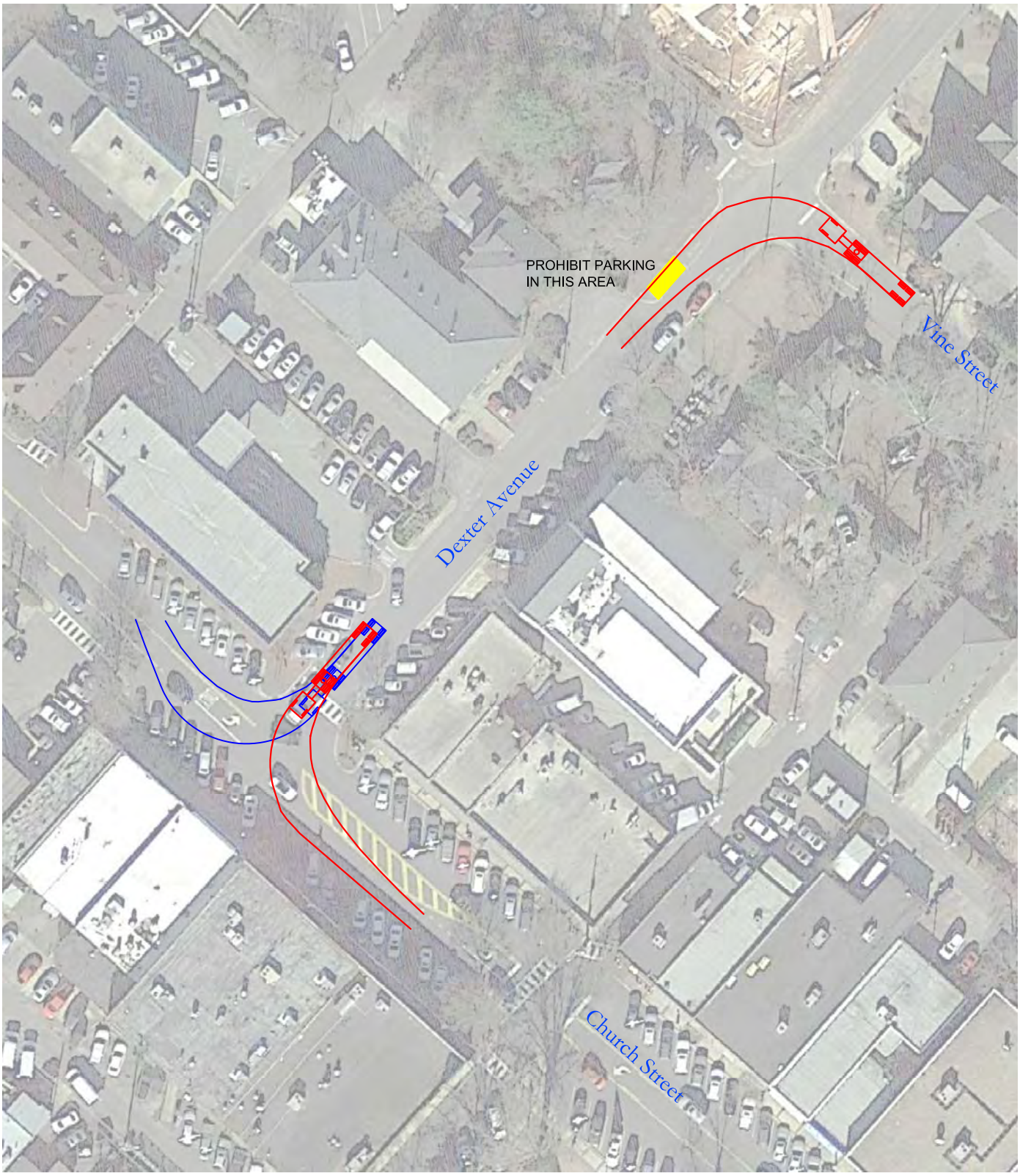
It should be noted that the results similar to either Option 2 or Option 4 could be achieved without any modification to the existing traffic control at the intersection by using a police officer to control the intersection during the two peak times for Crestline Elementary School. The required manpower to implement this alternative is considerable and would need to be carefully evaluated by the City and/or School Board before implementation.

Table 9
Future 2019 Microsimulation Model Comparison
Dexter Avenue at Vine Street

Peak Hour	*Movement*	*Average Queue (number of vehicles)*			
		Option 1 Vine Street Stop	*Option 2 Dexter Avenue Stop*	*Option 3 Four Way Stop*	*Option 4 Traffic Signal*
AM	Vine Street Eastbound	1	1	1	1
	Vine Street Westbound	21	2	2	6
	Dexter Avenue Northbound	1	2	2	1
	Dexter Avenue Southbound	0	3	3	3
Afternoon School	Vine Street Eastbound	1	1	1	1
	Vine Street Westbound	40	2	39	9
	Dexter Avenue Northbound	1	5	2	3
	Dexter Avenue Southbound	0	3	1	2

Delivery Truck Routing Analysis

An analysis was performed to determine the potential impacts of truck routing for deliveries to the proposed development. Negative impacts could include: 1) encroachment of the truck into adjacent lanes and 2) locations where parking will need to be prohibited. A WB-50 design vehicle was selected for the analysis. It is possible that the development could be serviced by larger vehicles. The analysis shows that a vehicle larger than a WB-50 will not be able to negotiate the required turns to access the loading dock. The analysis is depicted in Figures 12, 13, 14 and 15. As shown, a WB-50 design vehicle will require significant encroachment into adjacent travel lanes to negotiate the turns to access the loading dock of the proposed development. Additionally, parking will need to be prohibited in two locations where it is currently allowed in order for a WB-50 design vehicle to serve the development. If the 90 degree on street parking along the playing field is extended northward from its current terminus (as has been indicated on proposed changes to the site plan), then the potential parking conflict on Vine Street will be eliminated.



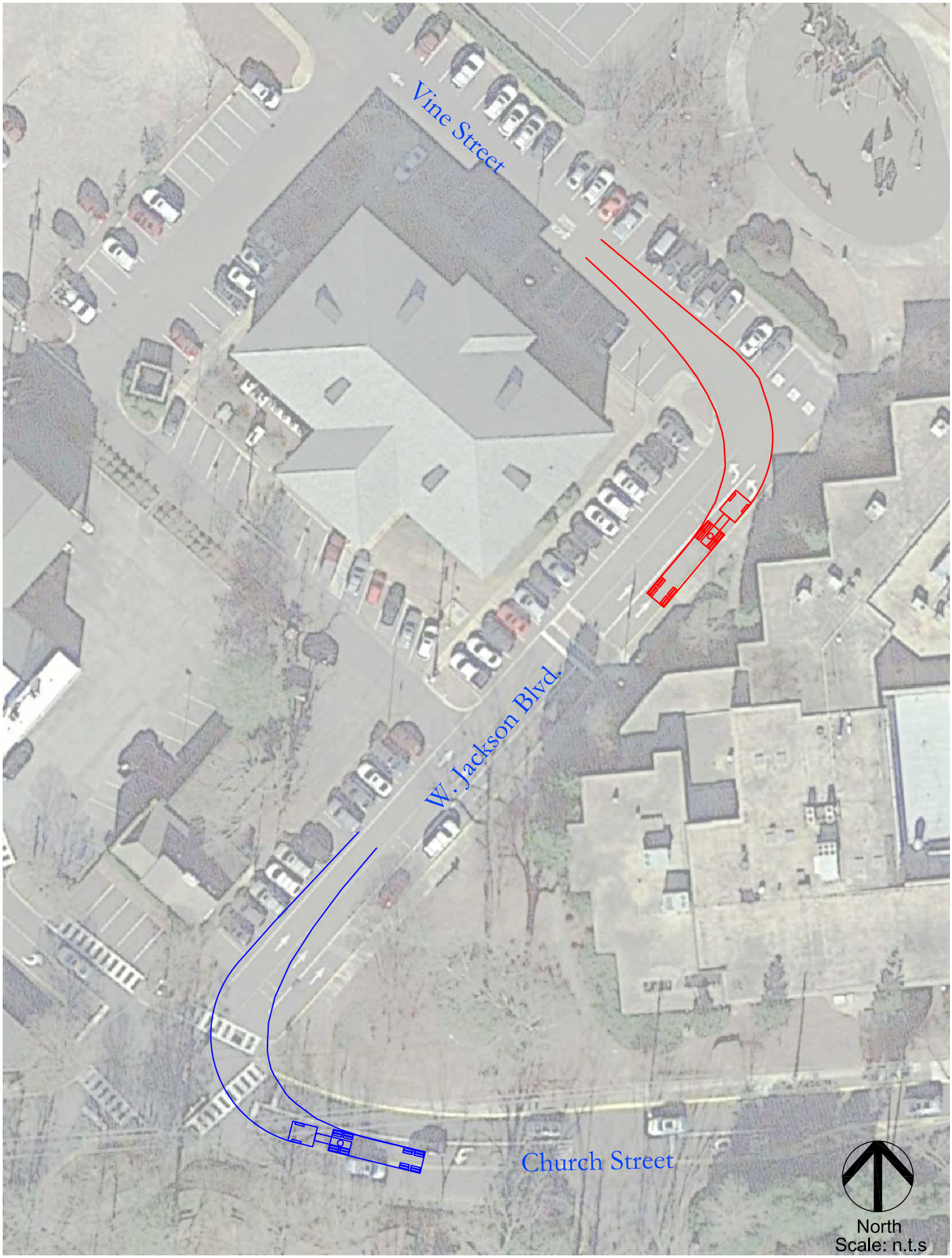
North
Scale: n.t.s

SKIPPER CONSULTING INC.

Figure 12 - Truck Turning Templates - Dexter Avenue

Crestline Piggly Wiggly - Mountain Brook, Alabama

September 2014

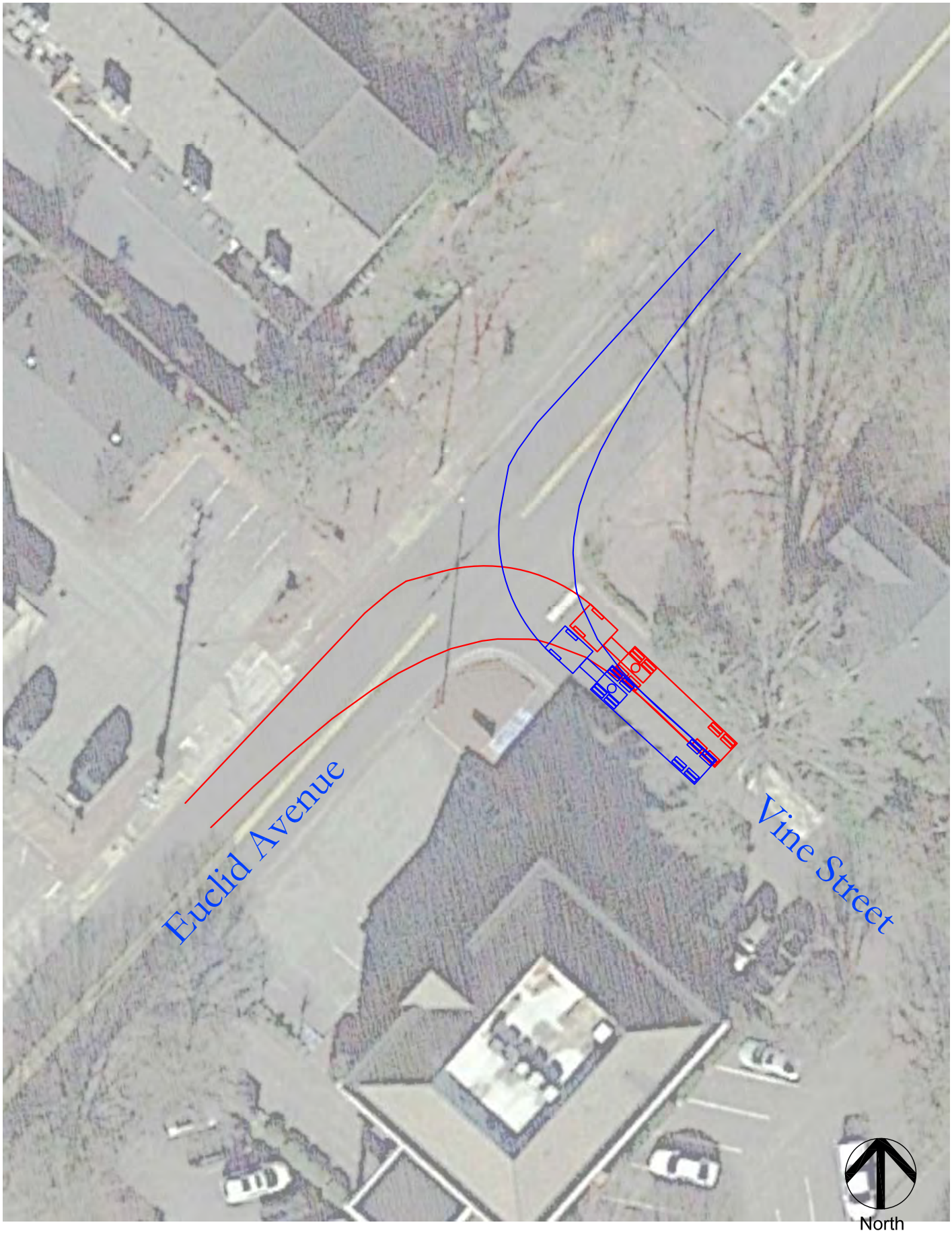


SKIPPER CONSULTING INC.

Figure 13 - Truck Turning Templates - West Jackson Blvd.

Crestline Piggly Wiggly - Mountain Brook, Alabama

September 2014



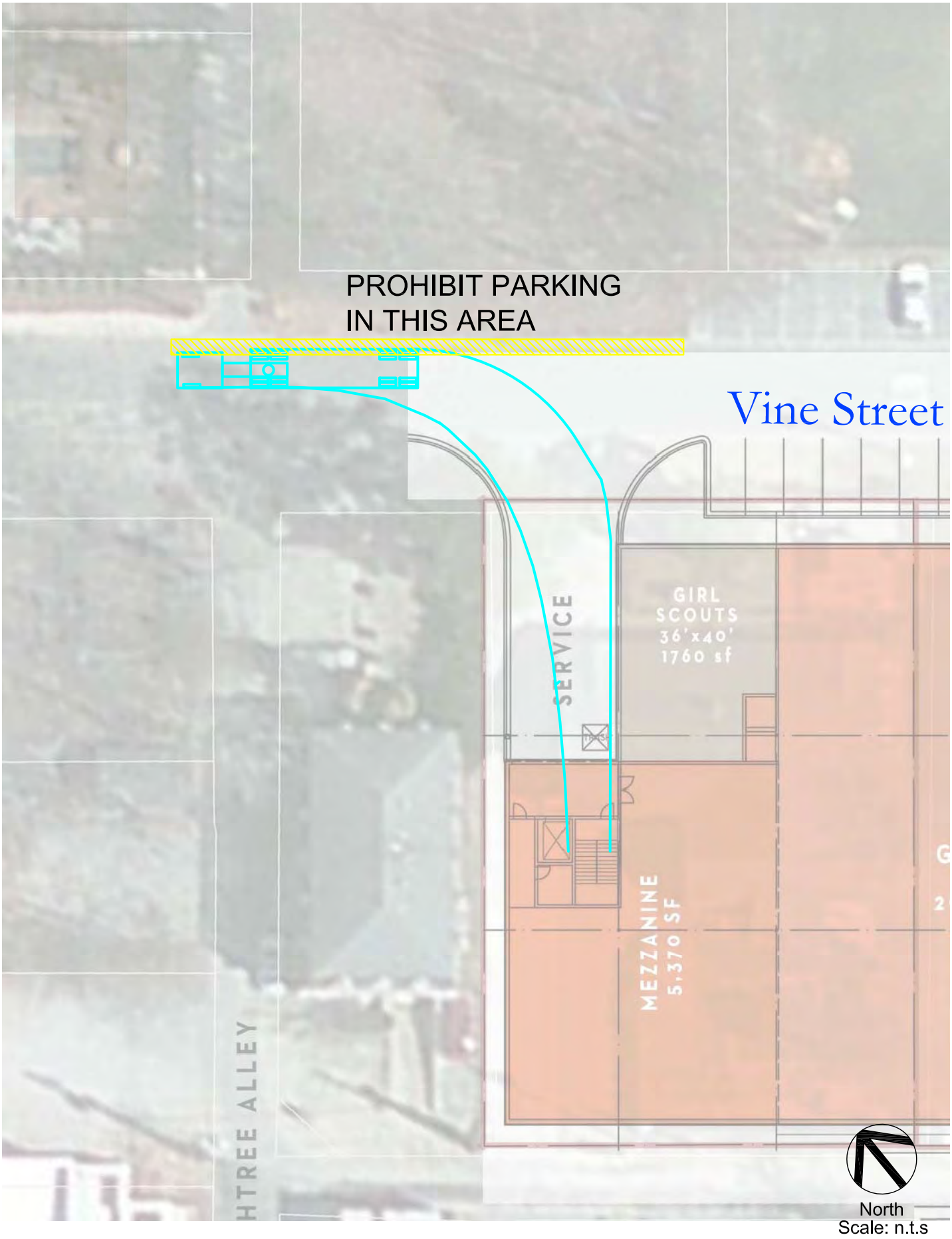
North
Scale: n.t.s

SKIPPER CONSULTING INC.

Figure 14 - Truck Turning Templates - Euclid Avenue

Crestline Piggly Wiggly - Mountain Brook, Alabama

September 2014



SKIPPER CONSULTING INC.

Figure 15 - Truck Turning Template - Loading Dock

Crestline Piggly Wiggly - Mountain Brook, Alabama

September 2014

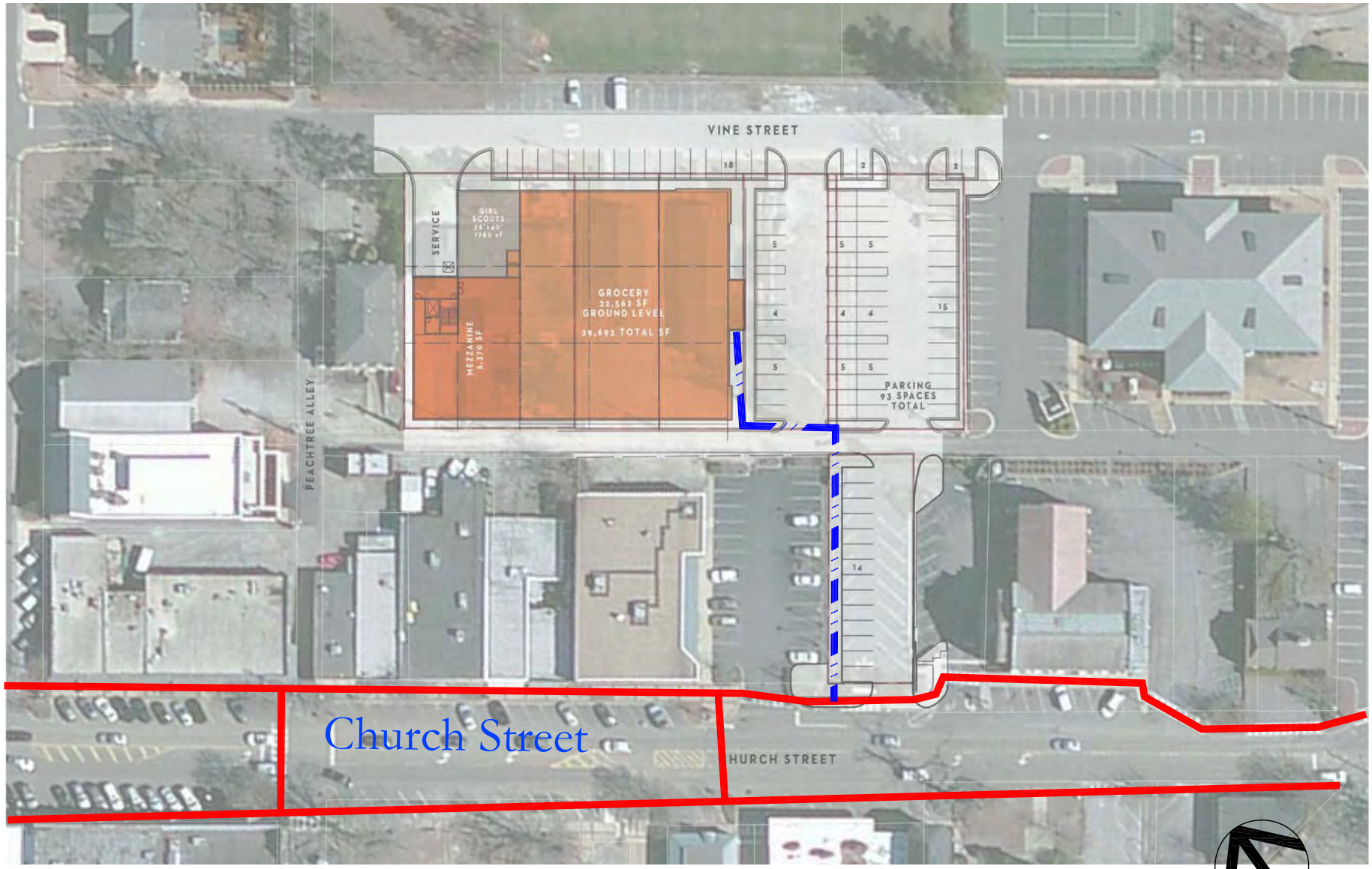
The traffic flow operations and pedestrian activity surrounding Crestline Elementary School on West Jackson Boulevard and Vine Street are not compatible with truck loading activities for the proposed development. It is therefore recommended that the owner place restrictions on times when deliveries may be made by trucks with more than six (6) wheels to the loading dock using either West Jackson Boulevard or Vine Street. In order to avoid most school-related activities, the preliminary hours of this truck restriction should be from 6:30 a.m. to 6:00 p.m. weekdays. The final hours should be discussed and agreed upon by the City and owner and made a condition of approval of the development. A sign should be posted at the south end of West Jackson Boulevard and west end of Vine Street noting this truck restriction and the hours it is in effect.

Pedestrian Access and Circulation Analysis

Pedestrian activity in the vicinity of the site is generated by two sources: 1) Crestline Elementary School, and, 2) commercial and institutional land uses within Crestline Village. For the second source (commercial and institutional land uses within Crestline Village), the pedestrian activity occurs mainly along Church Street from the intersection of Euclid Avenue to the intersection of West Jackson Boulevard. The location of the proposed development is isolated from this pedestrian corridor at the present time. The existing parking lots between the CVS and Regions Bank are configured to discourage pedestrian traffic beyond the alley which parallels Church Street and Vine Street.

The reconfiguration of the center parking lot to provide vehicular access for the Piggly Wiggly also provides an opportunity to improve pedestrian access which would allow the proposed development greater integration with the pedestrian system on Church Street. The current site plan shows an area between the between the center parking bay and the CVS parking which could be developed with a pedestrian walkway. The linkage between the existing pedestrian system and the proposed development using this corridor is illustrated in Figure 16.

The installation of the proposed signal at the intersection of Church Street at Dexter Avenue presents the opportunity to install a signalized crosswalk crossing Church Street. However, this would require removal of an existing parking space on the south side of Church Street. A concept for this crosswalk is illustrated in Figure 17.



Existing Pedestrian System

Proposed Pedestrian System

North
Scale: n.t.s

SKIPPER CONSULTING INC.

Figure 16 - Pedestrian System Recommendations

Crestline Piggly Wiggly - Mountain Brook, Alabama

September 2014

SKIPPER CONSULTING INC.

Figure 17 - Pedestrian Crosswalk - Church Street at Dexter Avenue

Crestline Piggly Wiggly - Mountain Brook, Alabama

September 2014

Site Circulation Issues

The construction of the proposed development with the access system as shown in the latest site plan will result in certain traffic operational issues which should be addressed as part of the planning for the proposed development. These issues are addressed in the following paragraphs.

Crestline Elementary School

Crestline Elementary School relies heavily upon West Jackson Boulevard and Vine Street for vehicular drop off and pick up of students as well as paths for pedestrian flow. These vehicle and pedestrian activities are present throughout a typical weekday, and are heavy from 7:30 a.m. to 8:15 a.m. and from 2:30 p.m. to 3:15 p.m. Currently, the developments which access Vine Street are limited and generate a negligible amount of traffic during these time periods. The traffic which will be generated by the proposed development is greater in magnitude than the existing developments, particularly during the period of 2:30 p.m. to 3:15 p.m. In order to discourage use of West Jackson Boulevard and Vine Street by traffic generated by the proposed development, ~~two~~ three measures are recommended:

- The City should erect a sign on West Jackson Boulevard at the intersection of Church Street with the message "SCHOOL TRAFFIC ONLY" and a placard with time restrictions from ~~7:30 a.m. to 8:15 a.m. and from 2:30 p.m. to 3:15 p.m.~~ 7:20 a.m. to 4:00 p.m.

- The manager of the proposed grocery store should place a barricade (such as a sawhorse) with a sign which reads "NO EXIT" in the throat of the driveway entering Vine Street from 7:30 a.m. to 8:15 a.m. and from 2:30 p.m. to 3:15 p.m. on each day when school is in session. It is anticipated that after a period of time when the patrons of the proposed grocery store have learned traffic patterns these barricades will no longer be needed and their use should be reevaluated by the City, the School Board, and the owner.

- The City should consider posted a 15 mile per hour speed limit on West Jackson Boulevard.

West Jackson Boulevard/Vine Street One-Way

Currently, West Jackson Boulevard and Vine Street are one way only from 7:20 a.m. to 4:00 p.m. It has been suggested that perhaps this one way restriction should be extended to 24 hours a day, 7 days a week. An element of this discussion includes the limits of the section which should be one way, whether it should be the entire length of the roadway or just the section of West Jackson Boulevard and Vine Street in front of Crestline Elementary School. Existing traffic counts show the following traffic flows which could potentially be impacted by a 24/7 one-way restriction on West Jackson Boulevard and Vines Street:

	Vehicles Exiting W. Jackson Blvd.	**Vehicles Entering Vine St.**
7:00-9:00 AM	0	19
2:30-3:30 PM	2	1
4:00-6:00 PM	28	30

As shown, if West Jackson Boulevard were restricted to one-way operation 24/7, approximately 80 vehicles would be impacted over the five hours counted. Furthermore, there are businesses and other properties located on the western end of Vine Street which would have no effective inbound route that would not involve going in front of the school if Vine Street were one-way 24/7.

This traffic study assumes that a limited amount of outbound traffic from the proposed grocery store will use West Jackson Boulevard during the p.m. peak period (after 4:00 p.m.), specifically 7% of the outbound site-generate traffic is assigned to West Jackson Boulevard during the p.m. peak period. However, the site is not dependent upon exiting via West Jackson Boulevard to provide adequate access during the p.m. peak hour. These trips could be reassigned to the site access on Church Street and to Dexter Avenue without causing any significant decline in levels of service.

Two factors may influence the decision on whether to extend the one way restriction of West Jackson Boulevard and Vine Street:

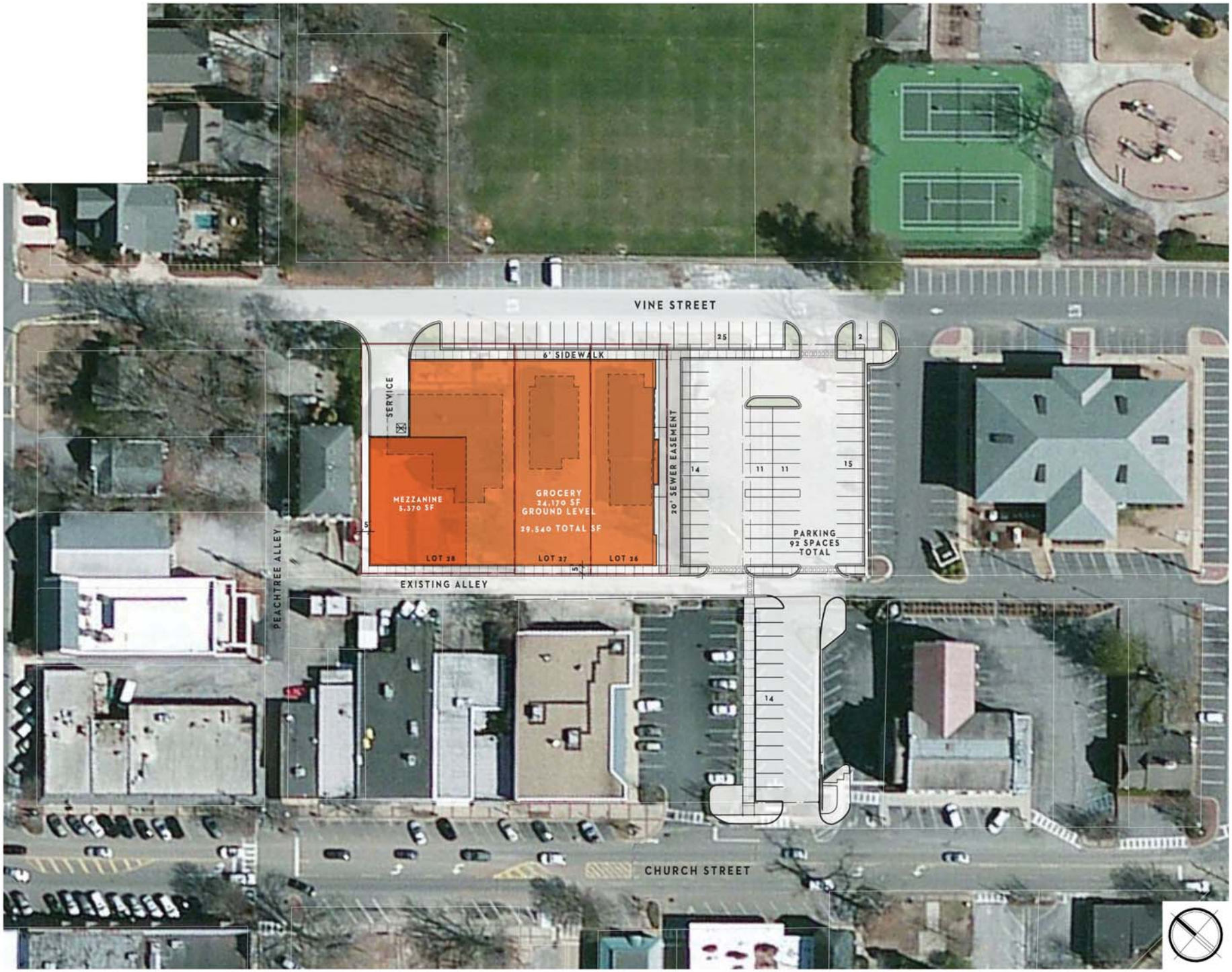
- The section of West Jackson Boulevard from Dexter Avenue to the Crestline Early Learning Center is narrow for two way operation, particularly when there are vehicles parked along the roadway; and
- The signing and striping on West Jackson Boulevard and Vine Street are not entirely appropriate and consistent for two way traffic operations, as shown in the following pictures:

Based on the traffic counts conducted, existing lane uses, striping and signing, ~~and~~ a review of property access constraints, and meetings with the City and Board of Education, this report recommends that the City consider the following restrictions to traffic on West Jackson Boulevard and Vine Street:

- West Jackson Boulevard should be considered for one way northbound operation 24 hours a day, 7 days a week along it entire length from Church Street to Vine Street.
- Vine Street should be considered for one way westbound operation 24 hours a day, 7 days a week from West Jackson Boulevard to the western edge of the Board of Education property.
- Vine Street should be considered for one way westbound operation during the period of ~~7:30 a.m. to 8:15 a.m. and 2:30 p.m. to 3:15 p.m.~~ 7:20 a.m. to 4:00 p.m. along its entire length from West Jackson Boulevard to Dexter Avenue (this is the current condition).

Appendix A

Site Plan



SCALE: 1" = 40'

PIGGLY WIGGLY

CRESTLINE VILLAGE - MOUNTAIN BROOK, AL

GOODWYN | MILLS | CAWOOD

Appendix B

Existing Intersection Turning Movement Traffic Counts

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

Mountain Brook, AL

File Name : mtnbrook02
Site Code : 00000000
Start Date : 05/14/2014
Page No : 1

Groups Printed- Unshifted

	MONTEVALLO RD Southbound				MONTOSE RD Westbound				MONTEVALLO RD Northbound				CHURCH ST Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
02:30 PM	6	55	21	0	19	53	21	0	47	52	15	0	5	26	28	0	348
02:45 PM	11	44	16	14	12	38	35	7	42	69	5	0	4	35	22	0	354
Total	17	99	37	14	31	91	56	7	89	121	20	0	9	61	50	0	702
03:00 PM	17	91	20	8	19	41	16	2	14	48	10	0	10	65	54	0	415
03:15 PM	18	53	10	0	15	43	33	0	53	84	43	0	11	52	38	0	453
Total	35	144	30	8	34	84	49	2	67	132	53	0	21	117	92	0	868
04:00 PM	5	45	9	1	10	41	17	1	36	98	10	0	11	36	43	0	363
04:15 PM	6	62	10	0	8	39	30	0	33	112	9	0	11	47	46	0	413
04:30 PM	12	77	8	0	4	31	19	0	36	116	18	0	13	48	38	0	420
04:45 PM	14	50	14	1	14	43	23	0	34	101	14	0	11	70	30	0	419
Total	37	234	41	2	36	154	89	1	139	427	51	0	46	201	157	0	1615
05:00 PM	19	76	11	0	10	45	30	0	43	109	20	0	17	65	42	0	487
05:15 PM	4	74	11	0	11	39	46	0	28	99	26	0	14	82	43	0	477
05:30 PM	11	78	22	1	5	42	40	0	45	131	18	0	15	75	23	0	506
05:45 PM	11	71	10	0	7	47	31	0	40	117	8	0	17	89	23	0	471
Total	45	299	54	1	33	173	147	0	156	456	72	0	63	311	131	0	1941
07:00 AM	19	89	10	3	12	36	11	0	32	41	8	0	5	27	31	0	324
07:15 AM	17	124	22	2	8	63	12	1	53	49	18	0	5	41	37	0	452
07:30 AM	12	109	10	50	9	65	3	28	64	53	11	0	1	69	66	0	550
07:45 AM	22	102	20	14	25	82	19	2	69	86	27	0	2	42	67	0	579
Total	70	424	62	69	54	246	45	31	218	229	64	0	13	179	201	0	1905
08:00 AM	17	119	21	7	18	86	15	0	37	50	23	0	6	29	32	0	460
08:15 AM	17	110	9	4	18	50	17	0	40	33	10	0	5	37	22	0	372
08:30 AM	17	110	14	4	10	35	8	2	47	51	5	0	5	30	29	0	367
08:45 AM	14	114	15	2	14	44	16	5	61	60	16	0	8	24	33	0	426
Total	65	453	59	17	60	215	56	7	185	194	54	0	24	120	116	0	1625
Grand Total	269	1653	283	111	248	963	442	48	854	1559	314	0	176	989	747	0	8656
Apprch %	11.6	71.4	12.2	4.8	14.6	56.6	26.0	2.8	31.3	57.2	11.5	0.0	9.2	51.7	39.1	0.0	
Total %	3.1	19.1	3.3	1.3	2.9	11.1	5.1	0.6	9.9	18.0	3.6	0.0	2.0	11.4	8.6	0.0	

	MONTEVALLO RD Southbound					MONTOSE RD Westbound					MONTEVALLO RD Northbound					CHURCH ST Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Intersection	05:00 PM																				
Volume	45	299	54	1	399	33	173	147	0	353	156	456	72	0	684	63	311	131	0	505	1941
Percent	11.3	74.9	13.5	0.3		9.3	49.0	41.6	0.0		22.8	66.7	10.5	0.0		12.5	61.6	25.9	0.0		
05:30 Volume	11	78	22	1	112	5	42	40	0	87	45	131	18	0	194	15	75	23	0	113	506
Peak Factor																					0.959
High Int.	05:30 PM					05:15 PM					05:30 PM					05:15 PM					
Volume	11	78	22	1	112	11	39	46	0	96	45	131	18	0	194	14	82	43	0	139	
Peak Factor					0.891					0.919					0.881					0.908	

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

File Name : mtnbrook02
Site Code : 00000000
Start Date : 05/14/2014
Page No : 2

	MONTEVALLO RD Southbound					MONTOSE RD Westbound					MONTEVALLO RD Northbound					CHURCH ST Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																					
By Approach	05:00 PM					05:00 PM					05:00 PM					05:00 PM					
Volume	45	299	54	1	399	33	173	147	0	353	156	456	72	0	684	63	311	131	0	505	
Percent	11.3	74.9	13.5	0.3		9.3	49.0	41.6	0.0		22.8	66.7	10.5	0.0		12.5	61.6	25.9	0.0		
High Int.	05:30 PM					05:15 PM					05:30 PM					05:15 PM					
Volume	11	78	22	1	112	11	39	46	0	96	45	131	18	0	194	14	82	43	0	139	
Peak Factor					0.891					0.919					0.881					0.908	
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Intersection	07:15 AM																				
Volume	68	454	73	73	668	60	296	49	31	436	223	238	79	0	540	14	181	202	0	397	2041
Percent	10.2	68.0	10.9	10.9		13.8	67.9	11.2	7.1		41.3	44.1	14.6	0.0		3.5	45.6	50.9	0.0		
07:45 Volume	22	102	20	14	158	25	82	19	2	128	69	86	27	0	182	2	42	67	0	111	579
Peak Factor																					0.881
High Int.	07:30 AM					07:45 AM					07:45 AM					07:30 AM					
Volume	12	109	10	50	181	25	82	19	2	128	69	86	27	0	182	1	69	66	0	136	
Peak Factor					0.923					0.852					0.742					0.730	
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																					
By Approach	07:15 AM					07:30 AM					07:15 AM					07:15 AM					
Volume	68	454	73	73	668	70	283	54	30	437	223	238	79	0	540	14	181	202	0	397	
Percent	10.2	68.0	10.9	10.9		16.0	64.8	12.4	6.9		41.3	44.1	14.6	0.0		3.5	45.6	50.9	0.0		
High Int.	07:30 AM					07:45 AM					07:45 AM					07:30 AM					
Volume	12	109	10	50	181	25	82	19	2	128	69	86	27	0	182	1	69	66	0	136	
Peak Factor					0.923					0.854					0.742					0.730	

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

Mountain Brook, AL

File Name : mtnbrook01
Site Code : 00000000
Start Date : 05/14/2014
Page No : 1

Groups Printed- 1 - Unshifted

	CHURCH ST Southbound			DEXTER AVE Westbound			CHURCH ST Northbound			
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Int. Total
02:30 PM	12	88	0	17	7	4	54	20	1	203
02:45 PM	10	114	0	32	8	3	46	8	0	221
Total	22	202	0	49	15	7	100	28	1	424
03:00 PM	8	100	0	47	10	1	66	11	0	243
03:15 PM	10	100	0	14	4	2	85	4	0	219
Total	18	200	0	61	14	3	151	15	0	462
04:00 PM	5	87	0	8	6	1	64	1	0	172
04:15 PM	10	77	0	8	3	0	55	7	1	161
04:30 PM	9	97	1	8	5	1	55	5	3	184
04:45 PM	14	94	0	6	5	1	58	10	0	188
Total	38	355	1	30	19	3	232	23	4	705
05:00 PM	14	126	0	9	6	2	75	7	1	240
05:15 PM	15	119	0	12	8	0	70	6	0	230
05:30 PM	19	126	0	17	11	7	73	7	0	260
05:45 PM	23	115	0	17	12	2	71	14	0	254
Total	71	486	0	55	37	11	289	34	1	984
07:00 AM	3	71	0	5	2	1	42	2	0	126
07:15 AM	1	103	0	18	9	0	61	4	0	196
07:30 AM	2	165	0	25	14	5	62	5	8	286
07:45 AM	4	108	1	42	17	4	96	7	3	282
Total	10	447	1	90	42	10	261	18	11	890
08:00 AM	6	89	2	12	9	2	87	3	3	213
08:15 AM	2	64	0	8	4	8	64	3	1	154
08:30 AM	2	73	0	10	9	1	57	7	4	163
08:45 AM	3	82	1	14	8	7	89	5	10	219
Total	13	308	3	44	30	18	297	18	18	749
Grand Total	172	1998	5	329	157	52	1330	136	35	4214
Apprch %	7.9	91.9	0.2	61.2	29.2	9.7	88.6	9.1	2.3	
Total %	4.1	47.4	0.1	7.8	3.7	1.2	31.6	3.2	0.8	

	CHURCH ST Southbound				DEXTER AVE Westbound				CHURCH ST Northbound					
Start Time	Left	Thru	Peds	App. Total	Left	Right	Peds	App. Total	Thru	Right	Peds	App. Total	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1														
Intersection	05:00 PM													
Volume	71	486	0	557	55	37	11	103	289	34	1	324	0	984
Percent	12.7	87.3	0.0		53.4	35.9	10.7		89.2	10.5	0.3			
05:30 Volume	19	126	0	145	17	11	7	35	73	7	0	80	0	260
Peak Factor														0.946
High Int.	05:30 PM				05:30 PM				05:45 PM					
Volume	19	126	0	145	17	11	7	35	71	14	0	85		
Peak Factor				0.960				0.736				0.953		

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

File Name : mtnbrook01
Site Code : 00000000
Start Date : 05/14/2014
Page No : 2

	CHURCH ST Southbound				DEXTER AVE Westbound				CHURCH ST Northbound					
Start Time	Left	Thru	Peds	App. Total	Left	Right	Peds	App. Total	Thru	Right	Peds	App. Total	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1														
By Approach	05:00 PM				05:00 PM				05:00 PM				04:00 PM	
Volume	71	486	0	557	55	37	11	103	289	34	1	324	0	
Percent	12.7	87.3	0.0		53.4	35.9	10.7		89.2	10.5	0.3			
High Int.	05:30 PM				05:30 PM				05:45 PM				-	
Volume	19	126	0	145	17	11	7	35	71	14	0	85	-	
Peak Factor				0.960				0.736				0.953	-	
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1														
Intersection	07:15 AM													
Volume	13	465	3	481	97	49	11	157	306	19	14	339	0	977
Percent	2.7	96.7	0.6		61.8	31.2	7.0		90.3	5.6	4.1			
07:30 Volume	2	165	0	167	25	14	5	44	62	5	8	75	0	286
Peak Factor														0.854
High Int.	07:30 AM				07:45 AM				07:45 AM					
Volume	2	165	0	167	42	17	4	63	96	7	3	106		
Peak Factor				0.720				0.623				0.800		
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1														
By Approach	07:15 AM				07:15 AM				07:30 AM				07:00 AM	
Volume	13	465	3	481	97	49	11	157	309	18	15	342	0	
Percent	2.7	96.7	0.6		61.8	31.2	7.0		90.4	5.3	4.4			
High Int.	07:30 AM				07:45 AM				07:45 AM				-	
Volume	2	165	0	167	42	17	4	63	96	7	3	106	-	
Peak Factor				0.720				0.623				0.807	-	

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

Mountain Brook, AL

File Name : mtnbrook03
Site Code : 00000000
Start Date : 05/14/2014
Page No : 1

Groups Printed- 1 - Unshifted

	CHURCH ST Southbound				JACKSON BLVD Westbound				CHURCH ST Northbound				OAK ST Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
02:30 PM	16	50	5	0	0	0	0	0	12	69	22	0	2	3	16	0	195
02:45 PM	19	83	3	0	0	0	0	16	12	46	24	47	1	3	23	4	281
Total	35	133	8	0	0	0	0	16	24	115	46	47	3	6	39	4	476
03:00 PM	23	120	1	0	0	0	0	2	15	68	13	5	2	0	25	0	274
03:15 PM	4	85	7	0	2	0	0	0	17	88	5	1	9	0	23	1	242
Total	27	205	8	0	2	0	0	2	32	156	18	6	11	0	48	1	516
04:00 PM	3	68	6	0	0	1	0	1	16	71	4	0	3	0	20	0	193
04:15 PM	3	84	3	0	5	1	0	0	19	60	10	0	2	3	18	0	208
04:30 PM	2	80	4	0	2	1	0	0	12	60	5	0	5	1	27	1	200
04:45 PM	3	90	2	0	4	0	0	0	15	73	13	0	2	1	21	0	224
Total	11	322	15	0	11	3	0	1	62	264	32	0	12	5	86	1	825
05:00 PM	6	105	0	0	0	1	0	0	13	75	8	0	1	1	31	0	241
05:15 PM	5	122	3	0	3	0	2	0	9	57	7	0	1	2	24	0	235
05:30 PM	18	95	1	0	1	1	2	0	10	83	18	0	1	4	23	0	257
05:45 PM	16	100	1	0	3	0	1	0	13	82	16	0	3	3	28	0	266
Total	45	422	5	0	7	2	5	0	45	297	49	0	6	10	106	0	999
07:00 AM	8	59	1	0	0	0	0	4	4	59	10	0	3	1	12	0	161
07:15 AM	20	88	2	0	0	0	0	0	6	78	44	0	1	0	9	0	248
07:30 AM	41	131	0	0	0	0	0	1	2	72	69	32	1	3	16	1	369
07:45 AM	32	112	1	0	0	0	0	1	11	105	40	11	3	2	11	0	329
Total	101	390	4	0	0	0	0	6	23	314	163	43	8	6	48	1	1107
08:00 AM	11	74	0	0	0	0	0	3	23	100	23	5	2	3	9	0	253
08:15 AM	8	54	1	1	0	0	0	2	11	71	15	1	3	3	9	1	180
08:30 AM	10	66	1	1	0	0	0	2	10	79	13	1	2	0	10	2	197
08:45 AM	12	67	3	1	0	0	0	2	15	100	7	2	1	1	6	1	218
Total	41	261	5	3	0	0	0	9	59	350	58	9	8	7	34	4	848
Grand Total	260	1733	45	3	20	5	5	34	245	1496	366	105	48	34	361	11	4771
Apprch %	12.7	84.9	2.2	0.1	31.3	7.8	7.8	53.1	11.1	67.6	16.5	4.7	10.6	7.5	79.5	2.4	
Total %	5.4	36.3	0.9	0.1	0.4	0.1	0.1	0.7	5.1	31.4	7.7	2.2	1.0	0.7	7.6	0.2	

	CHURCH ST Southbound					JACKSON BLVD Westbound					CHURCH ST Northbound					OAK ST Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Intersection	05:00 PM																				
Volume	45	422	5	0	472	7	2	5	0	14	45	297	49	0	391	6	10	106	0	122	999
Percent	9.5	89.4	1.1	0.0		50.0	14.3	35.7	0.0		11.5	76.0	12.5	0.0		4.9	8.2	86.9	0.0		
05:45 Volume	16	100	1	0	117	3	0	1	0	4	13	82	16	0	111	3	3	28	0	34	266
Peak Factor																					0.939
High Int.	05:15 PM					05:15 PM					05:30 PM					05:45 PM					
Volume	5	122	3	0	130	3	0	2	0	5	10	83	18	0	111	3	3	28	0	34	
Peak Factor					0.908					0.700					0.881					0.897	

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1409 Turnham Lane
Birmingham, AL 35216
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File Name : mtnbrook03
Site Code : 00000000
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	CHURCH ST Southbound					JACKSON BLVD Westbound					CHURCH ST Northbound					OAK ST Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																					
By Approach	05:00 PM					04:00 PM					05:00 PM					05:00 PM					
Volume	45	422	5	0	472	11	3	0	1	15	45	297	49	0	391	6	10	106	0	122	
Percent	9.5	89.4	1.1	0.0		73.3	20.0	0.0	6.7		11.5	76.0	12.5	0.0		4.9	8.2	86.9	0.0		
High Int.	05:15 PM					04:15 PM					05:30 PM					05:45 PM					
Volume	5	122	3	0	130	5	1	0	0	6	10	83	18	0	111	3	3	28	0	34	
Peak Factor					0.908					0.625					0.881					0.897	
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Intersection	07:15 AM																				
Volume	104	405	3	0	512	0	0	0	5	5	42	355	176	48	621	7	8	45	1	61	1199
Percent	20.3	79.1	0.6	0.0		0.0	0.0	0.0	100.0		6.8	57.2	28.3	7.7		11.5	13.1	73.8	1.6		
07:30 Volume	41	131	0	0	172	0	0	0	1	1	2	72	69	32	175	1	3	16	1	21	369
Peak Factor																					0.812
High Int.	07:30 AM					08:00 AM					07:30 AM					07:30 AM					
Volume	41	131	0	0	172	0	0	0	3	3	2	72	69	32	175	1	3	16	1	21	
Peak Factor					0.744					0.417					0.887					0.726	
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																					
By Approach	07:15 AM					08:00 AM					07:15 AM					07:30 AM					
Volume	104	405	3	0	512	0	0	0	9	9	42	355	176	48	621	9	11	45	2	67	
Percent	20.3	79.1	0.6	0.0		0.0	0.0	0.0	100.0		6.8	57.2	28.3	7.7		13.4	16.4	67.2	3.0		
High Int.	07:30 AM					08:00 AM					07:30 AM					07:30 AM					
Volume	41	131	0	0	172	0	0	0	3	3	2	72	69	32	175	1	3	16	1	21	
Peak Factor					0.744					0.750					0.887					0.798	

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

Mountain Brook, AL

File Name : mtnbrook04
Site Code : 00000000
Start Date : 05/14/2014
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Groups Printed- 1 - Unshifted

	VINE ST Southbound				DEXTER AVE Westbound				VINE ST Northbound				DEXTER AVE Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
02:30 PM	0	0	2	0	0	7	0	0	11	10	2	0	3	25	0	0	60
02:45 PM	0	0	1	0	0	10	0	0	30	22	12	0	1	18	0	0	94
Total	0	0	3	0	0	17	0	0	41	32	14	0	4	43	0	0	154
03:00 PM	2	0	4	0	0	18	2	0	38	44	35	0	6	7	0	0	156
03:15 PM	2	1	3	0	0	7	1	0	9	10	4	0	1	8	0	0	46
Total	4	1	7	0	0	25	3	0	47	54	39	0	7	15	0	0	202
04:00 PM	0	2	3	0	1	5	0	0	3	8	1	0	1	0	0	0	24
04:15 PM	2	4	3	0	2	9	1	0	4	8	2	0	2	10	0	0	47
04:30 PM	0	1	1	0	1	8	0	0	4	16	2	0	3	4	2	0	42
04:45 PM	5	0	4	0	1	4	0	0	6	4	3	1	3	10	1	0	42
Total	7	7	11	0	5	26	1	0	17	36	8	1	9	24	3	0	155
05:00 PM	1	2	2	0	1	6	0	0	6	18	7	1	6	10	0	0	60
05:15 PM	2	1	0	0	0	7	0	0	7	7	3	0	4	12	3	0	46
05:30 PM	1	0	3	0	2	13	0	0	16	17	9	0	1	12	2	0	76
05:45 PM	1	0	4	0	1	15	1	0	12	7	16	0	2	16	1	0	76
Total	5	3	9	0	4	41	1	0	41	49	35	1	13	50	6	0	258
07:00 AM	0	2	0	1	0	4	1	1	3	0	3	2	0	2	1	0	20
07:15 AM	1	1	0	1	0	5	0	0	21	16	5	1	2	9	0	0	62
07:30 AM	1	0	1	2	1	19	0	0	32	25	19	2	0	5	1	1	109
07:45 AM	1	0	2	0	2	27	1	0	27	21	25	0	3	7	0	0	116
Total	3	3	3	4	3	55	2	1	83	62	52	5	5	23	2	1	307
08:00 AM	0	1	4	3	1	4	0	0	10	7	6	2	1	1	1	0	41
08:15 AM	1	1	2	1	2	8	0	0	5	8	1	5	1	4	0	0	39
08:30 AM	0	0	3	0	0	6	0	0	8	1	2	1	3	5	0	0	29
08:45 AM	0	1	3	2	1	10	1	1	8	4	8	0	1	1	3	0	44
Total	1	3	12	6	4	28	1	1	31	20	17	8	6	11	4	0	153
Grand Total	20	17	45	10	16	192	8	2	260	253	165	15	44	166	15	1	1229
Apprch %	21.7	18.5	48.9	10.9	7.3	88.1	3.7	0.9	37.5	36.5	23.8	2.2	19.5	73.5	6.6	0.4	
Total %	1.6	1.4	3.7	0.8	1.3	15.6	0.7	0.2	21.2	20.6	13.4	1.2	3.6	13.5	1.2	0.1	

	VINE ST Southbound					DEXTER AVE Westbound					VINE ST Northbound					DEXTER AVE Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Intersection	05:00 PM																				
Volume	5	3	9	0	17	4	41	1	0	46	41	49	35	1	126	13	50	6	0	69	258
Percent	29.4	17.6	52.9	0.0		8.7	89.1	2.2	0.0		32.5	38.9	27.8	0.8		18.8	72.5	8.7	0.0		
05:45 Volume	1	0	4	0	5	1	15	1	0	17	12	7	16	0	35	2	16	1	0	19	76
Peak Factor																					0.849
High Int.	05:00 PM					05:45 PM					05:30 PM					05:15 PM					
Volume	1	2	2	0	5	1	15	1	0	17	16	17	9	0	42	4	12	3	0	19	
Peak Factor					0.850					0.676					0.750					0.908	

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

File Name : mtnbrook04
Site Code : 00000000
Start Date : 05/14/2014
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	VINE ST Southbound					DEXTER AVE Westbound					VINE ST Northbound					DEXTER AVE Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																					
By Approach	04:00 PM					05:00 PM					05:00 PM					05:00 PM					
Volume	7	7	11	0	25	4	41	1	0	46	41	49	35	1	126	13	50	6	0	69	
Percent	28.0	28.0	44.0	0.0		8.7	89.1	2.2	0.0		32.5	38.9	27.8	0.8		18.8	72.5	8.7	0.0		
High Int.	04:15 PM					05:45 PM					05:30 PM					05:15 PM					
Volume	2	4	3	0	9	1	15	1	0	17	16	17	9	0	42	4	12	3	0	19	
Peak Factor					0.694					0.676					0.750					0.908	
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Intersection	07:15 AM																				
Volume	3	2	7	6	18	4	55	1	0	60	90	69	55	5	219	6	22	2	1	31	328
Percent	16.7	11.1	38.9	33.3		6.7	91.7	1.7	0.0		41.1	31.5	25.1	2.3		19.4	71.0	6.5	3.2		
07:45 Volume	1	0	2	0	3	2	27	1	0	30	27	21	25	0	73	3	7	0	0	10	116
Peak Factor																					0.707
High Int.	08:00 AM					07:45 AM					07:30 AM					07:15 AM					
Volume	0	1	4	3	8	2	27	1	0	30	32	25	19	2	78	2	9	0	0	11	
Peak Factor					0.563					0.500					0.702					0.705	
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																					
By Approach	08:00 AM					07:30 AM					07:15 AM					07:00 AM					
Volume	1	3	12	6	22	6	58	1	0	65	90	69	55	5	219	5	23	2	1	31	
Percent	4.5	13.6	54.5	27.3		9.2	89.2	1.5	0.0		41.1	31.5	25.1	2.3		16.1	74.2	6.5	3.2		
High Int.	08:00 AM					07:45 AM					07:30 AM					07:15 AM					
Volume	0	1	4	3	8	2	27	1	0	30	32	25	19	2	78	2	9	0	0	11	
Peak Factor					0.688					0.542					0.702					0.705	

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

Mountain Brook, AL

File Name : mtnbrook06
Site Code : 00000000
Start Date : 05/21/2014
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Groups Printed- Unshifted

	CHURCH ST Southbound	REGIONS/CVS (S) ACCESS Westbound			
Start Time	Left	Left	Right	Peds	Int. Total
07:00 AM	0	0	1	4	5
07:15 AM	1	0	1	1	3
07:30 AM	0	6	7	0	13
07:45 AM	0	2	5	3	10
Total	1	8	14	8	31
08:00 AM	0	1	0	3	4
08:15 AM	0	0	2	3	5
08:30 AM	0	1	2	5	8
08:45 AM	0	0	1	5	6
Total	0	2	5	16	23
02:30 PM	0	2	4	5	11
02:45 PM	0	2	15	1	18
Total	0	4	19	6	29
03:00 PM	0	2	10	2	14
03:15 PM	0	4	4	2	10
Total	0	6	14	4	24
04:00 PM	0	3	6	2	11
04:15 PM	0	1	4	1	6
04:30 PM	0	1	6	2	9
04:45 PM	0	4	10	0	14
Total	0	9	26	5	40
05:00 PM	1	1	4	0	6
05:15 PM	0	4	1	2	7
05:30 PM	0	0	0	5	5
05:45 PM	1	0	0	12	13
Total	2	5	5	19	31
Grand Total	3	34	83	58	178
Apprch %	100.0	19.4	47.4	33.1	
Total %	1.7	19.1	46.6	32.6	

	CHURCH ST Southbound		REGIONS/CVS (S) ACCESS Westbound						
Start Time	Left	App. Total	Left	Right	Peds	App. Total	App. Total	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1									
Intersection	07:30 AM								
Volume	0	0	9	14	9	32	0	0	32
Percent	0.0		28.1	43.8	28.1				
07:30 Volume	0	0	6	7	0	13	0	0	13
Peak Factor									0.615
High Int.	6:45:00 AM		07:30 AM				6:45:00 AM	6:45:00 AM	
Volume	0	0	6	7	0	13			
Peak Factor						0.615			

TRAFFIC DATA, LLC

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	CHURCH ST Southbound		REGIONS/CVS (S) ACCESS Westbound						
Start Time	Left	App. Total	Left	Right	Peds	App. Total	App. Total	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1									
By Approach	07:00 AM		07:30 AM				07:00 AM	07:00 AM	
Volume	1	1	9	14	9	32	0	0	
Percent	100.0		28.1	43.8	28.1				
High Int.	07:15 AM		07:30 AM				-	-	
Volume	1	1	6	7	0	13	-	-	
Peak Factor		0.250				0.615	-	-	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1									
Intersection	04:00 PM								
Volume	0	0	9	26	5	40	0	0	40
Percent	0.0		22.5	65.0	12.5				
04:45 Volume	0	0	4	10	0	14	0	0	14
Peak Factor									0.714
High Int.			04:45 PM						
Volume	0	0	4	10	0	14			
Peak Factor						0.714			
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1									
By Approach	05:00 PM		04:00 PM				04:00 PM	04:00 PM	
Volume	2	2	9	26	5	40	0	0	
Percent	100.0		22.5	65.0	12.5				
High Int.	05:00 PM		04:45 PM				-	-	
Volume	1	1	4	10	0	14	-	-	
Peak Factor		0.500				0.714	-	-	

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

Mountain Brook, AL

File Name : mtnbrook07
Site Code : 00000000
Start Date : 05/21/2014
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Groups Printed- Unshifted

	CHURCH ST Southbound	REGIONS/CVS (M) ACCESS Westbound			
Start Time	Left	Left	Right	Peds	Int. Total
07:00 AM	0	0	0	4	4
07:15 AM	0	0	0	1	1
07:45 AM	0	0	0	3	3
Total	0	0	0	8	8
08:00 AM	0	0	0	1	1
08:15 AM	0	0	0	3	3
08:30 AM	0	0	0	5	5
08:45 AM	0	0	0	2	2
Total	0	0	0	11	11
02:30 PM	0	0	1	5	6
02:45 PM	0	0	0	4	4
Total	0	0	1	9	10
03:00 PM	0	0	2	2	4
03:15 PM	0	0	0	2	2
Total	0	0	2	4	6
04:00 PM	0	1	0	2	3
04:15 PM	0	3	0	1	4
04:30 PM	0	1	0	2	3
04:45 PM	0	0	2	0	2
Total	0	5	2	5	12
05:00 PM	0	1	0	0	1
05:15 PM	1	3	1	2	7
05:30 PM	0	0	0	5	5
05:45 PM	2	0	3	13	18
Total	3	4	4	20	31
Grand Total	3	9	9	57	78
Apprch %	100.0	12.0	12.0	76.0	
Total %	3.8	11.5	11.5	73.1	

	CHURCH ST Southbound		REGIONS/CVS (M) ACCESS Westbound						
Start Time	Left	App. Total	Left	Right	Peds	App. Total	App. Total	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1									
Intersection	07:45 AM								
Volume	0	0	0	0	12	12	0	0	12
Percent	0.0		0.0	0.0	100.0				
08:30 Volume	0	0	0	0	5	5	0	0	5
Peak Factor									0.600
High Int.	6:45:00 AM		08:30 AM				6:45:00 AM	6:45:00 AM	
Volume	0	0	0	0	5	5			
Peak Factor						0.600			

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

File Name : mtnbrook07
Site Code : 00000000
Start Date : 05/21/2014
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	CHURCH ST Southbound		REGIONS/CVS (M) ACCESS Westbound						
Start Time	Left	App. Total	Left	Right	Peds	App. Total	App. Total	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1									
By Approach	07:00 AM		07:45 AM				07:00 AM	07:00 AM	
Volume	0	0	0	0	12	12	0	0	
Percent	-		0.0	0.0	100.0				
High Int.	-		08:30 AM				-	-	
Volume	-	-	0	0	5	5	-	-	
Peak Factor		-				0.600	-	-	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1									
Intersection	05:00 PM								
Volume	3	3	4	4	20	28	0	0	31
Percent	100.0		14.3	14.3	71.4				
05:45 Volume	2	2	0	3	13	16	0	0	18
Peak Factor									0.431
High Int.	05:45 PM		05:45 PM						
Volume	2	2	0	3	13	16			
Peak Factor		0.375				0.438			
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1									
By Approach	05:00 PM		05:00 PM				04:00 PM	04:00 PM	
Volume	3	3	4	4	20	28	0	0	
Percent	100.0		14.3	14.3	71.4				
High Int.	05:45 PM		05:45 PM				-	-	
Volume	2	2	0	3	13	16	-	-	
Peak Factor		0.375				0.438	-	-	

TRAFFIC DATA, LLC

1409 Turnham Lane
Birmingham, AL 35216
205-824-0125

Mountain Brook, AL

File Name : mtnbrook05
Site Code : 00000000
Start Date : 05/21/2014
Page No : 1

Groups Printed- Unshifted

	CHURCH ST Southbound		CVS/REGIONS (N) ACCESS Westbound			CHURCH ST Northbound		
Start Time	Left	Peds	Left	Right	Peds	Right	Peds	Int. Total
07:00 AM	1	0	2	1	4	0	0	8
07:15 AM	0	0	0	0	1	1	0	2
07:30 AM	2	0	0	1	0	1	0	4
07:45 AM	2	0	1	2	3	0	0	8
Total	5	0	3	4	8	2	0	22
08:00 AM	1	1	0	1	2	0	0	5
08:15 AM	1	6	0	0	3	1	0	11
08:30 AM	2	2	2	1	5	0	0	12
08:45 AM	4	2	2	4	5	3	0	20
Total	8	11	4	6	15	4	0	48
02:30 PM	6	1	2	8	5	5	0	27
02:45 PM	8	3	5	9	2	6	0	33
Total	14	4	7	17	7	11	0	60
03:00 PM	4	7	6	6	3	7	0	33
03:15 PM	8	6	1	10	2	4	0	31
Total	12	13	7	16	5	11	0	64
04:00 PM	3	0	9	4	2	5	0	23
04:15 PM	7	1	5	5	1	8	0	27
04:30 PM	11	9	8	7	3	3	0	41
04:45 PM	7	1	4	8	0	4	0	24
Total	28	11	26	24	6	20	0	115
05:00 PM	4	2	3	7	0	4	0	20
05:15 PM	9	6	2	4	2	1	0	24
05:30 PM	6	6	0	6	5	4	0	27
05:45 PM	6	1	1	8	14	2	0	32
Total	25	15	6	25	21	11	0	103
Grand Total	92	54	53	92	62	59	0	412
Apprch %	63.0	37.0	25.6	44.4	30.0	100.0	0.0	
Total %	22.3	13.1	12.9	22.3	15.0	14.3	0.0	

	CHURCH ST Southbound			CVS/REGIONS (N) ACCESS Westbound				CHURCH ST Northbound				
Start Time	Left	Peds	App. Total	Left	Right	Peds	App. Total	Right	Peds	App. Total	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1												
Intersection	08:00 AM											
Volume	8	11	19	4	6	15	25	4	0	4	0	48
Percent	42.1	57.9		16.0	24.0	60.0		100.0	0.0			
08:45 Volume	4	2	6	2	4	5	11	3	0	3	0	20
Peak Factor												0.600
High Int.	08:15 AM			08:45 AM				08:45 AM			6:45:00 AM	
Volume	1	6	7	2	4	5	11	3	0	3		
Peak Factor			0.679				0.568			0.333		

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205-824-0125

File Name : mtnbrook05
Site Code : 00000000
Start Date : 05/21/2014
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	CHURCH ST Southbound			CVS/REGIONS (N) ACCESS Westbound				CHURCH ST Northbound				
Start Time	Left	Peds	App. Total	Left	Right	Peds	App. Total	Right	Peds	App. Total	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1												
By Approach	08:00 AM			08:00 AM				08:00 AM			07:00 AM	
Volume	8	11	19	4	6	15	25	4	0	4	0	
Percent	42.1	57.9		16.0	24.0	60.0		100.0	0.0			
High Int.	08:15 AM			08:45 AM				08:45 AM			-	
Volume	1	6	7	2	4	5	11	3	0	3	-	
Peak Factor			0.679				0.568			0.333	-	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1												
Intersection	04:00 PM											
Volume	28	11	39	26	24	6	56	20	0	20	0	115
Percent	71.8	28.2		46.4	42.9	10.7		100.0	0.0			
04:30 Volume	11	9	20	8	7	3	18	3	0	3	0	41
Peak Factor												0.701
High Int.	04:30 PM			04:30 PM				04:15 PM				
Volume	11	9	20	8	7	3	18	8	0	8		
Peak Factor			0.488				0.778			0.625		
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1												
By Approach	04:30 PM			04:00 PM				04:00 PM			04:00 PM	
Volume	31	18	49	26	24	6	56	20	0	20	0	
Percent	63.3	36.7		46.4	42.9	10.7		100.0	0.0			
High Int.	04:30 PM			04:30 PM				04:15 PM			-	
Volume	11	9	20	8	7	3	18	8	0	8	-	
Peak Factor			0.613				0.778			0.625	-	

Appendix C

Existing Intersection Capacity Analysis Worksheets

Movement	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	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Frpb, ped/bikes	1.00	0.90		1.00	0.99		1.00	0.98			0.96	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Frt	1.00	0.92		1.00	0.98		1.00	0.96			0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)	1770	1545		1770	1796		1770	1766			1749	
Flt Permitted	0.95	1.00		0.95	1.00		0.29	1.00			0.74	
Satd. Flow (perm)	1770	1545		1770	1796		532	1766			1298	
Volume (vph)	14	181	202	60	296	49	223	238	79	68	454	73
Peak-hour factor, PHF	0.73	0.73	0.73	0.85	0.85	0.85	0.74	0.74	0.74	0.92	0.92	0.92
Adj. Flow (vph)	19	248	277	71	348	58	301	322	107	74	493	79
RTOR Reduction (vph)	0	40	0	0	6	0	0	12	0	0	5	0
Lane Group Flow (vph)	19	485	0	71	400	0	301	417	0	0	641	0
Confl. Peds. (#/hr)	104		73			31	73		15	31		104
Turn Type	Split			Split			Perm			Perm		
Protected Phases	3	3		4	4			2			2	
Permitted Phases							2			2		
Actuated Green, G (s)	20.0	20.0		23.8	23.8		40.0	40.0			40.0	
Effective Green, g (s)	21.0	21.0		24.8	24.8		41.0	41.0			41.0	
Actuated g/C Ratio	0.21	0.21		0.25	0.25		0.41	0.41			0.41	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	376	328		444	451		221	733			539	
v/s Ratio Prot	0.01	c0.31		0.04	c0.22			0.24				
v/s Ratio Perm							c0.57				0.49	
v/c Ratio	0.05	1.48		0.16	0.89		1.36	0.57			1.19	
Uniform Delay, d1	31.0	38.9		28.9	35.6		28.9	22.1			28.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.1	231.0		0.2	18.5		189.3	3.2			102.4	
Delay (s)	31.0	269.9		29.0	54.2		218.2	25.3			131.3	
Level of Service	C	F		C	D		F	C			F	
Approach Delay (s)		261.5			50.4			104.8			131.3	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	136.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	98.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	95.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	104	405	3	42	355	176	7	8	45	0	0	0
Peak Hour Factor	0.74	0.74	0.74	0.89	0.89	0.89	0.73	0.73	0.73	0.90	0.90	0.90
Hourly flow rate (vph)	141	547	4	47	399	198	10	11	62	0	0	0
Pedestrians		15			15			15			15	
Lane Width (ft)		12.0			12.0			12.0			0.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			1			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)					600							
pX, platoon unblocked	0.78						0.78	0.78		0.78	0.78	0.78
vC, conflicting volume	612			566			1354	1551	579	1518	1455	528
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	499			566			1456	1711	579	1668	1586	391
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	83			95			86	80	88	100	100	100
cM capacity (veh/h)	826			993			68	55	502	36	65	504

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	141	551	47	597	82
Volume Left	141	0	47	0	10
Volume Right	0	4	0	198	62
cSH	826	1700	993	1700	177
Volume to Capacity	0.17	0.32	0.05	0.35	0.46
Queue Length 95th (ft)	15	0	4	0	55
Control Delay (s)	10.3	0.0	8.8	0.0	41.9
Lane LOS	B		A		E
Approach Delay (s)	2.1		0.6		41.9
Approach LOS					E

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	558	362	0	9	14
Peak Hour Factor	0.72	0.72	0.80	0.80	0.62	0.62
Hourly flow rate (vph)	0	775	452	0	15	23
Pedestrians		15	15		15	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		1	1		1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			825			
pX, platoon unblocked						
vC, conflicting volume	468				1258	482
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	468				1258	482
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				92	96
cM capacity (veh/h)	1080				184	569

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	775	452	15	23
Volume Left	0	0	15	0
Volume Right	0	0	0	23
cSH	1700	1700	184	569
Volume to Capacity	0.46	0.27	0.08	0.04
Queue Length 95th (ft)	0	0	6	3
Control Delay (s)	0.0	0.0	26.2	11.6
Lane LOS			D	B
Approach Delay (s)	0.0	0.0	17.3	
Approach LOS			C	

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	43.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	558	376	0	0	0
Peak Hour Factor	0.72	0.72	0.80	0.80	0.90	0.90
Hourly flow rate (vph)	0	775	470	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			925			
pX, platoon unblocked						
vC, conflicting volume	470				1245	470
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	470				1245	470
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1092				192	594

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	775	470	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1700	1700
Volume to Capacity	0.46	0.28	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	0.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	32.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	8	554	372	4	4	6
Peak Hour Factor	0.72	0.72	0.80	0.80	0.57	0.57
Hourly flow rate (vph)	11	769	465	5	7	11
Pedestrians		15	15		15	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		1	1		1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			1025			
pX, platoon unblocked						
vC, conflicting volume	485				1289	498
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	485				1289	498
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				96	98
cM capacity (veh/h)	1064				174	558

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	11	769	470	18
Volume Left	11	0	0	7
Volume Right	0	0	5	11
cSH	1064	1700	1700	297
Volume to Capacity	0.01	0.45	0.28	0.06
Queue Length 95th (ft)	1	0	0	5
Control Delay (s)	8.4	0.0	0.0	17.9
Lane LOS	A			C
Approach Delay (s)	0.1		0.0	17.9
Approach LOS				C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	43.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	14	465	306	19	97	49
Peak Hour Factor	0.72	0.72	0.80	0.80	0.62	0.62
Hourly flow rate (vph)	19	646	382	24	156	79
Pedestrians		15	15		15	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		1	1		1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	421				1109	424
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	421				1109	424
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				30	87
cM capacity (veh/h)	1124				222	614

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	19	646	406	235
Volume Left	19	0	0	156
Volume Right	0	0	24	79
cSH	1124	1700	1700	283
Volume to Capacity	0.02	0.38	0.24	0.83
Queue Length 95th (ft)	1	0	0	172
Control Delay (s)	8.3	0.0	0.0	58.7
Lane LOS	A			F
Approach Delay (s)	0.2		0.0	58.7
Approach LOS				F

Intersection Summary			
Average Delay	10.7		
Intersection Capacity Utilization	41.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	3	2	7	90	69	55	6	22	2	4	55	1
Peak Hour Factor	0.56	0.56	0.56	0.70	0.70	0.70	0.71	0.71	0.71	0.50	0.50	0.50
Hourly flow rate (vph)	5	4	12	129	99	79	8	31	3	8	110	2
Pedestrians		15			15			15			15	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			1			1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	334	208	141	221	207	62	127			49		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	334	208	141	221	207	62	127			49		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	99	99	81	85	92	99			99		
cM capacity (veh/h)	479	665	884	685	665	977	1441			1539		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	21	306	42	120
Volume Left	5	129	8	8
Volume Right	12	79	3	2
cSH	698	734	1441	1539
Volume to Capacity	0.03	0.42	0.01	0.01
Queue Length 95th (ft)	2	52	0	0
Control Delay (s)	10.3	13.4	1.5	0.5
Lane LOS	B	B	A	A
Approach Delay (s)	10.3	13.4	1.5	0.5
Approach LOS	B	B		

Intersection Summary			
Average Delay	9.1		
Intersection Capacity Utilization	33.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	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	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.98		1.00	1.00			0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.98	1.00			1.00	
Frt	1.00	0.93		1.00	0.94		1.00	0.97			0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)	1770	1739		1770	1731		1735	1800			1771	
Flt Permitted	0.95	1.00		0.95	1.00		0.41	1.00			0.70	
Satd. Flow (perm)	1770	1739		1770	1731		746	1800			1253	
Volume (vph)	30	178	142	65	175	105	156	253	73	52	243	67
Peak-hour factor, PHF	0.73	0.73	0.73	0.85	0.85	0.85	0.74	0.74	0.74	0.92	0.92	0.92
Adj. Flow (vph)	41	244	195	76	206	124	211	342	99	57	264	73
RTOR Reduction (vph)	0	33	0	0	24	0	0	11	0	0	9	0
Lane Group Flow (vph)	41	406	0	76	306	0	211	430	0	0	385	0
Confl. Peds. (#/hr)	31					9	22			9		31
Turn Type	Split			Split			Perm			Perm		
Protected Phases	3	3		4	4			2			2	
Permitted Phases							2			2		
Actuated Green, G (s)	22.1	22.1		17.6	17.6		30.2	30.2			30.2	
Effective Green, g (s)	23.1	23.1		18.6	18.6		31.2	31.2			31.2	
Actuated g/C Ratio	0.27	0.27		0.22	0.22		0.37	0.37			0.37	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	482	473		388	379		274	661			460	
v/s Ratio Prot	0.02	c0.23		0.04	c0.18			0.24				
v/s Ratio Perm							0.28				c0.31	
v/c Ratio	0.09	0.86		0.20	0.81		0.77	0.65			0.84	
Uniform Delay, d1	23.0	29.4		27.0	31.4		23.7	22.3			24.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.1	14.4		0.2	11.9		18.6	4.9			16.4	
Delay (s)	23.1	43.7		27.3	43.3		42.3	27.2			41.0	
Level of Service	C	D		C	D		D	C			D	
Approach Delay (s)		41.9			40.3			32.1			41.0	
Approach LOS		D			D			C			D	

Intersection Summary			
HCM Average Control Delay	38.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	84.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
2: Church Street & West Jackson Boulevard

9/9/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	62	338	16	56	271	64	14	6	87	0	0	0
Peak Hour Factor	0.72	0.72	0.72	0.89	0.89	0.89	0.84	0.84	0.84	0.90	0.90	0.90
Hourly flow rate (vph)	86	469	22	63	304	72	17	7	104	0	0	0
Pedestrians		20			20			20			20	
Lane Width (ft)		12.0			12.0			12.0			0.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		2			2			2			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)					600							
pX, platoon unblocked	1.00						1.00	1.00		1.00	1.00	1.00
vC, conflicting volume	396			512			1123	1195	521	1255	1170	380
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	394			512			1124	1196	521	1256	1171	378
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	93			94			89	95	81	100	100	100
cM capacity (veh/h)	1160			1036			157	159	537	101	164	655

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	86	492	63	376	127
Volume Left	86	0	63	0	17
Volume Right	0	22	0	72	104
cSH	1160	1700	1036	1700	370
Volume to Capacity	0.07	0.29	0.06	0.22	0.34
Queue Length 95th (ft)	6	0	5	0	38
Control Delay (s)	8.4	0.0	8.7	0.0	19.8
Lane LOS	A		A		C
Approach Delay (s)	1.2		1.2		19.8
Approach LOS					C

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	42.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	500	285	0	10	33
Peak Hour Factor	0.89	0.89	0.83	0.83	0.77	0.77
Hourly flow rate (vph)	0	562	343	0	13	43
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			825			
pX, platoon unblocked						
vC, conflicting volume	363				945	383
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	363				945	383
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				95	93
cM capacity (veh/h)	1175				281	642

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	562	343	13	43
Volume Left	0	0	13	0
Volume Right	0	0	0	43
cSH	1700	1700	281	642
Volume to Capacity	0.33	0.20	0.05	0.07
Queue Length 95th (ft)	0	0	4	5
Control Delay (s)	0.0	0.0	18.4	11.0
Lane LOS			C	B
Approach Delay (s)	0.0	0.0	12.7	
Approach LOS			B	

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	41.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	500	318	0	0	3
Peak Hour Factor	0.89	0.89	0.83	0.83	0.90	0.90
Hourly flow rate (vph)	0	562	383	0	0	3
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			925			
pX, platoon unblocked						
vC, conflicting volume	403				985	423
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	403				985	423
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	1136				266	610

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	562	383	3
Volume Left	0	0	0
Volume Right	0	0	3
cSH	1700	1700	610
Volume to Capacity	0.33	0.23	0.01
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	10.9
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.9
Approach LOS			B

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	41.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	26	486	329	22	14	33
Peak Hour Factor	0.89	0.89	0.83	0.83	0.85	0.85
Hourly flow rate (vph)	29	546	396	27	16	39
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			1025			
pX, platoon unblocked						
vC, conflicting volume	443				1054	450
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	443				1054	450
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				93	93
cM capacity (veh/h)	1099				235	589

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	29	546	423	55
Volume Left	29	0	0	16
Volume Right	0	0	27	39
cSH	1099	1700	1700	407
Volume to Capacity	0.03	0.32	0.25	0.14
Queue Length 95th (ft)	2	0	0	12
Control Delay (s)	8.4	0.0	0.0	15.2
Lane LOS	A			C
Approach Delay (s)	0.4		0.0	15.2
Approach LOS				C

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	40.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	40	402	251	43	110	29
Peak Hour Factor	0.89	0.89	0.83	0.83	0.61	0.61
Hourly flow rate (vph)	45	452	302	52	180	48
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	374				910	368
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	374				910	368
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				36	93
cM capacity (veh/h)	1165				283	655

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	45	452	354	228
Volume Left	45	0	0	180
Volume Right	0	0	52	48
cSH	1165	1700	1700	321
Volume to Capacity	0.04	0.27	0.21	0.71
Queue Length 95th (ft)	3	0	0	127
Control Delay (s)	8.2	0.0	0.0	39.4
Lane LOS	A			E
Approach Delay (s)	0.7		0.0	39.4
Approach LOS				E

Intersection Summary			
Average Delay	8.7		
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	4	1	10	88	86	53	11	58	0	0	42	3
Peak Hour Factor	0.63	0.63	0.63	0.49	0.49	0.49	0.61	0.61	0.61	0.56	0.56	0.56
Hourly flow rate (vph)	6	2	16	180	176	108	18	95	0	0	75	5
Pedestrians		20			20			20			20	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		2			2			2			2	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	445	249	118	265	252	135	100			115		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	445	249	118	265	252	135	100			115		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	98	71	72	88	99			100		
cM capacity (veh/h)	336	624	903	629	622	884	1467			1449		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	24	463	113	80
Volume Left	6	180	18	0
Volume Right	16	108	0	5
cSH	610	672	1467	1449
Volume to Capacity	0.04	0.69	0.01	0.00
Queue Length 95th (ft)	3	138	1	0
Control Delay (s)	11.1	21.4	1.3	0.0
Lane LOS	B	C	A	
Approach Delay (s)	11.1	21.4	1.3	0.0
Approach LOS	B	C		

Intersection Summary			
Average Delay	15.2		
Intersection Capacity Utilization	38.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
1: Church Street & Montevallo Road

9/9/2014

Movement	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	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Frt	1.00	0.96		1.00	0.93		1.00	0.98			0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)	1770	1780		1770	1735		1770	1825			1818	
Flt Permitted	0.95	1.00		0.95	1.00		0.37	1.00			0.24	
Satd. Flow (perm)	1770	1780		1770	1735		689	1825			437	
Volume (vph)	63	311	131	33	173	147	156	456	72	45	299	54
Peak-hour factor, PHF	0.73	0.73	0.73	0.85	0.85	0.85	0.74	0.74	0.74	0.92	0.92	0.92
Adj. Flow (vph)	86	426	179	39	204	173	211	616	97	49	325	59
RTOR Reduction (vph)	0	14	0	0	28	0	0	5	0	0	5	0
Lane Group Flow (vph)	86	591	0	39	349	0	211	708	0	0	428	0
Turn Type	Split			Split			Perm			Perm		
Protected Phases	3	3		4	4			2			2	
Permitted Phases							2			2		
Actuated Green, G (s)	30.0	30.0		23.7	23.7		40.0	40.0			40.0	
Effective Green, g (s)	31.0	31.0		24.7	24.7		41.0	41.0			41.0	
Actuated g/C Ratio	0.29	0.29		0.23	0.23		0.38	0.38			0.38	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	505	508		402	394		260	688			165	
v/s Ratio Prot	0.05	c0.33		0.02	c0.20			0.39				
v/s Ratio Perm							0.31				c0.98	
v/c Ratio	0.17	1.16		0.10	0.89		0.81	1.03			2.59	
Uniform Delay, d1	29.2	38.9		33.2	40.6		30.4	33.9			33.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.2	93.7		0.1	20.5		23.4	42.0			734.7	
Delay (s)	29.3	132.6		33.3	61.2		53.8	75.8			768.5	
Level of Service	C	F		C	E		D	E			F	
Approach Delay (s)		119.7			58.6			70.8			768.5	
Approach LOS		F			E			E			F	

Intersection Summary			
HCM Average Control Delay	205.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.70		
Actuated Cycle Length (s)	108.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
2: Church Street & West Jackson Boulevard

9/9/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	45	422	5	45	297	49	6	10	106	7	2	5
Peak Hour Factor	0.91	0.91	0.91	0.88	0.88	0.88	0.90	0.90	0.90	0.70	0.70	0.70
Hourly flow rate (vph)	49	464	5	51	338	56	7	11	118	10	3	7
Pedestrians		20			20			20			20	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		2			2			2			2	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)					600							
pX, platoon unblocked	0.96						0.96	0.96		0.96	0.96	0.96
vC, conflicting volume	413			489			1054	1101	506	1194	1076	405
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	389			489			1056	1105	506	1202	1079	381
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			95			96	94	78	90	98	99
cM capacity (veh/h)	1104			1056			167	178	547	102	184	619

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	49	469	51	393	136	20
Volume Left	49	0	51	0	7	10
Volume Right	0	5	0	56	118	7
cSH	1104	1700	1056	1700	427	160
Volume to Capacity	0.04	0.28	0.05	0.23	0.32	0.13
Queue Length 95th (ft)	4	0	4	0	34	10
Control Delay (s)	8.4	0.0	8.6	0.0	17.3	30.8
Lane LOS	A		A		C	D
Approach Delay (s)	0.8		1.0		17.3	30.8
Approach LOS					C	D

Intersection Summary			
Average Delay	3.4		
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	539	308	0	9	26
Peak Hour Factor	0.96	0.96	0.95	0.95	0.71	0.71
Hourly flow rate (vph)	0	561	324	0	13	37
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			825			
pX, platoon unblocked						
vC, conflicting volume	344				926	364
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	344				926	364
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				96	94
cM capacity (veh/h)	1195				289	658

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	561	324	13	37
Volume Left	0	0	13	0
Volume Right	0	0	0	37
cSH	1700	1700	289	658
Volume to Capacity	0.33	0.19	0.04	0.06
Queue Length 95th (ft)	0	0	3	4
Control Delay (s)	0.0	0.0	18.0	10.8
Lane LOS			C	B
Approach Delay (s)	0.0	0.0	12.7	
Approach LOS			B	

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	43.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	539	334	0	4	4
Peak Hour Factor	0.96	0.96	0.95	0.95	0.90	0.90
Hourly flow rate (vph)	0	561	352	0	4	4
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			925			
pX, platoon unblocked						
vC, conflicting volume	372				953	392
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	372				953	392
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				98	99
cM capacity (veh/h)	1167				278	635

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	561	352	9
Volume Left	0	0	4
Volume Right	0	0	4
cSH	1700	1700	387
Volume to Capacity	0.33	0.21	0.02
Queue Length 95th (ft)	0	0	2
Control Delay (s)	0.0	0.0	14.5
Lane LOS			B
Approach Delay (s)	0.0	0.0	14.5
Approach LOS			B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	43.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	28	513	318	20	26	24
Peak Hour Factor	0.96	0.96	0.95	0.95	0.78	0.78
Hourly flow rate (vph)	29	534	335	21	33	31
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			1025			
pX, platoon unblocked						
vC, conflicting volume	376				978	385
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	376				978	385
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				87	95
cM capacity (veh/h)	1163				262	641

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	29	534	356	64
Volume Left	29	0	0	33
Volume Right	0	0	21	31
cSH	1163	1700	1700	366
Volume to Capacity	0.03	0.31	0.21	0.18
Queue Length 95th (ft)	2	0	0	16
Control Delay (s)	8.2	0.0	0.0	16.9
Lane LOS	A			C
Approach Delay (s)	0.4		0.0	16.9
Approach LOS				C

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	71	486	289	34	55	37
Peak Hour Factor	0.96	0.96	0.95	0.95	0.74	0.74
Hourly flow rate (vph)	74	506	304	36	74	50
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	360				1016	362
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	360				1016	362
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				69	92
cM capacity (veh/h)	1179				239	660

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	74	506	340	124
Volume Left	74	0	0	74
Volume Right	0	0	36	50
cSH	1179	1700	1700	321
Volume to Capacity	0.06	0.30	0.20	0.39
Queue Length 95th (ft)	5	0	0	44
Control Delay (s)	8.3	0.0	0.0	23.1
Lane LOS	A			C
Approach Delay (s)	1.1		0.0	23.1
Approach LOS				C

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	41.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	5	3	9	13	50	6	41	49	35	4	41	1
Peak Hour Factor	0.85	0.85	0.85	0.91	0.91	0.91	0.75	0.75	0.75	0.68	0.68	0.68
Hourly flow rate (vph)	6	4	11	14	55	7	55	65	47	6	60	1
Pedestrians		20			20			20			20	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		2			2			2			2	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	345	334	101	323	312	129	82			132		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	345	334	101	323	312	129	82			132		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	99	99	97	90	99	96			100		
cM capacity (veh/h)	512	544	923	566	560	891	1490			1429		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	20	76	167	68
Volume Left	6	14	55	6
Volume Right	11	7	47	1
cSH	679	580	1490	1429
Volume to Capacity	0.03	0.13	0.04	0.00
Queue Length 95th (ft)	2	11	3	0
Control Delay (s)	10.5	12.1	2.7	0.7
Lane LOS	B	B	A	A
Approach Delay (s)	10.5	12.1	2.7	0.7
Approach LOS	B	B		

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	29.7%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix D

Background 2019 Intersection Capacity Analysis Worksheets

HCM Signalized Intersection Capacity Analysis
1: Church Street & Montevallo Road

9/9/2014

Movement	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	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Frpb, ped/bikes	1.00	0.90		1.00	0.99		1.00	0.98			0.96	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Frt	1.00	0.92		1.00	0.98		1.00	0.96			0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)	1770	1543		1770	1796		1770	1766			1754	
Flt Permitted	0.95	1.00		0.95	1.00		0.24	1.00			0.61	
Satd. Flow (perm)	1770	1543		1770	1796		454	1766			1074	
Volume (vph)	16	208	232	69	340	56	256	274	91	78	522	84
Peak-hour factor, PHF	0.73	0.73	0.73	0.85	0.85	0.85	0.74	0.74	0.74	0.92	0.92	0.92
Adj. Flow (vph)	22	285	318	81	400	66	346	370	123	85	567	91
RTOR Reduction (vph)	0	40	0	0	6	0	0	12	0	0	5	0
Lane Group Flow (vph)	22	563	0	81	460	0	346	481	0	0	738	0
Confl. Peds. (#/hr)	104		73			31	73		15	31		104
Turn Type	Split			Split			Perm			Perm		
Protected Phases	3	3		4	4			2			2	
Permitted Phases							2			2		
Actuated Green, G (s)	20.0	20.0		25.0	25.0		40.0	40.0			40.0	
Effective Green, g (s)	21.0	21.0		26.0	26.0		41.0	41.0			41.0	
Actuated g/C Ratio	0.21	0.21		0.26	0.26		0.41	0.41			0.41	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	372	324		460	467		186	724			440	
v/s Ratio Prot	0.01	c0.36		0.05	c0.26			0.27				
v/s Ratio Perm							c0.76				0.69	
v/c Ratio	0.06	1.74		0.18	0.99		1.86	0.66			1.68	
Uniform Delay, d1	31.6	39.5		28.7	36.8		29.5	23.9			29.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.1	344.2		0.2	37.5		407.0	4.8			314.3	
Delay (s)	31.7	383.7		28.9	74.3		436.5	28.7			343.8	
Level of Service	C	F		C	E		F	C			F	
Approach Delay (s)		371.3			67.6			196.9			343.8	
Approach LOS		F			E			F			F	

Intersection Summary			
HCM Average Control Delay	250.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.57		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	105.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	120	466	3	48	408	202	8	9	52	0	0	0
Peak Hour Factor	0.74	0.74	0.74	0.89	0.89	0.89	0.73	0.73	0.73	0.90	0.90	0.90
Hourly flow rate (vph)	162	630	4	54	458	227	11	12	71	0	0	0
Pedestrians		15			15			15			15	
Lane Width (ft)		12.0			12.0			12.0			0.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			1			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)					600							
pX, platoon unblocked	0.71						0.71	0.71		0.71	0.71	0.71
vC, conflicting volume	700			649			1552	1779	662	1741	1668	602
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	578			649			1778	2098	662	2044	1941	439
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	77			94			68	53	84	100	100	100
cM capacity (veh/h)	707			925			35	26	450	12	33	433

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	162	634	54	685	95
Volume Left	162	0	54	0	11
Volume Right	0	4	0	227	71
cSH	707	1700	925	1700	100
Volume to Capacity	0.23	0.37	0.06	0.40	0.94
Queue Length 95th (ft)	22	0	5	0	140
Control Delay (s)	11.6	0.0	9.1	0.0	151.5
Lane LOS	B		A		F
Approach Delay (s)	2.4		0.7		151.5
Approach LOS					F

Intersection Summary			
Average Delay	10.2		
Intersection Capacity Utilization	59.4%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	642	416	0	10	16
Peak Hour Factor	0.72	0.72	0.80	0.80	0.62	0.62
Hourly flow rate (vph)	0	892	520	0	16	26
Pedestrians		15	15		15	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		1	1		1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			825			
pX, platoon unblocked						
vC, conflicting volume	535				1442	550
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	535				1442	550
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				89	95
cM capacity (veh/h)	1020				142	521

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	892	520	16	26
Volume Left	0	0	16	0
Volume Right	0	0	0	26
cSH	1700	1700	142	521
Volume to Capacity	0.52	0.31	0.11	0.05
Queue Length 95th (ft)	0	0	9	4
Control Delay (s)	0.0	0.0	33.5	12.3
Lane LOS			D	B
Approach Delay (s)	0.0	0.0	20.4	
Approach LOS			C	

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	47.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	642	432	0	0	0
Peak Hour Factor	0.72	0.72	0.80	0.80	0.90	0.90
Hourly flow rate (vph)	0	892	540	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			925			
pX, platoon unblocked						
vC, conflicting volume	540				1432	540
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	540				1432	540
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1028				148	542

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	892	540	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1700	1700
Volume to Capacity	0.52	0.32	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	0.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	37.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	9	637	428	5	5	7
Peak Hour Factor	0.72	0.72	0.80	0.80	0.57	0.57
Hourly flow rate (vph)	12	885	535	6	9	12
Pedestrians		15	15		15	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		1	1		1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			1025			
pX, platoon unblocked						
vC, conflicting volume	556				1478	568
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	556				1478	568
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				93	98
cM capacity (veh/h)	1002				134	509

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	12	885	541	21
Volume Left	12	0	0	9
Volume Right	0	0	6	12
cSH	1002	1700	1700	234
Volume to Capacity	0.01	0.52	0.32	0.09
Queue Length 95th (ft)	1	0	0	7
Control Delay (s)	8.6	0.0	0.0	21.9
Lane LOS	A			C
Approach Delay (s)	0.1		0.0	21.9
Approach LOS				C

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	47.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	15	535	352	22	112	55
Peak Hour Factor	0.72	0.72	0.80	0.80	0.62	0.62
Hourly flow rate (vph)	21	743	440	28	181	89
Pedestrians		15	15		15	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		1	1		1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	482				1268	484
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	482				1268	484
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				0	84
cM capacity (veh/h)	1067				178	569

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	21	743	468	269
Volume Left	21	0	0	181
Volume Right	0	0	28	89
cSH	1067	1700	1700	230
Volume to Capacity	0.02	0.44	0.28	1.17
Queue Length 95th (ft)	1	0	0	321
Control Delay (s)	8.4	0.0	0.0	158.3
Lane LOS	A			F
Approach Delay (s)	0.2		0.0	158.3
Approach LOS				F

Intersection Summary			
Average Delay	28.5		
Intersection Capacity Utilization	46.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	3	2	8	104	79	63	7	25	2	5	63	1
Peak Hour Factor	0.56	0.56	0.56	0.70	0.70	0.70	0.71	0.71	0.71	0.50	0.50	0.50
Hourly flow rate (vph)	5	4	14	149	113	90	10	35	3	10	126	2
Pedestrians		15			15			15			15	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			1			1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	380	235	157	249	234	67	143			53		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	380	235	157	249	234	67	143			53		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	99	98	77	82	91	99			99		
cM capacity (veh/h)	430	640	866	653	641	972	1422			1533		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	23	351	48	138
Volume Left	5	149	10	10
Volume Right	14	90	3	2
cSH	672	708	1422	1533
Volume to Capacity	0.03	0.50	0.01	0.01
Queue Length 95th (ft)	3	70	1	0
Control Delay (s)	10.5	15.0	1.6	0.6
Lane LOS	B	B	A	A
Approach Delay (s)	10.5	15.0	1.6	0.6
Approach LOS	B	B		

Intersection Summary			
Average Delay	10.1		
Intersection Capacity Utilization	35.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	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	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.98		1.00	1.00			0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.98	1.00			1.00	
Frt	1.00	0.93		1.00	0.94		1.00	0.97			0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)	1770	1739		1770	1730		1741	1800			1771	
Flt Permitted	0.95	1.00		0.95	1.00		0.35	1.00			0.51	
Satd. Flow (perm)	1770	1739		1770	1730		643	1800			907	
Volume (vph)	35	205	163	75	201	121	179	291	84	60	279	77
Peak-hour factor, PHF	0.73	0.73	0.73	0.85	0.85	0.85	0.74	0.74	0.74	0.92	0.92	0.92
Adj. Flow (vph)	48	281	223	88	236	142	242	393	114	65	303	84
RTOR Reduction (vph)	0	32	0	0	24	0	0	12	0	0	9	0
Lane Group Flow (vph)	48	472	0	88	354	0	242	495	0	0	443	0
Confl. Peds. (#/hr)	31					9	22			9		31
Turn Type	Split			Split			Perm			Perm		
Protected Phases	3	3		4	4			2			2	
Permitted Phases							2			2		
Actuated Green, G (s)	24.6	24.6		19.3	19.3		30.0	30.0			30.0	
Effective Green, g (s)	25.6	25.6		20.3	20.3		31.0	31.0			31.0	
Actuated g/C Ratio	0.29	0.29		0.23	0.23		0.35	0.35			0.35	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	510	501		404	395		224	628			316	
v/s Ratio Prot	0.03	c0.27		0.05	c0.20			0.28				
v/s Ratio Perm							0.38				c0.49	
v/c Ratio	0.09	0.94		0.22	0.90		1.08	0.79			1.40	
Uniform Delay, d1	23.2	30.9		27.9	33.3		29.0	26.0			29.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.1	26.3		0.3	22.1		83.1	9.7			198.8	
Delay (s)	23.2	57.2		28.1	55.3		112.1	35.7			227.7	
Level of Service	C	E		C	E		F	D			F	
Approach Delay (s)		54.3			50.2			60.4			227.7	
Approach LOS		D			D			E			F	

Intersection Summary			
HCM Average Control Delay	90.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	88.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	71	389	18	64	312	74	16	7	100	0	0	0
Peak Hour Factor	0.72	0.72	0.72	0.89	0.89	0.89	0.84	0.84	0.84	0.90	0.90	0.90
Hourly flow rate (vph)	99	540	25	72	351	83	19	8	119	0	0	0
Pedestrians		20			20			20			20	
Lane Width (ft)		12.0			12.0			12.0			0.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		2			2			2			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)					600							
pX, platoon unblocked	0.97						0.97	0.97		0.97	0.97	0.97
vC, conflicting volume	454			585			1284	1368	593	1437	1338	432
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	435			585			1294	1380	593	1452	1350	413
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	91			93			83	93	76	100	100	100
cM capacity (veh/h)	1087			973			113	116	489	64	120	608

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	99	565	72	434	146
Volume Left	99	0	72	0	19
Volume Right	0	25	0	83	119
cSH	1087	1700	973	1700	303
Volume to Capacity	0.09	0.33	0.07	0.26	0.48
Queue Length 95th (ft)	7	0	6	0	62
Control Delay (s)	8.6	0.0	9.0	0.0	27.6
Lane LOS	A		A		D
Approach Delay (s)	1.3		1.3		27.6
Approach LOS					D

Intersection Summary			
Average Delay	4.2		
Intersection Capacity Utilization	46.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	575	328	0	12	38
Peak Hour Factor	0.89	0.89	0.83	0.83	0.77	0.77
Hourly flow rate (vph)	0	646	395	0	16	49
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			825			
pX, platoon unblocked						
vC, conflicting volume	415				1081	435
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	415				1081	435
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				93	92
cM capacity (veh/h)	1125				233	600

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	646	395	16	49
Volume Left	0	0	16	0
Volume Right	0	0	0	49
cSH	1700	1700	233	600
Volume to Capacity	0.38	0.23	0.07	0.08
Queue Length 95th (ft)	0	0	5	7
Control Delay (s)	0.0	0.0	21.6	11.5
Lane LOS			C	B
Approach Delay (s)	0.0	0.0	13.9	
Approach LOS			B	

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	45.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	575	366	0	0	3
Peak Hour Factor	0.89	0.89	0.83	0.83	0.90	0.90
Hourly flow rate (vph)	0	646	441	0	0	3
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			925			
pX, platoon unblocked						
vC, conflicting volume	461				1127	481
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	461				1127	481
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	1082				219	566

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	646	441	3
Volume Left	0	0	0
Volume Right	0	0	3
cSH	1700	1700	566
Volume to Capacity	0.38	0.26	0.01
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	11.4
Lane LOS			B
Approach Delay (s)	0.0	0.0	11.4
Approach LOS			B

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	45.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	30	559	378	25	16	38
Peak Hour Factor	0.89	0.89	0.83	0.83	0.85	0.85
Hourly flow rate (vph)	34	628	455	30	19	45
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			1025			
pX, platoon unblocked						
vC, conflicting volume	506				1206	510
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	506				1206	510
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				90	92
cM capacity (veh/h)	1041				190	544

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	34	628	486	64
Volume Left	34	0	0	19
Volume Right	0	0	30	45
cSH	1041	1700	1700	350
Volume to Capacity	0.03	0.37	0.29	0.18
Queue Length 95th (ft)	3	0	0	16
Control Delay (s)	8.6	0.0	0.0	17.5
Lane LOS	A			C
Approach Delay (s)	0.4		0.0	17.5
Approach LOS				C

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	44.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	46	462	289	49	127	32
Peak Hour Factor	0.89	0.89	0.83	0.83	0.61	0.61
Hourly flow rate (vph)	52	519	348	59	208	52
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	427				1040	418
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	427				1040	418
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				11	91
cM capacity (veh/h)	1113				235	614

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	52	519	407	261
Volume Left	52	0	0	208
Volume Right	0	0	59	52
cSH	1113	1700	1700	268
Volume to Capacity	0.05	0.31	0.24	0.97
Queue Length 95th (ft)	4	0	0	235
Control Delay (s)	8.4	0.0	0.0	88.7
Lane LOS	A			F
Approach Delay (s)	0.8		0.0	88.7
Approach LOS				F

Intersection Summary			
Average Delay	19.0		
Intersection Capacity Utilization	43.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	5	1	2	101	99	61	13	67	0	0	48	3
Peak Hour Factor	0.63	0.63	0.63	0.49	0.49	0.49	0.61	0.61	0.61	0.56	0.56	0.56
Hourly flow rate (vph)	8	2	3	206	202	124	21	110	0	0	86	5
Pedestrians		20			20			20			20	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		2			2			2			2	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	506	281	128	285	284	150	111			130		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	506	281	128	285	284	150	111			130		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	100	100	67	66	86	99			100		
cM capacity (veh/h)	281	598	891	619	596	867	1454			1431		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	13	533	131	91
Volume Left	8	206	21	0
Volume Right	3	124	0	5
cSH	368	653	1454	1431
Volume to Capacity	0.03	0.82	0.01	0.00
Queue Length 95th (ft)	3	212	1	0
Control Delay (s)	15.1	30.2	1.3	0.0
Lane LOS	C	D	A	
Approach Delay (s)	15.1	30.2	1.3	0.0
Approach LOS	C	D		

Intersection Summary			
Average Delay	21.5		
Intersection Capacity Utilization	34.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	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	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Frt	1.00	0.96		1.00	0.93		1.00	0.98			0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)	1770	1780		1770	1734		1770	1825			1819	
Flt Permitted	0.95	1.00		0.95	1.00		0.33	1.00			0.19	
Satd. Flow (perm)	1770	1780		1770	1734		607	1825			349	
Volume (vph)	72	358	151	38	199	169	179	524	83	52	344	62
Peak-hour factor, PHF	0.73	0.73	0.73	0.85	0.85	0.85	0.74	0.74	0.74	0.92	0.92	0.92
Adj. Flow (vph)	99	490	207	45	234	199	242	708	112	57	374	67
RTOR Reduction (vph)	0	14	0	0	27	0	0	5	0	0	5	0
Lane Group Flow (vph)	99	683	0	45	406	0	242	815	0	0	493	0
Turn Type	Split			Split			Perm			Perm		
Protected Phases	3	3		4	4			2			2	
Permitted Phases							2			2		
Actuated Green, G (s)	30.0	30.0		25.0	25.0		40.0	40.0			40.0	
Effective Green, g (s)	31.0	31.0		26.0	26.0		41.0	41.0			41.0	
Actuated g/C Ratio	0.28	0.28		0.24	0.24		0.37	0.37			0.37	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	499	502		418	410		226	680			130	
v/s Ratio Prot	0.06	c0.38		0.03	c0.23			0.45				
v/s Ratio Perm							0.40				c1.41	
v/c Ratio	0.20	1.36		0.11	0.99		1.07	1.20			3.79	
Uniform Delay, d1	30.0	39.5		32.9	41.9		34.5	34.5			34.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.2	175.1		0.1	41.1		79.9	103.2			1275.0	
Delay (s)	30.2	214.6		33.0	83.0		114.4	137.7			1309.5	
Level of Service	C	F		C	F		F	F			F	
Approach Delay (s)		191.7			78.3			132.4			1309.5	
Approach LOS		F			E			F			F	

Intersection Summary			
HCM Average Control Delay	346.7	HCM Level of Service	F
HCM Volume to Capacity ratio	2.28		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	105.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
2: Church Street & West Jackson Boulevard

9/10/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	52	485	6	52	342	56	7	12	122	8	2	6
Peak Hour Factor	0.91	0.91	0.91	0.88	0.88	0.88	0.90	0.90	0.90	0.70	0.70	0.70
Hourly flow rate (vph)	57	533	7	59	389	64	8	13	136	11	3	9
Pedestrians		20			20			20			20	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		2			2			2			2	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)					600							
pX, platoon unblocked	0.94						0.94	0.94		0.94	0.94	0.94
vC, conflicting volume	472			560			1207	1261	576	1368	1232	460
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	439			560			1221	1278	576	1391	1247	426
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	94			94			94	90	73	83	98	98
cM capacity (veh/h)	1037			995			123	134	500	65	140	571

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	57	540	59	452	157	23
Volume Left	57	0	59	0	8	11
Volume Right	0	7	0	64	136	9
cSH	1037	1700	995	1700	361	109
Volume to Capacity	0.06	0.32	0.06	0.27	0.43	0.21
Queue Length 95th (ft)	4	0	5	0	53	19
Control Delay (s)	8.7	0.0	8.8	0.0	22.4	46.7
Lane LOS	A		A		C	E
Approach Delay (s)	0.8		1.0		22.4	46.7
Approach LOS					C	E

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	51.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	620	354	0	10	30
Peak Hour Factor	0.96	0.96	0.95	0.95	0.71	0.71
Hourly flow rate (vph)	0	646	373	0	14	42
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			825			
pX, platoon unblocked						
vC, conflicting volume	393				1058	413
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	393				1058	413
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				94	93
cM capacity (veh/h)	1146				240	618

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	646	373	14	42
Volume Left	0	0	14	0
Volume Right	0	0	0	42
cSH	1700	1700	240	618
Volume to Capacity	0.38	0.22	0.06	0.07
Queue Length 95th (ft)	0	0	5	5
Control Delay (s)	0.0	0.0	20.9	11.2
Lane LOS			C	B
Approach Delay (s)	0.0	0.0	13.7	
Approach LOS			B	

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	47.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	620	384	0	5	5
Peak Hour Factor	0.96	0.96	0.95	0.95	0.90	0.90
Hourly flow rate (vph)	0	646	404	0	6	6
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			925			
pX, platoon unblocked						
vC, conflicting volume	424				1090	444
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	424				1090	444
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				98	99
cM capacity (veh/h)	1116				230	593

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	646	404	11
Volume Left	0	0	6
Volume Right	0	0	6
cSH	1700	1700	332
Volume to Capacity	0.38	0.24	0.03
Queue Length 95th (ft)	0	0	3
Control Delay (s)	0.0	0.0	16.2
Lane LOS			C
Approach Delay (s)	0.0	0.0	16.2
Approach LOS			C

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	47.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	32	590	366	23	30	28
Peak Hour Factor	0.96	0.96	0.95	0.95	0.78	0.78
Hourly flow rate (vph)	33	615	385	24	38	36
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			1025			
pX, platoon unblocked						
vC, conflicting volume	429				1119	437
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	429				1119	437
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				82	94
cM capacity (veh/h)	1111				215	599

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	33	615	409	74
Volume Left	33	0	0	38
Volume Right	0	0	24	36
cSH	1111	1700	1700	311
Volume to Capacity	0.03	0.36	0.24	0.24
Queue Length 95th (ft)	2	0	0	23
Control Delay (s)	8.3	0.0	0.0	20.2
Lane LOS	A			C
Approach Delay (s)	0.4		0.0	20.2
Approach LOS				C

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	82	559	332	39	63	43
Peak Hour Factor	0.96	0.96	0.95	0.95	0.74	0.74
Hourly flow rate (vph)	85	582	349	41	85	58
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	411				1163	410
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	411				1163	410
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				56	91
cM capacity (veh/h)	1129				192	620

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	85	582	391	143
Volume Left	85	0	0	85
Volume Right	0	0	41	58
cSH	1129	1700	1700	267
Volume to Capacity	0.08	0.34	0.23	0.54
Queue Length 95th (ft)	6	0	0	73
Control Delay (s)	8.4	0.0	0.0	33.0
Lane LOS	A			D
Approach Delay (s)	1.1		0.0	33.0
Approach LOS				D

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	46.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	6	3	10	15	58	7	47	56	40	5	47	1
Peak Hour Factor	0.85	0.85	0.85	0.91	0.91	0.91	0.75	0.75	0.75	0.68	0.68	0.68
Hourly flow rate (vph)	7	4	12	16	64	8	63	75	53	7	69	1
Pedestrians		20			20			20			20	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		2			2			2			2	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	391	378	110	365	352	141	91			148		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	391	378	110	365	352	141	91			148		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	99	99	97	88	99	96			99		
cM capacity (veh/h)	465	510	912	528	528	877	1479			1410		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	22	88	191	78
Volume Left	7	16	63	7
Volume Right	12	8	53	1
cSH	639	547	1479	1410
Volume to Capacity	0.03	0.16	0.04	0.01
Queue Length 95th (ft)	3	14	3	0
Control Delay (s)	10.8	12.8	2.7	0.8
Lane LOS	B	B	A	A
Approach Delay (s)	10.8	12.8	2.7	0.8
Approach LOS	B	B		

Intersection Summary			
Average Delay	5.1		
Intersection Capacity Utilization	31.0%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix E

Future 2019 Intersection Capacity Analysis Worksheets

HCM Signalized Intersection Capacity Analysis
1: Church Street & Montevallo Road

9/10/2014

Movement	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	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Frpb, ped/bikes	1.00	0.90		1.00	0.99		1.00	0.98			0.96	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Frt	1.00	0.92		1.00	0.98		1.00	0.96			0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)	1770	1543		1770	1798		1770	1766			1746	
Flt Permitted	0.95	1.00		0.95	1.00		0.24	1.00			0.62	
Satd. Flow (perm)	1770	1543		1770	1798		451	1766			1082	
Volume (vph)	17	211	236	68	350	56	267	271	90	78	521	87
Peak-hour factor, PHF	0.73	0.73	0.73	0.85	0.85	0.85	0.74	0.74	0.74	0.92	0.92	0.92
Adj. Flow (vph)	23	289	323	80	412	66	361	366	122	85	566	95
RTOR Reduction (vph)	0	40	0	0	6	0	0	12	0	0	5	0
Lane Group Flow (vph)	23	572	0	80	472	0	361	476	0	0	741	0
Confl. Peds. (#/hr)	104		73			31	73		15	31		104
Turn Type	Split			Split			Perm			Perm		
Protected Phases	3	3		4	4			2			2	
Permitted Phases							2			2		
Actuated Green, G (s)	20.0	20.0		25.0	25.0		40.0	40.0			40.0	
Effective Green, g (s)	21.0	21.0		26.0	26.0		41.0	41.0			41.0	
Actuated g/C Ratio	0.21	0.21		0.26	0.26		0.41	0.41			0.41	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	372	324		460	467		185	724			444	
v/s Ratio Prot	0.01	c0.37		0.05	c0.26			0.27				
v/s Ratio Perm							c0.80				0.68	
v/c Ratio	0.06	1.76		0.17	1.01		1.95	0.66			1.67	
Uniform Delay, d1	31.6	39.5		28.7	37.0		29.5	23.8			29.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.1	356.4		0.2	44.4		447.2	4.6			310.5	
Delay (s)	31.7	395.9		28.9	81.4		476.7	28.5			340.0	
Level of Service	C	F		C	F		F	C			F	
Approach Delay (s)		382.7			73.9			219.1			340.0	
Approach LOS		F			E			F			F	

Intersection Summary			
HCM Average Control Delay	259.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.63		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	106.1%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	120	474	5	48	426	208	10	10	51	0	0	0
Peak Hour Factor	0.74	0.74	0.74	0.89	0.89	0.89	0.73	0.73	0.73	0.90	0.90	0.90
Hourly flow rate (vph)	162	641	7	54	479	234	14	14	70	0	0	0
Pedestrians		15			15			15			15	
Lane Width (ft)		12.0			12.0			12.0			0.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			1			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)					600							
pX, platoon unblocked	0.69						0.69	0.69		0.69	0.69	0.69
vC, conflicting volume	727			662			1585	1818	674	1775	1705	626
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	606			662			1845	2182	674	2119	2018	459
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	76			94			54	39	84	100	100	100
cM capacity (veh/h)	673			915			30	22	443	9	28	412

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	162	647	54	712	97
Volume Left	162	0	54	0	14
Volume Right	0	7	0	234	70
cSH	673	1700	915	1700	79
Volume to Capacity	0.24	0.38	0.06	0.42	1.23
Queue Length 95th (ft)	23	0	5	0	182
Control Delay (s)	12.0	0.0	9.2	0.0	267.2
Lane LOS	B		A		F
Approach Delay (s)	2.4		0.6		267.2
Approach LOS					F

Intersection Summary			
Average Delay	17.0		
Intersection Capacity Utilization	60.7%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	651	436	0	10	16
Peak Hour Factor	0.72	0.72	0.80	0.80	0.62	0.62
Hourly flow rate (vph)	0	904	545	0	16	26
Pedestrians		15	15		15	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		1	1		1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			825			
pX, platoon unblocked						
vC, conflicting volume	560				1479	575
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	560				1479	575
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				88	95
cM capacity (veh/h)	998				135	505

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	904	545	16	26
Volume Left	0	0	16	0
Volume Right	0	0	0	26
cSH	1700	1700	135	505
Volume to Capacity	0.53	0.32	0.12	0.05
Queue Length 95th (ft)	0	0	10	4
Control Delay (s)	0.0	0.0	35.3	12.5
Lane LOS			E	B
Approach Delay (s)	0.0	0.0	21.3	
Approach LOS			C	

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	48.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	30	633	429	23	18	10
Peak Hour Factor	0.72	0.72	0.80	0.80	0.90	0.90
Hourly flow rate (vph)	42	879	536	29	20	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			925			
pX, platoon unblocked						
vC, conflicting volume	565				1513	551
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	565				1513	551
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				84	98
cM capacity (veh/h)	1007				126	534

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	42	879	565	31
Volume Left	42	0	0	20
Volume Right	0	0	29	11
cSH	1007	1700	1700	174
Volume to Capacity	0.04	0.52	0.33	0.18
Queue Length 95th (ft)	3	0	0	16
Control Delay (s)	8.7	0.0	0.0	30.2
Lane LOS	A			D
Approach Delay (s)	0.4		0.0	30.2
Approach LOS				D

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	43.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	9	658	434	5	5	7
Peak Hour Factor	0.72	0.72	0.80	0.80	0.57	0.57
Hourly flow rate (vph)	12	914	542	6	9	12
Pedestrians		15	15		15	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		1	1		1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			1025			
pX, platoon unblocked						
vC, conflicting volume	564				1515	576
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	564				1515	576
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				93	98
cM capacity (veh/h)	995				127	504

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	12	914	549	21
Volume Left	12	0	0	9
Volume Right	0	0	6	12
cSH	995	1700	1700	225
Volume to Capacity	0.01	0.54	0.32	0.09
Queue Length 95th (ft)	1	0	0	8
Control Delay (s)	8.7	0.0	0.0	22.6
Lane LOS	A			C
Approach Delay (s)	0.1		0.0	22.6
Approach LOS				C

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	48.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	14	551	358	22	116	60
Peak Hour Factor	0.72	0.72	0.80	0.80	0.62	0.62
Hourly flow rate (vph)	19	765	448	28	187	97
Pedestrians		15	15		15	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		1	1		1	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	490				1295	491
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	490				1295	491
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				0	83
cM capacity (veh/h)	1060				171	563

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	19	765	475	284
Volume Left	19	0	0	187
Volume Right	0	0	28	97
cSH	1060	1700	1700	225
Volume to Capacity	0.02	0.45	0.28	1.26
Queue Length 95th (ft)	1	0	0	367
Control Delay (s)	8.5	0.0	0.0	192.7
Lane LOS	A			F
Approach Delay (s)	0.2		0.0	192.7
Approach LOS				F

Intersection Summary			
Average Delay	35.5		
Intersection Capacity Utilization	47.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	3	2	10	109	81	65	7	25	2	5	65	1
Peak Hour Factor	0.56	0.56	0.56	0.70	0.70	0.70	0.71	0.71	0.71	0.50	0.50	0.50
Hourly flow rate (vph)	5	4	18	156	116	93	10	35	3	10	130	2
Pedestrians		15			15			15			15	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			1			1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	388	239	161	257	238	67	147			53		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	388	239	161	257	238	67	147			53		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	99	98	76	82	90	99			99		
cM capacity (veh/h)	421	637	862	643	638	972	1417			1533		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	27	364	48	142
Volume Left	5	156	10	10
Volume Right	18	93	3	2
cSH	686	702	1417	1533
Volume to Capacity	0.04	0.52	0.01	0.01
Queue Length 95th (ft)	3	76	1	0
Control Delay (s)	10.5	15.5	1.6	0.6
Lane LOS	B	C	A	A
Approach Delay (s)	10.5	15.5	1.6	0.6
Approach LOS	B	C		

Intersection Summary			
Average Delay	10.5		
Intersection Capacity Utilization	35.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
1: Church Street & Montevallo Road

9/10/2014

Movement	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	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00			0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.98	1.00			1.00	
Frt	1.00	0.93		1.00	0.95		1.00	0.97			0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)	1770	1736		1770	1740		1741	1800			1766	
Flt Permitted	0.95	1.00		0.95	1.00		0.34	1.00			0.54	
Satd. Flow (perm)	1770	1736		1770	1740		627	1800			960	
Volume (vph)	40	223	184	72	224	119	205	285	82	54	278	84
Peak-hour factor, PHF	0.73	0.73	0.73	0.85	0.85	0.85	0.74	0.74	0.74	0.92	0.92	0.92
Adj. Flow (vph)	55	305	252	85	264	140	277	385	111	59	302	91
RTOR Reduction (vph)	0	33	0	0	21	0	0	12	0	0	10	0
Lane Group Flow (vph)	55	524	0	85	383	0	277	484	0	0	442	0
Confl. Peds. (#/hr)	31					9	22			9		31
Turn Type	Split			Split			Perm			Perm		
Protected Phases	3	3		4	4			2			2	
Permitted Phases							2			2		
Actuated Green, G (s)	25.0	25.0		20.0	20.0		30.0	30.0			30.0	
Effective Green, g (s)	26.0	26.0		21.0	21.0		31.0	31.0			31.0	
Actuated g/C Ratio	0.29	0.29		0.23	0.23		0.34	0.34			0.34	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	511	502		413	406		216	620			331	
v/s Ratio Prot	0.03	c0.30		0.05	c0.22			0.27				
v/s Ratio Perm							0.44				c0.46	
v/c Ratio	0.11	1.04		0.21	0.94		1.28	0.78			1.34	
Uniform Delay, d1	23.5	32.0		27.8	33.9		29.5	26.5			29.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.1	52.2		0.2	30.2		157.6	9.4			170.3	
Delay (s)	23.6	84.2		28.0	64.1		187.1	35.9			199.8	
Level of Service	C	F		C	E		F	D			F	
Approach Delay (s)		78.8			57.9			90.1			199.8	
Approach LOS		E			E			F			F	

Intersection Summary			
HCM Average Control Delay	101.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	71	435	25	63	353	88	21	8	98	0	0	0
Peak Hour Factor	0.72	0.72	0.72	0.89	0.89	0.89	0.84	0.84	0.84	0.90	0.90	0.90
Hourly flow rate (vph)	99	604	35	71	397	99	25	10	117	0	0	0
Pedestrians		20			20			20			20	
Lane Width (ft)		12.0			12.0			12.0			0.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		2			2			2			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)					600							
pX, platoon unblocked	0.94						0.94	0.94		0.94	0.94	0.94
vC, conflicting volume	516			659			1397	1496	662	1550	1464	486
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	484			659			1423	1528	662	1586	1494	453
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	90			92			72	89	74	100	100	100
cM capacity (veh/h)	1013			914			89	90	447	47	95	561

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	99	639	71	496	151
Volume Left	99	0	71	0	25
Volume Right	0	35	0	99	117
cSH	1013	1700	914	1700	233
Volume to Capacity	0.10	0.38	0.08	0.29	0.65
Queue Length 95th (ft)	8	0	6	0	100
Control Delay (s)	8.9	0.0	9.3	0.0	45.0
Lane LOS	A		A		E
Approach Delay (s)	1.2		1.2		45.0
Approach LOS					E

Intersection Summary			
Average Delay	5.7		
Intersection Capacity Utilization	49.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	628	375	0	12	38
Peak Hour Factor	0.89	0.89	0.83	0.83	0.77	0.77
Hourly flow rate (vph)	0	706	452	0	16	49
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			825			
pX, platoon unblocked						
vC, conflicting volume	472				1197	492
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	472				1197	492
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				92	91
cM capacity (veh/h)	1072				198	558

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	706	452	16	49
Volume Left	0	0	16	0
Volume Right	0	0	0	49
cSH	1700	1700	198	558
Volume to Capacity	0.42	0.27	0.08	0.09
Queue Length 95th (ft)	0	0	6	7
Control Delay (s)	0.0	0.0	24.7	12.1
Lane LOS			C	B
Approach Delay (s)	0.0	0.0	15.1	
Approach LOS			C	

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	72	554	357	56	74	43
Peak Hour Factor	0.89	0.89	0.83	0.83	0.90	0.90
Hourly flow rate (vph)	81	622	430	67	82	48
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			925			
pX, platoon unblocked						
vC, conflicting volume	518				1288	504
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	518				1288	504
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				49	91
cM capacity (veh/h)	1031				161	549

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	81	622	498	130
Volume Left	81	0	0	82
Volume Right	0	0	67	48
cSH	1031	1700	1700	218
Volume to Capacity	0.08	0.37	0.29	0.60
Queue Length 95th (ft)	6	0	0	85
Control Delay (s)	8.8	0.0	0.0	43.4
Lane LOS	A			E
Approach Delay (s)	1.0		0.0	43.4
Approach LOS				E

Intersection Summary			
Average Delay	4.8		
Intersection Capacity Utilization	46.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	30	610	409	25	16	38
Peak Hour Factor	0.89	0.89	0.83	0.83	0.85	0.85
Hourly flow rate (vph)	34	685	493	30	19	45
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			1025			
pX, platoon unblocked						
vC, conflicting volume	543				1301	548
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	543				1301	548
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				89	91
cM capacity (veh/h)	1009				166	519

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	34	685	523	64
Volume Left	34	0	0	19
Volume Right	0	0	30	45
cSH	1009	1700	1700	318
Volume to Capacity	0.03	0.40	0.31	0.20
Queue Length 95th (ft)	3	0	0	18
Control Delay (s)	8.7	0.0	0.0	19.1
Lane LOS	A			C
Approach Delay (s)	0.4		0.0	19.1
Approach LOS				C

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	47.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	43	501	318	51	138	53
Peak Hour Factor	0.89	0.89	0.83	0.83	0.61	0.61
Hourly flow rate (vph)	48	563	383	61	226	87
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	465				1113	454
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	465				1113	454
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				0	85
cM capacity (veh/h)	1078				213	586

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	48	563	445	313
Volume Left	48	0	0	226
Volume Right	0	0	61	87
cSH	1078	1700	1700	259
Volume to Capacity	0.04	0.33	0.26	1.21
Queue Length 95th (ft)	4	0	0	369
Control Delay (s)	8.5	0.0	0.0	165.5
Lane LOS	A			F
Approach Delay (s)	0.7		0.0	165.5
Approach LOS				F

Intersection Summary			
Average Delay	38.2		
Intersection Capacity Utilization	45.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	4	1	17	123	105	67	13	66	0	0	53	3
Peak Hour Factor	0.63	0.63	0.63	0.49	0.49	0.49	0.61	0.61	0.61	0.56	0.56	0.56
Hourly flow rate (vph)	6	2	27	251	214	137	21	108	0	0	95	5
Pedestrians		20			20			20			20	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		2			2			2			2	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	532	288	137	316	291	148	120			128		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	532	288	137	316	291	148	120			128		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	97	56	64	84	99			100		
cM capacity (veh/h)	259	592	881	574	590	869	1443			1433		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	35	602	130	100
Volume Left	6	251	21	0
Volume Right	27	137	0	5
cSH	604	629	1443	1433
Volume to Capacity	0.06	0.96	0.01	0.00
Queue Length 95th (ft)	5	336	1	0
Control Delay (s)	11.3	51.8	1.3	0.0
Lane LOS	B	F	A	
Approach Delay (s)	11.3	51.8	1.3	0.0
Approach LOS	B	F		

Intersection Summary			
Average Delay	36.6		
Intersection Capacity Utilization	42.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	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	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Frt	1.00	0.95		1.00	0.94		1.00	0.98			0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)	1770	1775		1770	1743		1770	1825			1815	
Flt Permitted	0.95	1.00		0.95	1.00		0.32	1.00			0.20	
Satd. Flow (perm)	1770	1775		1770	1743		600	1825			363	
Volume (vph)	78	375	171	35	223	167	207	518	81	51	342	69
Peak-hour factor, PHF	0.73	0.73	0.73	0.85	0.85	0.85	0.74	0.74	0.74	0.92	0.92	0.92
Adj. Flow (vph)	107	514	234	41	262	196	280	700	109	55	372	75
RTOR Reduction (vph)	0	15	0	0	24	0	0	5	0	0	6	0
Lane Group Flow (vph)	107	733	0	41	434	0	280	804	0	0	496	0
Turn Type	Split			Split			Perm			Perm		
Protected Phases	3	3		4	4			2			2	
Permitted Phases							2			2		
Actuated Green, G (s)	30.0	30.0		25.0	25.0		40.0	40.0			40.0	
Effective Green, g (s)	31.0	31.0		26.0	26.0		41.0	41.0			41.0	
Actuated g/C Ratio	0.28	0.28		0.24	0.24		0.37	0.37			0.37	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	499	500		418	412		224	680			135	
v/s Ratio Prot	0.06	c0.41		0.02	c0.25			0.44				
v/s Ratio Perm							0.47				c1.37	
v/c Ratio	0.21	1.47		0.10	1.05		1.25	1.18			3.68	
Uniform Delay, d1	30.2	39.5		32.8	42.0		34.5	34.5			34.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.2	220.4		0.1	58.8		143.9	96.6			1222.6	
Delay (s)	30.4	259.9		32.9	100.8		178.4	131.1			1257.1	
Level of Service	C	F		C	F		F	F			F	
Approach Delay (s)		231.2			95.2			143.3			1257.1	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	350.5	HCM Level of Service	F
HCM Volume to Capacity ratio	2.28		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	107.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
2: Church Street & West Jackson Boulevard

9/10/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	52	523	10	50	371	87	11	15	120	15	5	6
Peak Hour Factor	0.91	0.91	0.91	0.88	0.88	0.88	0.90	0.90	0.90	0.70	0.70	0.70
Hourly flow rate (vph)	57	575	11	57	422	99	12	17	133	21	7	9
Pedestrians		20			20			20			20	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		2			2			2			2	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)					600							
pX, platoon unblocked	0.92						0.92	0.92		0.92	0.92	0.92
vC, conflicting volume	540			606			1282	1369	620	1455	1325	511
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	499			606			1308	1402	620	1497	1354	467
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	94			94			88	85	72	58	94	98
cM capacity (veh/h)	960			956			101	110	472	51	117	528

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	57	586	57	520	162	37
Volume Left	57	0	57	0	12	21
Volume Right	0	11	0	99	133	9
cSH	960	1700	956	1700	292	74
Volume to Capacity	0.06	0.34	0.06	0.31	0.56	0.50
Queue Length 95th (ft)	5	0	5	0	79	52
Control Delay (s)	9.0	0.0	9.0	0.0	31.7	94.8
Lane LOS	A		A		D	F
Approach Delay (s)	0.8		0.9		31.7	94.8
Approach LOS					D	F

Intersection Summary			
Average Delay	6.8		
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	661	388	0	10	30
Peak Hour Factor	0.96	0.96	0.95	0.95	0.71	0.71
Hourly flow rate (vph)	0	689	408	0	14	42
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			825			
pX, platoon unblocked						
vC, conflicting volume	428				1137	448
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	428				1137	448
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				93	93
cM capacity (veh/h)	1112				216	590

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	689	408	14	42
Volume Left	0	0	14	0
Volume Right	0	0	0	42
cSH	1700	1700	216	590
Volume to Capacity	0.41	0.24	0.07	0.07
Queue Length 95th (ft)	0	0	5	6
Control Delay (s)	0.0	0.0	22.8	11.6
Lane LOS			C	B
Approach Delay (s)	0.0	0.0	14.4	
Approach LOS			B	

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	49.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	62	598	375	43	68	45
Peak Hour Factor	0.96	0.96	0.95	0.95	0.90	0.90
Hourly flow rate (vph)	65	623	395	45	76	50
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			925			
pX, platoon unblocked						
vC, conflicting volume	460				1209	457
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	460				1209	457
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				59	91
cM capacity (veh/h)	1083				184	583

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	65	623	440	126
Volume Left	65	0	0	76
Volume Right	0	0	45	50
cSH	1083	1700	1700	252
Volume to Capacity	0.06	0.37	0.26	0.50
Queue Length 95th (ft)	5	0	0	64
Control Delay (s)	8.5	0.0	0.0	32.6
Lane LOS	A			D
Approach Delay (s)	0.8		0.0	32.6
Approach LOS				D

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	48.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	32	630	396	23	30	28
Peak Hour Factor	0.96	0.96	0.95	0.95	0.78	0.78
Hourly flow rate (vph)	33	656	417	24	38	36
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)			1025			
pX, platoon unblocked						
vC, conflicting volume	461				1192	469
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	461				1192	469
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				80	94
cM capacity (veh/h)	1082				194	575

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	33	656	441	74
Volume Left	33	0	0	38
Volume Right	0	0	24	36
cSH	1082	1700	1700	285
Volume to Capacity	0.03	0.39	0.26	0.26
Queue Length 95th (ft)	2	0	0	25
Control Delay (s)	8.4	0.0	0.0	22.0
Lane LOS	A			C
Approach Delay (s)	0.4		0.0	22.0
Approach LOS				C

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	48.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	79	601	361	41	60	63
Peak Hour Factor	0.96	0.96	0.95	0.95	0.74	0.74
Hourly flow rate (vph)	82	626	380	43	81	85
Pedestrians		20	20		20	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	443				1232	442
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	443				1232	442
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	93				54	86
cM capacity (veh/h)	1098				175	595

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	82	626	423	166
Volume Left	82	0	0	81
Volume Right	0	0	43	85
cSH	1098	1700	1700	274
Volume to Capacity	0.07	0.37	0.25	0.61
Queue Length 95th (ft)	6	0	0	91
Control Delay (s)	8.5	0.0	0.0	36.5
Lane LOS	A			E
Approach Delay (s)	1.0		0.0	36.5
Approach LOS				E

Intersection Summary			
Average Delay	5.2		
Intersection Capacity Utilization	49.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	5	11	9	37	63	13	48	55	40	12	44	1
Peak Hour Factor	0.85	0.85	0.85	0.91	0.91	0.91	0.75	0.75	0.75	0.68	0.68	0.68
Hourly flow rate (vph)	6	13	11	41	69	14	64	73	53	18	65	1
Pedestrians		20			20			20			20	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		2			2			2			2	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	418	395	105	386	369	140	86			147		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	418	395	105	386	369	140	86			147		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	97	99	92	86	98	96			99		
cM capacity (veh/h)	435	495	918	501	512	878	1485			1411		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	29	124	191	84
Volume Left	6	41	64	18
Volume Right	11	14	53	1
cSH	574	534	1485	1411
Volume to Capacity	0.05	0.23	0.04	0.01
Queue Length 95th (ft)	4	22	3	1
Control Delay (s)	11.6	13.8	2.8	1.7
Lane LOS	B	B	A	A
Approach Delay (s)	11.6	13.8	2.8	1.7
Approach LOS	B	B		

Intersection Summary			
Average Delay	6.4		
Intersection Capacity Utilization	32.1%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix F

Future 2019 Right Turn Lane Warrant Analysis Worksheets

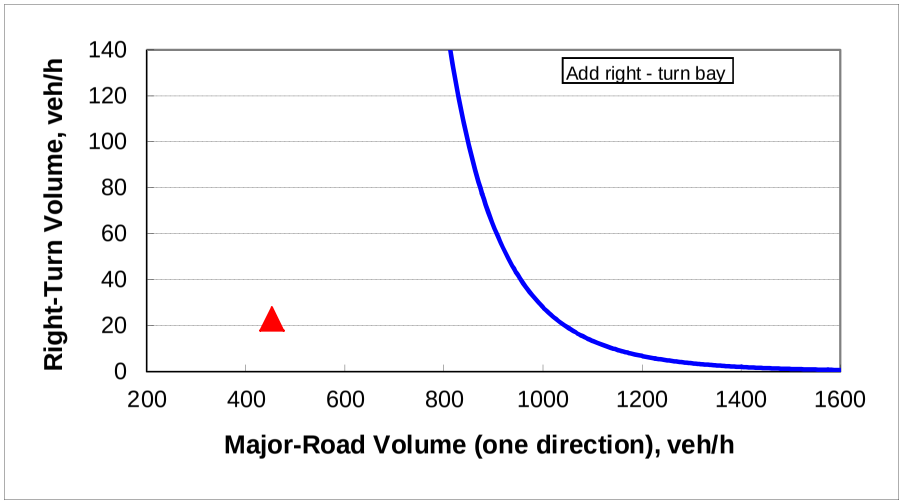
Figure 2 - 6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

INPUT

Roadway geometry:	2-lane roadway
Variable	Value
Major-road speed, mph:	20
Major-road volume (one direction), veh/h:	452
Right-turn volume, veh/h:	23

OUTPUT

Variable	Value
Limiting right-turn volume, veh/h:	13132
Guidance for determining the need for a major-road right-turn bay for a 2-lane roadway:	
Do NOT add right-turn bay.	



RIGHT TURN LANE WARRANT
CHURCH STREET AT SITE ACCESS
FUTURE A.M. PEAK HOUR

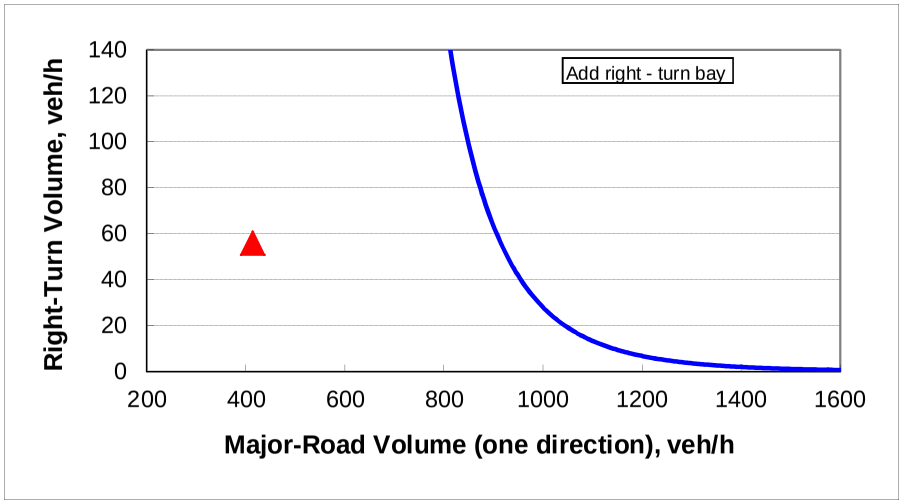
Figure 2 - 6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

INPUT

Roadway geometry:	2-lane roadway
Variable	Value
Major-road speed, mph:	20
Major-road volume (one direction), veh/h:	413
Right-turn volume, veh/h:	56

OUTPUT

Variable	Value
Limiting right-turn volume, veh/h:	26418
Guidance for determining the need for a major-road right-turn bay for a 2-lane roadway:	
Do NOT add right-turn bay.	



RIGHT TURN LANE WARRANT
CHURCH STREET AT SITE ACCESS
FUTURE AFTERNOON SCHOOL PEAK HOUR

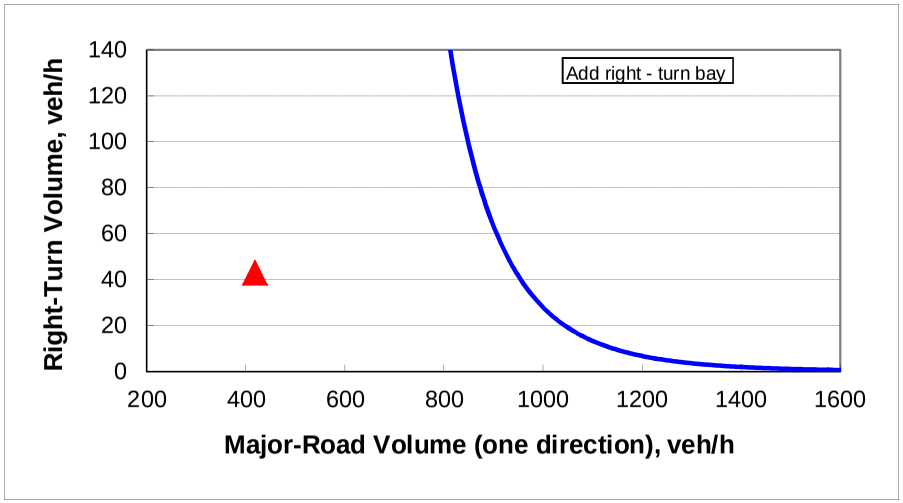
Figure 2 - 6. Guideline for determining the need for a major-road right-turn bay at a two-way stop-controlled intersection.

INPUT

Roadway geometry:	2-lane roadway
Variable	Value
Major-road speed, mph:	20
Major-road volume (one direction), veh/h:	418
Right-turn volume, veh/h:	43

OUTPUT

Variable	Value
Limiting right-turn volume, veh/h:	24066
Guidance for determining the need for a major-road right-turn bay for a 2-lane roadway:	
Do NOT add right-turn bay.	



RIGHT TURN LANE WARRANT
CHURCH STREET AT SITE ACCESS
FUTURE P.M. PEAK HOUR

Appendix G

Future 2019 Intersection Capacity Analysis Worksheets – Church Street at Dexter Avenue (Signalized)

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	1.00		0.99	
Flpb, ped/bikes	0.99	1.00	1.00		1.00	
Frt	1.00	1.00	0.99		0.95	
Flt Protected	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1753	1583	1567		1442	
Flt Permitted	0.45	1.00	1.00		0.97	
Satd. Flow (perm)	822	1583	1567		1442	
Volume (vph)	14	551	358	22	116	60
Peak-hour factor, PHF	0.72	0.72	0.80	0.80	0.62	0.62
Adj. Flow (vph)	19	765	448	28	187	97
RTOR Reduction (vph)	0	0	4	0	43	0
Lane Group Flow (vph)	19	765	472	0	241	0
Confl. Peds. (#/hr)	15			15	15	15
Parking (#/hr)		10	10	10	10	10
Turn Type	Perm					
Protected Phases		2	2		4	
Permitted Phases	2					
Actuated Green, G (s)	24.9	24.9	24.9		9.5	
Effective Green, g (s)	24.9	24.9	24.9		9.5	
Actuated g/C Ratio	0.59	0.59	0.59		0.22	
Clearance Time (s)	4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	483	930	920		323	
v/s Ratio Prot		c0.48	0.30		c0.17	
v/s Ratio Perm	0.02					
v/c Ratio	0.04	0.82	0.51		0.75	
Uniform Delay, d1	3.7	7.0	5.2		15.3	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.0	5.9	0.5		9.1	
Delay (s)	3.7	12.9	5.7		24.4	
Level of Service	A	B	A		C	
Approach Delay (s)		12.7	5.7		24.4	
Approach LOS		B	A		C	

Intersection Summary			
HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	42.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	0.99		0.99	
Flpb, ped/bikes	0.99	1.00	1.00		1.00	
Frt	1.00	1.00	0.98		0.96	
Flt Protected	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1747	1583	1544		1452	
Flt Permitted	0.44	1.00	1.00		0.97	
Satd. Flow (perm)	804	1583	1544		1452	
Volume (vph)	43	501	318	51	138	53
Peak-hour factor, PHF	0.89	0.89	0.83	0.83	0.61	0.61
Adj. Flow (vph)	48	563	383	61	226	87
RTOR Reduction (vph)	0	0	12	0	24	0
Lane Group Flow (vph)	48	563	432	0	289	0
Confl. Peds. (#/hr)	20			20	20	20
Parking (#/hr)		10	10	10	10	10
Turn Type	Perm					
Protected Phases		2	2		4	
Permitted Phases	2					
Actuated Green, G (s)	20.5	20.5	20.5		12.7	
Effective Green, g (s)	20.5	20.5	20.5		12.7	
Actuated g/C Ratio	0.50	0.50	0.50		0.31	
Clearance Time (s)	4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	400	788	768		448	
v/s Ratio Prot		c0.36	0.28		c0.20	
v/s Ratio Perm	0.06					
v/c Ratio	0.12	0.71	0.56		0.64	
Uniform Delay, d1	5.5	8.1	7.2		12.3	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.1	3.1	0.9		3.2	
Delay (s)	5.7	11.2	8.2		15.5	
Level of Service	A	B	A		B	
Approach Delay (s)		10.7	8.2		15.5	
Approach LOS		B	A		B	

Intersection Summary			
HCM Average Control Delay	11.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	41.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	45.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	1.00		0.98	
Flpb, ped/bikes	0.99	1.00	1.00		1.00	
Frt	1.00	1.00	0.99		0.93	
Flt Protected	0.95	1.00	1.00		0.98	
Satd. Flow (prot)	1749	1583	1555		1409	
Flt Permitted	0.51	1.00	1.00		0.98	
Satd. Flow (perm)	933	1583	1555		1409	
Volume (vph)	79	601	361	41	60	63
Peak-hour factor, PHF	0.96	0.96	0.95	0.95	0.74	0.74
Adj. Flow (vph)	82	626	380	43	81	85
RTOR Reduction (vph)	0	0	7	0	70	0
Lane Group Flow (vph)	82	626	416	0	96	0
Confl. Peds. (#/hr)	20			20	20	20
Parking (#/hr)		10	10	10	10	10
Turn Type	Perm					
Protected Phases		2	2		4	
Permitted Phases	2					
Actuated Green, G (s)	19.9	19.9	19.9		6.1	
Effective Green, g (s)	19.9	19.9	19.9		6.1	
Actuated g/C Ratio	0.59	0.59	0.59		0.18	
Clearance Time (s)	4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	546	927	910		253	
v/s Ratio Prot		c0.40	0.27		c0.07	
v/s Ratio Perm	0.09					
v/c Ratio	0.15	0.68	0.46		0.38	
Uniform Delay, d1	3.2	4.8	4.0		12.3	
Progression Factor	1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.1	2.0	0.4		1.0	
Delay (s)	3.3	6.8	4.4		13.2	
Level of Service	A	A	A		B	
Approach Delay (s)		6.4	4.4		13.2	
Approach LOS		A	A		B	

Intersection Summary			
HCM Average Control Delay	6.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	34.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			