

ORDINANCE NO. 1937

**AN ORDINANCE TO PROVIDE FOR STOP SIGN ON BROOKWOOD ROAD
AT ITS INTERSECTION WITH CROSSHILL ROAD AND
TO PROVIDE FOR PUNISHMENT THEREOF**

BE IT ORDAINED by the City Council of the City of Mountain Brook, Alabama, as follows:

Section 1. It shall be unlawful for the driver of any vehicle to cause or allow such vehicle traveling in a southerly direction along Brookwood Road Way to enter its intersection with Crosshill Road when there is standing at such intersection a "Stop" sign facing in the direction of such driver without having first brought such vehicle to a complete stop within ten (10) feet of said intersection.

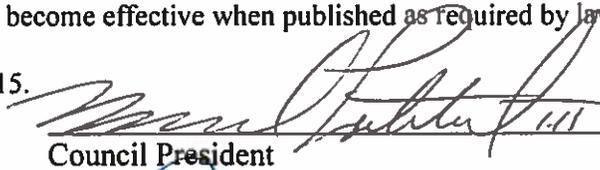
Section 2. Any person violating the provisions of this ordinance shall be punished by a fine not to exceed \$500.00, or by imprisonment not to exceed 180 days, or both.

Section 3. All ordinances or portions of ordinances conflicting with this ordinance are hereby repealed.

Section 4. If a court or competent authority finds that any provision of this ordinance is invalid, illegal, or unenforceable, that provision or part-provision shall, to the extent required, be deemed to be deleted, and the validity and enforceability of the other provisions of this ordinance shall not be affected.

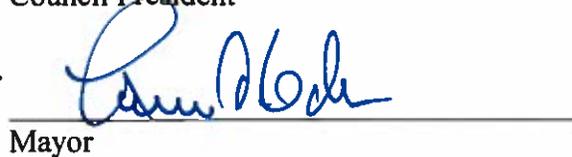
Section 5. This ordinance shall become effective when published as required by law.

ADOPTED: This 10th day of August, 2015.



Council President

APPROVED: This 10th day of August, 2015.



Mayor

CERTIFICATION

I, Steven Boone, City Clerk of the City of Mountain Brook, Alabama, hereby certify the above to be a true and correct copy of an ordinance adopted by the City Council of the City of Mountain Brook, Alabama, at its meeting held on this 10th day of August, 2015, as same appears in the minutes of record of said meeting, and published by posting copies thereof on August 11, 2015, at the following public places, which copies remained posted for five (5) days as required by law.

City Hall, 56 Church Street
Gilchrist Pharmacy, 2850 Cahaba Road

Overton Park, 3020 Overton Road
The Invitation Place, 3150 Overton Road



City Clerk

Brookwood Road at Crosshill Road

The intersection of Overbrook Road at Crosshill Road was examined to determine the scope of both non-widening and widening projects which could alleviate existing traffic congestion experienced at the intersection. The general study area for the analysis is shown in Figure 1.



Figure 1. Site Location Map

In the vicinity of the intersection, Brookwood Road is a two lane roadway with a posted speed limit of 30 miles per hour. Crosshill Road is a two lane roadway with no posted speed limit. The configuration of the intersection is an offset intersection, forming two traffic triangles on Brookwood Road, separated by approximately 165 feet. The configuration of the intersection of Brookwood Road at Crosshill Road and the current location of stop signs is shown in Figure 2.

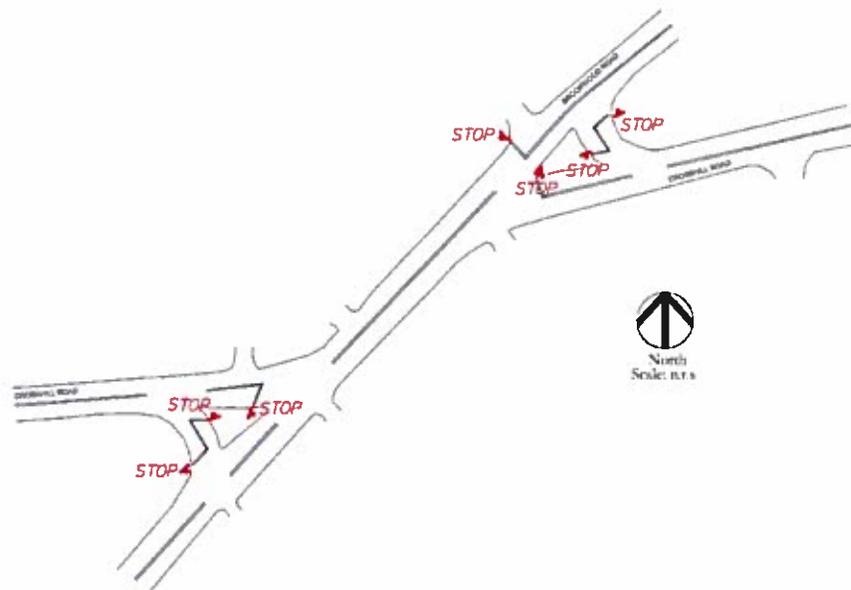


Figure 2. Existing Traffic Control

Existing Intersection Turning Movement Traffic Counts

An existing intersection turning movement traffic count was performed at the intersection of Brookwood Road at Crosshill Road on Wednesday to Thursday, March 11 to 12, 2015, during the hours of 7:00 to 9:00 a.m. and 4:00 to 6:00 p.m., by Traffic Data, LLC on behalf of Skipper Consulting, Inc. The traffic count data is included in Appendix A. Peak hour turning movement traffic volumes are illustrated in Figure 3.

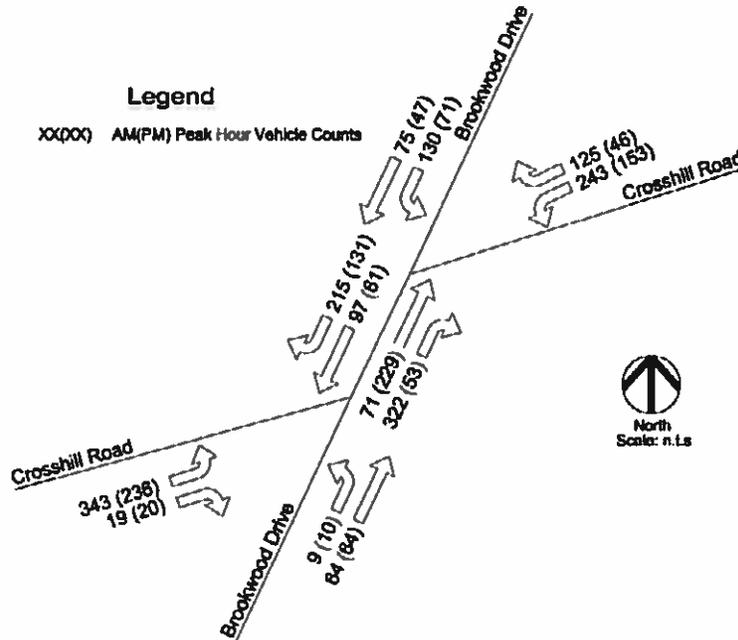


Figure 3. Existing Intersection Turning Movement Traffic Counts

Existing Intersection Capacity Analysis and Queue Calculations

Existing a.m. and p.m. peak hour intersection capacity analyses and queue calculations were performed for the intersection of Brookwood Road at Crosshill Road using the methods of analysis contained in the *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 the peak hours of traffic flow. The results of the intersection capacity analyses and queue calculations are included in Appendix B and are summarized in Table 1.

Table 1. Existing Intersection Capacity Analysis and Queue Calculations

Intersection	Approach	Movement	AM Peak			PM Peak		
			LOS	Delay	Queue	LOS	Delay	Queue
Brookwood Road at Crosshill Road (North)	Crosshill Road Westbound	Left	F	52	395'	B	14	100'
		Right	C	17		A	5	
	Brookwood Road Northbound	Through	A	7	20'	A	3	0'
		Right	A	5		A	3	
	Brookwood Road Southbound	Left	F	109	55'	A	9	65'
		Through	F	66	480'	A	10	70'
Overall intersection			D	34		A	8	
Brookwood Road at Crosshill Road (South)	Crosshill Road Eastbound	Left	D	33	380'	A	12	105'
		Right	B	15		A	7	
	Brookwood Road Northbound	Left	A	6	30'	A	6	25'
		Through	A	4		A	2	
	Brookwood Road Southbound	Through	A	3	0'	A	4	0'
		Right	A	4		A	3	
Overall Intersection			C	18		A	7	

Note: Delay is expressed in average seconds per vehicle

Crash History

Crash information for the intersection of Brookwood Road at Crosshill Road was provided by the City of Mountain Brook Police Department for 2012, 2013, and 2014. During the period, there were three crashes related to the intersection of Brookwood Road at Crosshill Road. One crash was a rear-end crash on Crosshill Road eastbound. Two crashes were right angle crashes, with one of the crashes occurring on Crosshill Road eastbound and the other crash on Crosshill Road westbound. A crash diagram is provided in Figure 4.

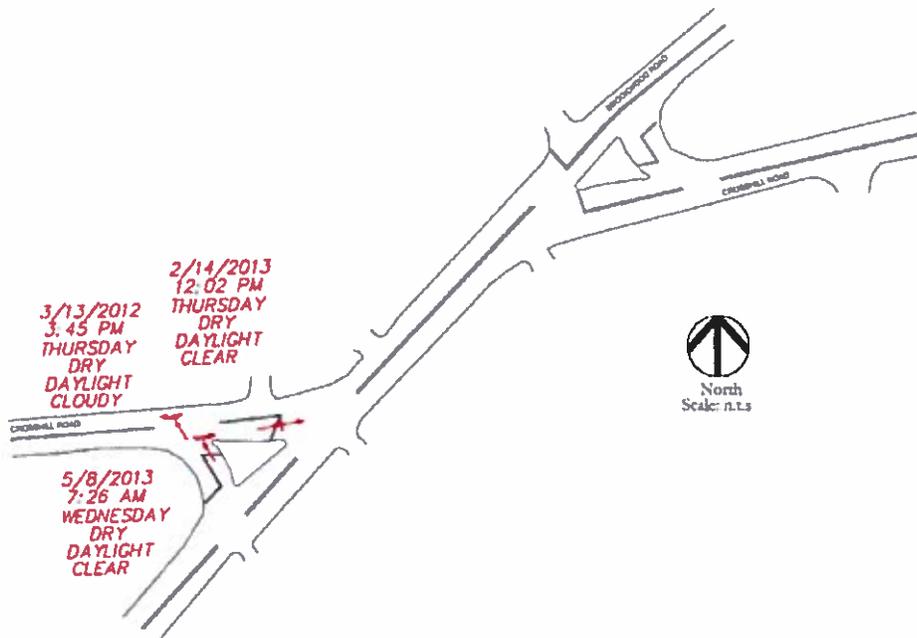


Figure 4. Crash History

Sight Distance

Sight distance measurements were made for all movements at each of the intersection for all movements where sight distance of approaching vehicles is required in order to make the desired movement. The minimum required sight distance according to the AASHTO Policy on the Geometric Design of Highways and Streets (Green Book) is 335 feet, based on the posted speed limit of 30 miles per hour on Brookwood Road. The sight distance measurements are shown in Figure 5 and Figure 6.

The only location where sight distance is limited below minimum requirements is for traffic entering the southern intersection of Crosshill Road looking to the right (Point "A"), where the sight distance is limited to 170 feet. In the narrative for the crash which occurred at this intersection on March 13, 2012, the driver of the vehicle entering Crosshill Road stated that she did not see the vehicle approaching from Brookwood Road.

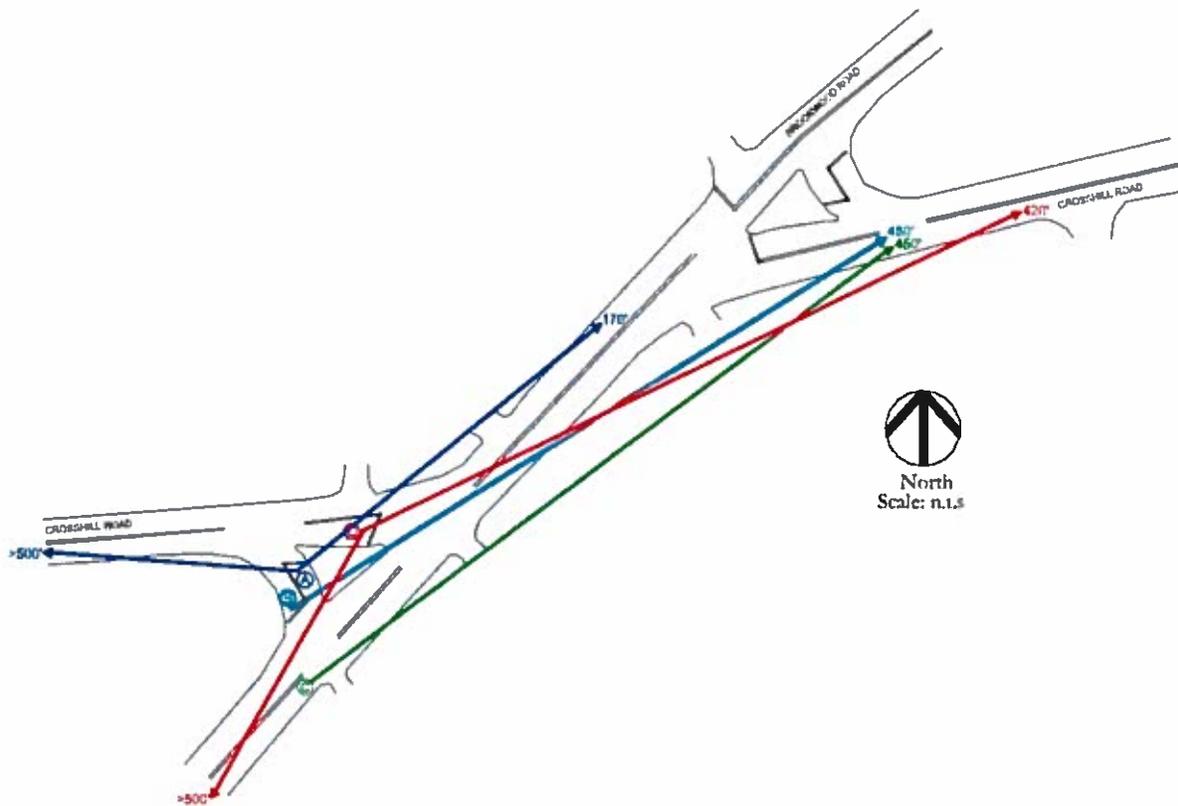


Figure 5. Sight Distance Measurements Crosshill Road (South)

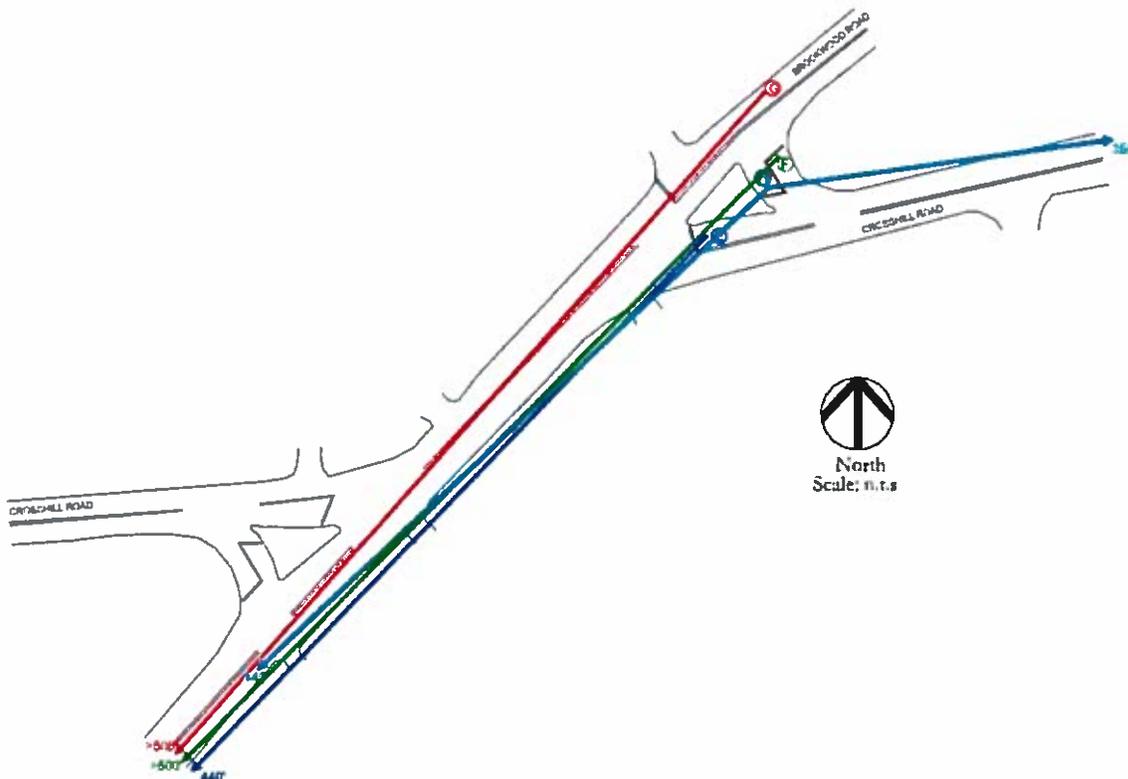


Figure 6. Sight Distance Measurements Crosshill Road (North)

Additional field work was undertaken to determine the cause for the limitation of the sight distance looking to the right from Point "A" on Figure 5. The sight distance limitation is caused by numerous objects, including landscaping on either side of the driveway of 3329 Brookwood Road, a tree in the front yard of 3329 Brookwood Road, and undergrowth at the northern edge of the property line of 3329 Brookwood Road. Pictures depicting the sight distance restrictions are given below. All of these obstructions would need to be removed in order to have adequate sight distance from Point "A" for at least 335 feet, which is approximately the location of the existing stop sign on Brookwood Road southbound at the northern intersection of Crosshill Road.





Observations

Observations of traffic flow at the intersection of Brookwood Road at Crosshill Road were performed on Tuesday, May 12 and Wednesday May 13, 2015 by Skipper Consulting, Inc. Observations were conducted from 7:15 to 8:00 a.m., 2:30 to 3:20 p.m., and 4:45 to 5:30 p.m. The findings of the observations are discussed below.

AM Peak Period Observations

- While traffic flow was constant, the eastbound left queue from Crosshill Road onto Brookwood Road caused congestion and delay for the eastbound right and northbound left movements from 7:37 a.m. to 7:53 a.m. This problem persisted 4 other times during the study period.
- Similarly, the westbound left queue from Crosshill Road onto Brookwood Road caused congestion and delay for the westbound right and southbound left movements during the study period. However, the problem was minimal in comparison to the eastbound movement as it only persisted 2 times during the study period.

Afternoon School Peak Period Observations

- The eastbound left queue from Crosshill Road onto Brookwood Road did not cause any congestion or delay during the study period.
- The westbound left queue from Crosshill Road onto Brookwood Road caused congestion and delay for the westbound right and southbound left movements multiple times during the study period. However, no instance where movements were blocked lasted longer than 1 minute.

PM Peak Period Observations

- The eastbound left queue from Crosshill Road onto Brookwood Road caused congestion and delay for the eastbound right and northbound left movements from 4:11 p.m. to 4:30 p.m. This problem persisted 5 other times during the study period lasting less than 1 minute each time.
- Similarly, the westbound left queue from Crosshill Road onto Brookwood Road caused congestion and delay for the westbound right and southbound left movements 6 times during the study period.

Alternative Improvements

Alternative 1 – Install Additional Stop Signs

In order to correct deficiencies shown to exist in intersection capacity, sight distance, and based on observations, three additional stop signs could be installed on Brookwood Road. The locations of the proposed stop signs are shown in Figure 7. Capacity and queue analyses were performed to determine the traffic operation of the proposed alternative. The results of these analyses are shown in Table 2 and are included in Appendix C.

While the analyses show that installation of additional stop signs results in overall improvements in delay and level of service, the queue on Brookwood Road northbound approaching the northern intersection of Crosshill Road is significantly greater than the available stacking room between the two triangles. Therefore, installation of the proposed stop sign on Brookwood Road northbound at the northern intersection of Crosshill Road would not be advisable.

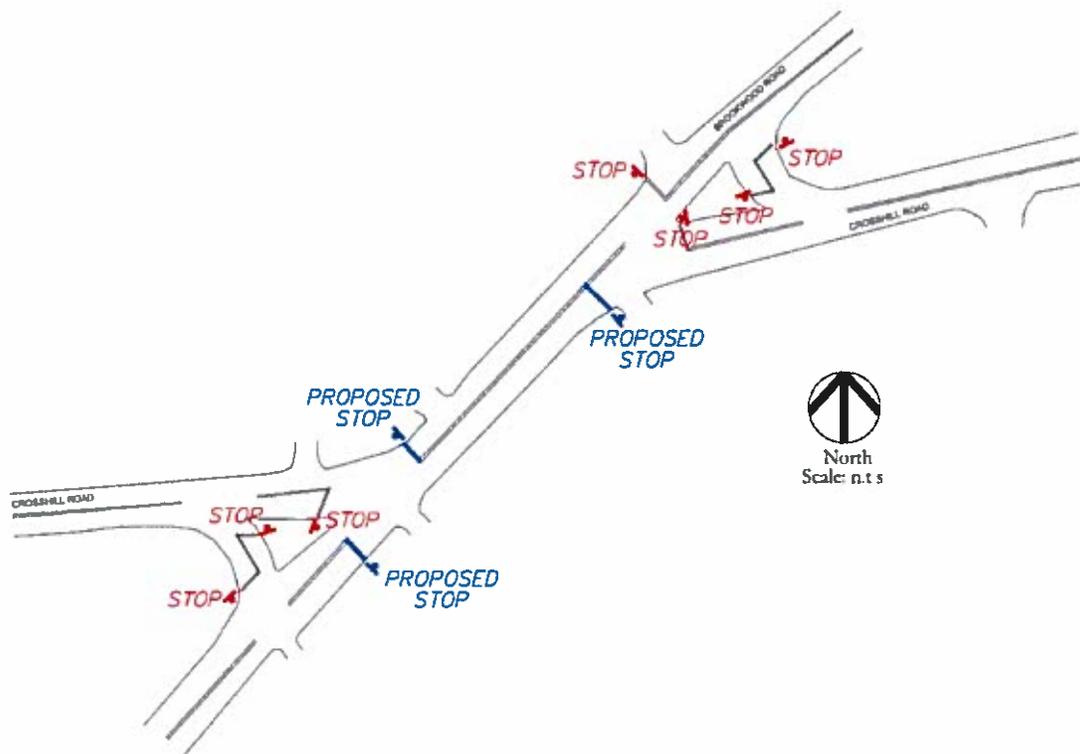


Figure 7. Improvement Alternative 1 (All-Way Stop)

Table 2. Intersection Capacity Analysis and Queue Calculations – Alternative 1

Intersection	Approach	Movement	AM Peak			PM Peak		
			LOS	Delay	Queue	LOS	Delay	Queue
Brookwood Road at Crosshill Road (North)	Crosshill Road Westbound	Left	C	18	120'	B	12	85'
		Right	A	9		A	5	
	Brookwood Road Northbound	Through	D	28	440'	B	12	105'
		Right	D	28		A	8	
	Brookwood Road Southbound	Left	B	14	65'	A	8	60'
		Through	B	12	110'	A	9	70'
Overall intersection			C	20		A	10	
Brookwood Road at Crosshill Road (South)	Crosshill Road Eastbound	Left	C	23	150'	B	11	100'
		Right	B	13		A	7	
	Brookwood Road Northbound	Left	A	9	70'	A	9	55'
		Through	B	12		A	8	
	Brookwood Road Southbound	Through	A	8	105'	A	7	90'
		Right	A	9		A	7	
Overall Intersection			C	16		A	9	

Note: Delay is expressed in average seconds per vehicle

In response to concerns of local residents, additional analyses were performed to determine the impacts of installation of only one of the two proposed stop signs at the southern intersection of Brookwood Road at Crosshill Road. Two additional sub-alternatives were developed and analyzed:

Sub-Alternate 1A – installation of a stop sign on only Brookwood Road northbound (results are tabulated in Table 3 and are included in Appendix D)

Sub-alternate 1B – installation of a stop sign on only Brookwood Road southbound (results are tabulated in Table 4 and are included in Appendix E)

Table 3. Intersection Capacity Analysis and Queue Calculations – Sub-Alternate 1A

Intersection	Approach	Movement	AM Peak			PM Peak		
			LOS	Delay	Queue	LOS	Delay	Queue
Brookwood Road at Crosshill Road (North)	Crosshill Road Westbound	Left	D	52	395'	B	15	105'
		Right	B	17		A	5	
	Brookwood Road Northbound	Through	A	8	15'	A	4	0'
		Right	A	6		A	3	
	Brookwood Road Southbound	Left	F	113	55'	A	10	65'
		Through	E	68	495'	A	10	80'
Overall intersection			D	36		A	8	
Brookwood Road at Crosshill Road (South)	Crosshill Road Eastbound	Left	C	30	335'	B	12	100'
		Right	B	14		A	7	
	Brookwood Road Northbound	Left	A	9	75'	B	11	55'
		Through	B	13		A	8	
	Brookwood Road Southbound	Through	A	4	0'	A	3	0'
		Right	A	3		A	3	
Overall Intersection			B	17		A	7	

Note: Delay is expressed in average seconds per vehicle

Table 4. Intersection Capacity Analysis and Queue Calculations – Sub-Alternate 1B

Intersection	Approach	Movement	AM Peak			PM Peak		
			LOS	Delay	Queue	LOS	Delay	Queue
Brookwood Road at Crosshill Road (North)	Crosshill Road Westbound	Left	D	48	350'	B	15	105'
		Right	B	15		A	5	
	Brookwood Road Northbound	Through	A	7	10'	A	3	0'
		Right	A	5		A	3	
	Brookwood Road Southbound	Left	E	77	60'	A	9	65'
		Through	D	45	390'	A	10	70'
Overall intersection			C	28		A	8	
Brookwood Road at Crosshill Road (South)	Crosshill Road Eastbound	Left	C	25	275'	B	11	100'
		Right	B	13		A	7	
	Brookwood Road Northbound	Left	A	4	30'	A	6	20'
		Through	A	4		A	1	
	Brookwood Road Southbound	Through	A	8	110'	A	7	85'
		Right	A	8		A	6	
Overall Intersection			B	16		A	8	

Note: Delay is expressed in average seconds per vehicle

As shown in Tables 3 and 4, neither Sub-Alternate 1A or Sub-Alternate 1B completely addresses the queue on Crosshill Road eastbound at Brookwood Road during the a.m. peak period. Both sub-alternates decrease the queue, with Sub-Alternate 1B having the best overall impact on the queue (approximately 30% reduction). It should be noted that the stop sign which would be installed under Sub-Alternate 1B would also correct the one existing sight distance limitation.

Alternative 2 – Traffic Signalization

A second alternative for correction of capacity and sight distance deficiencies at the intersection of Brookwood Road at Crosshill Road would be the installation of a traffic signal. In order to determine if this would be a viable alternative, a traffic signal warrant analysis was performed for the intersection using the methodology included in the 2009 *Manual on Uniform Traffic Control Devices*, published by the Federal Highway Administration. Approach traffic counts for the intersection are included in Appendix F. The results of the warrant analysis are included in Appendix G. The results of the traffic signal warrant study show that the existing traffic volumes at the intersection of Brookwood Road at Crosshill Road do not meet either the eight hour volume warrants or four hour volume warrant. Therefore, signalization of the intersection is not advised.

Recommended Improvements

The analyses presented in this report indicate that there are three primary deficiencies with the intersection of Brookwood Road at Crosshill Road to be addressed. These deficiencies are:

- The limited sight distance looking to the right from the left turn from Brookwood Road northbound onto Crosshill Road westbound (southern intersection)
- The excessive queue during the a.m. peak period on Crosshill Road westbound turning left onto Brookwood Road southbound (northern intersection)
- The excessive queue during the a.m. peak period on Crosshill Road eastbound turning left onto Brookwood Road northbound (southern intersection)

The research performed during this study effort has shown that the sight distance limitation looking to the right from the left turn from Brookwood Road northbound onto Crosshill Road westbound (southern intersection) is a safety concern. Within the last three years, there has been crash where this sight distance limitation may have been a contributing factor. This sight distance limitation can be corrected in two reasonable ways:

1. removal of existing landscaping, undergrowth, and one tree along the property frontage of 3329 Brookwood Road; or
2. installation of a stop sign on Brookwood Road southbound at the intersection of Crosshill Road (southern intersection)

The excessive queue on Crosshill Road westbound (northern intersection) can only be corrected by installation of a stop sign on Brookwood Road northbound or traffic signalization. This report has demonstrated that neither of these options would be acceptable.

The excessive queue on Crosshill Road eastbound (southern intersection) can only be corrected to an acceptable level by installation of two stop signs on Brookwood Road or a traffic signal. This report has already shown that traffic signalization is not warranted. Installation of only one stop sign will not produce the same level of result as installation of two stop signs.

Based on the analyses of the alternative improvements, it is recommended that two stop signs be installed at the intersection of Brookwood Road at Crosshill Road. The locations of the proposed stop signs are shown in Figure 8. The stop sign on Brookwood Road southbound is needed to correct the sight distance deficiency and reduce the queue on Crosshill Road eastbound. The stop sign on Brookwood Road northbound is needed only to reduce the queue on Crosshill Road eastbound.

The stop sign on Brookwood Road northbound could be eliminated from consideration if the City deems that the moderate improvement in queue on Crosshill Road eastbound is acceptable. The stop sign on Brookwood Road southbound could likewise be eliminated provided that other measures are employed to establish adequate sight distance.

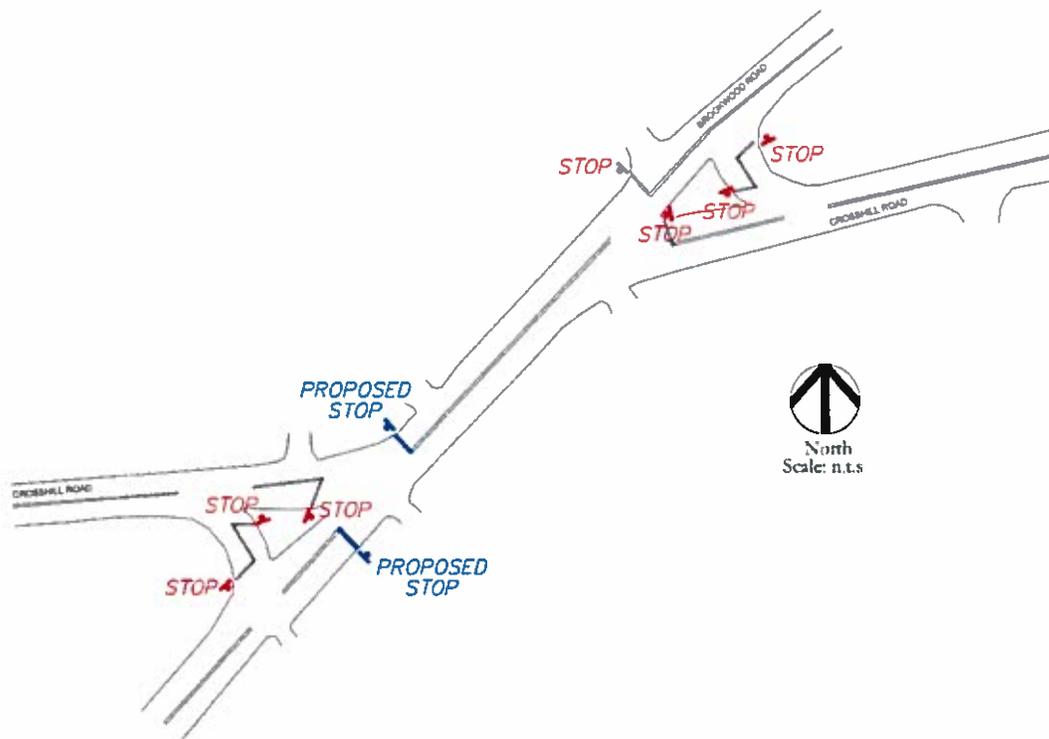


Figure 8. Recommended Improvements

Operational Analysis of Recommended Improvements

Capacity and queue analyses were performed to determine the traffic operation of the recommended improvements. The results of these analyses are shown in Table 5 and are included in Appendix H.

Table 3. Intersection Capacity Analysis and Queue Calculations – Recommended Improvements

Intersection	Approach	Movement	AM Peak			PM Peak		
			LOS	Delay	Queue	LOS	Delay	Queue
Brookwood Road at Crosshill Road (North)	Crosshill Road Westbound	Left	F	58	550'	B	15	105'
		Right	C	23		A	5	
	Brookwood Road Northbound	Through	A	8	15'	A	4	0'
		Right	A	5		A	3	
	Brookwood Road Southbound	Left	F	137	55'	A	10	65'
		Through	F	91	605'	A	10	80'
	Overall intersection			E	42		A	8
Brookwood Road at Crosshill Road (South)	Crosshill Road Eastbound	Left	C	23	245'	B	11	95'
		Right	B	13		A	7	
	Brookwood Road Northbound	Left	A	9	75'	A	9	55'
		Through	B	12		A	8	
	Brookwood Road Southbound	Through	A	8	90'	A	7	85'
		Right	A	8		A	6	
	Overall Intersection			C	16		A	9

Note: Delay is expressed in average seconds per vehicle

Cost Estimates

The cost estimate for implementation of the recommended improvements is as follows:

Two STOP signs on U-channel posts	\$ 600.00
45 linear feet of 2' white stop line	<u>\$ 600.00</u>
Total	\$1,200.00

Funding Sources

The recommended improvements should be installed by City forces.

Appendix A

Existing Intersection Turning Movement Traffic Counts

TRAFFIC DATA, LLC

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

Mountain Brook, AL

File Name : mountainbrook02
 Site Code : 00000000
 Start Date : 03/11/2015
 Page No : 1

Groups Printed- Unshifted

Start Time	BROOKWOOD RD Southbound		CROSSHILL RD Westbound		BROOKWOOD RD Northbound		Int. Total
	Left	Thru	Left	Right	Thru	Right	
04:00 PM	12	11	22	8	9	27	89
04:15 PM	14	8	27	7	15	37	106
04:30 PM	20	13	29	15	14	44	135
04:45 PM	25	18	35	10	9	51	148
Total	71	48	113	40	47	159	478
05:00 PM	11	10	31	14	17	58	139
05:15 PM	20	10	47	11	11	60	159
05:30 PM	15	9	40	11	16	62	153
05:45 PM	23	12	28	22	11	47	143
Total	69	41	146	58	55	225	594
07:00 AM	17	13	39	13	5	42	129
07:15 AM	19	7	69	41	18	72	226
07:30 AM	44	22	78	49	31	120	344
07:45 AM	50	33	57	22	17	88	267
Total	130	75	243	125	71	322	968
08:00 AM	6	18	39	8	7	24	100
08:15 AM	9	8	38	11	3	19	86
08:30 AM	13	14	38	8	5	13	91
08:45 AM	8	16	21	5	4	16	72
Total	36	52	136	32	19	74	349
Grand Total	306	216	638	255	192	780	2387
Apprch %	58.8	41.4	71.4	28.6	19.8	80.2	
Total %	12.8	9.0	28.7	10.7	8.0	32.7	

Start Time	BROOKWOOD RD Southbound			CROSSHILL RD Westbound			BROOKWOOD RD Northbound			App. Total	Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total		
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1											
Intersection	04:45 PM			05:15 PM			05:30 PM			3:45:00 PM	
Volume	71	47	118	153	46	199	63	229	282	0	599
Percent	60.2	39.8		76.9	23.1		18.8	81.2			
05:15 Volume	20	10	30	47	11	58	11	60	71	0	159
Peak Factor										0.942	
High Int.	04:45 PM			05:15 PM			05:30 PM			3:45:00 PM	
Volume	26	18	43	47	11	58	16	62	78		
Peak Factor	0.866			0.858			0.904				
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1											
By Approach	04:30 PM			05:00 PM			04:45 PM			04:00 PM	
Volume	76	51	127	146	58	204	63	229	282	0	
Percent	59.8	40.2		71.6	28.4		18.8	81.2			
High Int.	04:45 PM			05:15 PM			05:30 PM				
Volume	25	18	43	47	11	58	16	62	78		
Peak Factor	0.738			0.878			0.904				

TRAFFIC DATA, LLC

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

File Name : mountainbrook02
Site Code : 00000000
Start Date : 03/11/2015
Page No : 2

Start Time	BROOKWOOD RD Southbound			CROSSHILL RD Westbound			BROOKWOOD RD Northbound			App. Total	Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total		
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1											
Intersection	07:00 AM										
Volume	130	75	205	243	125	368	71	322	393	0	966
Percent	63.4	36.6		66.0	34.0		18.1	81.9			
07:30 Volume	44	22	66	78	49	127	31	120	151	0	344
Peak Factor	0.702										
High Int.	07:45 AM			07:30 AM			07:30 AM				
Volume	50	33	83	78	49	127	31	120	151		
Peak Factor	0.617			0.724			0.651				
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1											
By Approach	07:00 AM										
Volume	130	75	205	243	125	368	71	322	393	0	
Percent	63.4	36.6		66.0	34.0		18.1	81.9			
High Int.	07:45 AM			07:30 AM			07:30 AM				
Volume	50	33	83	78	49	127	31	120	151	-	-
Peak Factor	0.617			0.724			0.651				

TRAFFIC DATA, LLC

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

Mountain Brook, AL

File Name : mountainbrook01
Site Code : 00000000
Start Date : 03/11/2015
Page No : 1

Groups Printed- Unshifted

Start Time	BROOKWOOD RD Southbound		BROOKWOOD RD Northbound			CROSSHILL RD Eastbound		Int. Total
	Thru	Right	Left	Thru	Left	Right		
04:00 PM	12	21	3	16	30	3	85	
04:15 PM	10	23	2	15	40	7	97	
04:30 PM	16	26	4	21	37	4	108	
04:45 PM	20	30	4	13	55	4	126	
Total	58	100	13	65	162	18	416	
05:00 PM	15	28	1	21	50	7	120	
05:15 PM	13	41	1	13	67	4	139	
05:30 PM	13	34	4	17	64	5	137	
05:45 PM	16	28	0	15	46	2	107	
Total	57	129	6	68	227	18	603	
07:00 AM	18	33	0	5	41	2	99	
07:15 AM	13	64	1	18	72	2	170	
07:30 AM	28	67	5	27	131	5	263	
07:45 AM	38	51	3	14	99	10	215	
Total	97	215	9	64	343	19	747	
08:00 AM	27	32	1	7	23	2	92	
08:15 AM	17	28	2	5	17	2	71	
08:30 AM	28	27	0	5	12	3	75	
08:45 AM	18	22	1	3	19	2	65	
Total	90	109	4	20	71	9	303	
Grand Total	302	553	32	215	803	64	1969	
Apprch %	35.3	64.7	13.0	87.0	92.6	7.4		
Total %	15.3	28.1	1.8	10.9	40.8	3.3		

Start Time	BROOKWOOD RD Southbound			App. Total	BROOKWOOD RD Northbound			App. Total	CROSSHILL RD Eastbound			Int. Total
	Thru	Right	App. Total		Left	Thru	App. Total		Left	Right	App. Total	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1												
Intersection 04:45 PM												
Volume	61	131	192	0	10	64	74	236	20	256	522	
Percent	31.8	68.2		0	13.5	86.6	14	92.2	7.8		139	
05:15 Volume	13	41	54	0	1	13	14	67	4	71		
Peak Factor											0.939	
High Int. 05:15 PM												
Volume	13	41	54	0	1	21	22	67	4	71		
Peak Factor			0.889				0.841			0.801		
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1												
By Approach 04:45 PM												
Volume	61	131	192	04:00 PM	0	11	70	81	04:45 PM	236	20	256
Percent	31.8	68.2				13.6	86.4			92.2	7.8	
High Int.	05:15 PM					04:30 PM			05:15 PM			
Volume	13	41	54			4	21	25	67	4	71	
Peak Factor			0.889					0.810			0.801	

TRAFFIC DATA, LLC

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

File Name : mountainbrook01
Site Code : 00000000
Start Date : 03/11/2015
Page No : 2

Start Time	BROOKWOOD RD Southbound			App. Total	BROOKWOOD RD Northbound			CROSSHILL RD Eastbound			Int. Total
	Thru	Right	App. Total		Left	Thru	App. Total	Left	Right	App. Total	
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1											
Intersection	07:00 AM										
Volume	97	215	312	0	8	64	73	343	19	362	747
Percent	31.1	68.9			12.3	87.7		94.8	5.2		
07:30 Volume	28	67	95	0	5	27	32	131	5	136	263
Peak Factor	0.710										
High Int.	07:30 AM										
Volume	28	67	95	0	5	27	32	131	5	136	
Peak Factor	0.821						0.570			0.665	
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1											
By Approach	07:15 AM										
Volume	108	214	320	07:00 AM	07:15 AM			07:00 AM			
Percent	33.1	66.9			10	66	76	343	19	362	
High Int.	07:30 AM										
Volume	28	67	95	-	5	27	32	131	5	136	
Peak Factor	0.842			-			0.594			0.665	

Appendix B

Existing Intersection Capacity and Queue Analysis Worksheets

1: Crosshill Road WB & Brookwood Road Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Delay / Veh (s)	51.5	17.2	7.3	5.0	108.6	65.8	34.4

2: Crosshill Road EB & Brookwood Road Performance by movement

Movement	EBL	EBR	NBL	NBT	SBT	SBR	All
Delay / Veh (s)	33.2	14.6	5.8	3.5	3.4	3.5	18.0

Total Network Performance

Delay / Veh (s)	55.0
-----------------	------

Intersection: 1: Crosshill Road WB & Brookwood Road

Movement	WB	NB	SB	SB
Directions Served	LR	TR	L	T
Maximum Queue (ft)	507	22	56	503
Average Queue (ft)	204	4	55	246
95th Queue (ft)	396	19	56	478
Link Distance (ft)	2693	1591		2765
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			30	
Storage Blk Time (%)			0.89	0.13
Queuing Penalty (veh)			108	28

Intersection: 2: Crosshill Road EB & Brookwood Road

Movement	EB	NB
Directions Served	LR	L
Maximum Queue (ft)	457	32
Average Queue (ft)	226	7
95th Queue (ft)	382	29
Link Distance (ft)	2848	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		30
Storage Blk Time (%)		0.01
Queuing Penalty (veh)		1

Network Summary

Network wide Queuing Penalty: 136

1: Crosshill Road WB & Brookwood Road Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Delay / Veh (s)	14.4	5.0	3.3	3.2	9.0	9.7	7.6

2: Crosshill Road EB & Brookwood Road Performance by movement

Movement	EBL	EBR	NBL	NBT	SBT	SBR	All
Delay / Veh (s)	12.0	7.4	6.6	1.6	3.5	2.7	6.8

Total Network Performance

Delay / Veh (s)	18.7
-----------------	------

Intersection: 1: Crosshill Road WB & Brookwood Road

Movement	WB	SB	SB
Directions Served	LR	L	T
Maximum Queue (ft)	113	55	99
Average Queue (ft)	63	42	39
95th Queue (ft)	98	64	71
Link Distance (ft)	2693		2765
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		30	
Storage Blk Time (%)		0.11	0.06
Queuing Penalty (veh)		7	6

Intersection: 2: Crosshill Road EB & Brookwood Road

Movement	EB	NB
Directions Served	LR	L
Maximum Queue (ft)	113	32
Average Queue (ft)	66	5
95th Queue (ft)	105	24
Link Distance (ft)	2848	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		30
Storage Blk Time (%)		0.00
Queuing Penalty (veh)		0

Network Summary

Network wide Queuing Penalty: 14

Appendix C

Intersection Capacity and Queue Analysis Worksheets Alternative 1 – Additional Stop Signs

1: Crosshill Road WB & Brookwood Road Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Delay / Veh (s)	17.8	9.0	27.9	27.8	13.9	12.1	20.4

2: Crosshill Road EB & Brookwood Road Performance by movement

Movement	EBL	EBR	NBL	NBT	SBT	SBR	All
Delay / Veh (s)	23.2	13.1	8.7	11.5	7.8	8.6	15.8

Total Network Performance

Delay / Veh (s)	39.5
-----------------	------

Intersection: 1: Crosshill Road WB & Brookwood Road

Movement	WB	NB	SB	SB
Directions Served	LR	TR	L	T
Maximum Queue (ft)	140	595	56	136
Average Queue (ft)	82	225	52	61
95th Queue (ft)	118	439	64	109
Link Distance (ft)	2693	1591		2765
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			30	
Storage Blk Time (%)			0.26	0.11
Queuing Penalty (veh)			31	24

Intersection: 2: Crosshill Road EB & Brookwood Road

Movement	EB	NB	NB	SB
Directions Served	LR	L	T	TR
Maximum Queue (ft)	309	55	76	138
Average Queue (ft)	149	14	47	68
95th Queue (ft)	237	47	72	107
Link Distance (ft)	2848		3458	1591
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		30		
Storage Blk Time (%)		0.02	0.14	
Queuing Penalty (veh)		2	2	

Network Summary

Network wide Queuing Penalty: 59

1: Crosshill Road WB & Brookwood Road Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Delay / Veh (s)	11.9	5.0	11.5	8.3	7.9	9.2	10.2

2: Crosshill Road EB & Brookwood Road Performance by movement

Movement	EBL	EBR	NBL	NBT	SBT	SBR	All
Delay / Veh (s)	11.0	7.4	9.0	7.9	7.1	6.8	8.7

Total Network Performance

Delay / Veh (s)	23.0
-----------------	------

Intersection: 1: Crosshill Road WB & Brookwood Road

Movement	WB	NB	SB	SB
Directions Served	LR	TR	L	T
Maximum Queue (ft)	100	114	55	99
Average Queue (ft)	58	66	39	38
95th Queue (ft)	87	104	61	69
Link Distance (ft)	2693	1591		2765
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			30	
Storage Blk Time (%)			0.08	0.05
Queuing Penalty (veh)			6	5

Intersection: 2: Crosshill Road EB & Brookwood Road

Movement	EB	NB	NB	SB
Directions Served	LR	L	T	TR
Maximum Queue (ft)	113	55	55	100
Average Queue (ft)	63	14	35	60
95th Queue (ft)	99	44	54	88
Link Distance (ft)	2848		3458	1591
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		30		
Storage Blk Time (%)		0.01	0.05	
Queuing Penalty (veh)		1	1	

Network Summary

Network wide Queuing Penalty: 12

Appendix D

Intersection Capacity and Queue Analysis Worksheets Sub-Alternate 1A

1: Crosshill Road WB & Brookwood Road Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Delay / Veh (s)	52.2	17.4	7.8	5.6	113.4	67.5	35.6

2: Crosshill Road EB & Brookwood Road Performance by movement

Movement	EBL	EBR	NBL	NBT	SBT	SBR	All
Delay / Veh (s)	30.2	14.2	9.2	12.5	3.5	3.1	17.4

Total Network Performance

Delay / Veh (s)	55.7
-----------------	------

Intersection: 1: Crosshill Road WB & Brookwood Road

Movement	WB	NB	SB	SB
Directions Served	LR	TR	L	T
Maximum Queue (ft)	464	32	56	519
Average Queue (ft)	204	3	55	256
95th Queue (ft)	396	17	56	497
Link Distance (ft)	2693	1591		2765
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			30	
Storage Blk Time (%)			0.91	0.14
Queuing Penalty (veh)			110	29

Intersection: 2: Crosshill Road EB & Brookwood Road

Movement	EB	NB	NB
Directions Served	LR	L	T
Maximum Queue (ft)	368	55	77
Average Queue (ft)	201	15	48
95th Queue (ft)	336	48	74
Link Distance (ft)	2848		3458
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		30	
Storage Blk Time (%)		0.02	0.17
Queuing Penalty (veh)		2	3

Network Summary

Network wide Queuing Penalty: 144

1: Crosshill Road WB & Brookwood Road Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Delay / Veh (s)	14.7	5.0	3.7	3.4	10.4	10.1	8.1

2: Crosshill Road EB & Brookwood Road Performance by movement

Movement	EBL	EBR	NBL	NBT	SBT	SBR	All
Delay / Veh (s)	11.5	7.4	11.1	8.1	3.4	2.6	7.3

Total Network Performance

Delay / Veh (s)	19.5
-----------------	------

Intersection: 1: Crosshill Road WB & Brookwood Road

Movement	WB	SB	SB
Directions Served	LR	L	T
Maximum Queue (ft)	138	55	118
Average Queue (ft)	65	41	40
95th Queue (ft)	104	64	79
Link Distance (ft)	2693		2765
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		30	
Storage Blk Time (%)		0.12	0.06
Queuing Penalty (veh)		8	6

Intersection: 2: Crosshill Road EB & Brookwood Road

Movement	EB	NB	NB
Directions Served	LR	L	T
Maximum Queue (ft)	108	55	55
Average Queue (ft)	64	15	35
95th Queue (ft)	99	46	54
Link Distance (ft)	2848		3458
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		30	
Storage Blk Time (%)		0.02	0.06
Queuing Penalty (veh)		1	1

Network Summary

Network wide Queuing Penalty: 17

Appendix E

Intersection Capacity and Queue Analysis Worksheets Sub-Alternate 1B

1: Crosshill Road WB & Brookwood Road Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Delay / Veh (s)	48.4	14.6	7.2	5.0	77.1	44.6	27.9

2: Crosshill Road EB & Brookwood Road Performance by movement

Movement	EBL	EBR	NBL	NBT	SBT	SBR	All
Delay / Veh (s)	24.9	13.1	4.4	3.6	8.0	8.2	15.7

Total Network Performance

Delay / Veh (s)	47.1
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Intersection: 1: Crosshill Road WB & Brookwood Road

Movement	WB	NB	SB	SB
Directions Served	LR	TR	L	T
Maximum Queue (ft)	356	22	56	424
Average Queue (ft)	188	2	54	200
95th Queue (ft)	348	12	61	389
Link Distance (ft)	2693	1591		2765
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			30	
Storage Blk Time (%)			0.84	0.13
Queuing Penalty (veh)			101	28

Intersection: 2: Crosshill Road EB & Brookwood Road

Movement	EB	NB	SB
Directions Served	LR	L	TR
Maximum Queue (ft)	386	32	156
Average Queue (ft)	165	8	67
95th Queue (ft)	277	31	108
Link Distance (ft)	2848		1591
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		30	
Storage Blk Time (%)		0.00	
Queuing Penalty (veh)		0	

Network Summary

Network wide Queuing Penalty: 130

1: Crosshill Road WB & Brookwood Road Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Delay / Veh (s)	14.8	5.0	3.3	3.1	9.0	9.8	7.7

2: Crosshill Road EB & Brookwood Road Performance by movement

Movement	EBL	EBR	NBL	NBT	SBT	SBR	All
Delay / Veh (s)	11.2	7.4	5.7	1.7	7.1	6.3	8.0

Total Network Performance

Delay / Veh (s)	19.9
-----------------	------

Intersection: 1: Crosshill Road WB & Brookwood Road

Movement	WB	SB	SB
Directions Served	LR	L	T
Maximum Queue (ft)	138	55	99
Average Queue (ft)	66	42	39
95th Queue (ft)	105	64	71
Link Distance (ft)	2693		2765
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		30	
Storage Blk Time (%)		0.11	0.06
Queuing Penalty (veh)		7	6

Intersection: 2: Crosshill Road EB & Brookwood Road

Movement	EB	NB	SB
Directions Served	LR	L	TR
Maximum Queue (ft)	113	32	100
Average Queue (ft)	63	4	55
95th Queue (ft)	99	21	84
Link Distance (ft)	2848		1591
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		30	
Storage Blk Time (%)		0.00	
Queuing Penalty (veh)		0	

Network Summary

Network wide Queuing Penalty: 14

Appendix F

Existing Intersection Approach Traffic Counts

TRAFFIC DATA, LLC
1409 Turnham Lane, Birmingham, AL 35216
205-824-0125

Location: : CROSSHILL RD west of BROOKWOOD RD
City, State: : MOUNTAIN BROOK, AL

Date: 3/11/2015
Wednesday

24 Hour Volume																	
24 Hour Volume						24 Hour Volume											
Begin	EB	WB	Combined	Begin	EB	WB	Combined	Begin	EB	WB	Combined						
11:00 AM	12	60	19	72	31	132	11:00 PM	3	6	0	2	3	8				
11:15 AM	14		15		29		11:15 PM	1		1		2					
11:30 AM	17		26		43		11:30 PM	1		0		1					
11:45 AM	17		12		29		11:45 PM	1		1		2					
12:00 PM	23	77	11	68	34	145	12:00 AM	1	2	1	4	2	6				
12:15 PM	12		12		24		12:15 AM	1		1		2					
12:30 PM	17		25		42		12:30 AM	0		0		0					
12:45 PM	25		20		45		12:45 AM	0		2		2					
1:00 PM	19	85	13	60	32	145	1:00 AM	0	0	0	0	0	0				
1:15 PM	21		12		33		1:15 AM	0		0		0					
1:30 PM	23		26		49		1:30 AM	0		0		0					
1:45 PM	22		9		31		1:45 AM	0		0		0					
2:00 PM	18	90	15	156	33	246	2:00 AM	2	2	0	2	2	4				
2:15 PM	30		19		49		2:15 AM	0		1		1					
2:30 PM	12		80		92		2:30 AM	0		0		0					
2:45 PM	30		42		72		2:45 AM	0		1		1					
3:00 PM	27	172	39	183	66	355	3:00 AM	0	0	0	0	0	0				
3:15 PM	54		39		93		3:15 AM	0		0		0					
3:30 PM	56		79		135		3:30 AM	0		0		0					
3:45 PM	35		26		61		3:45 AM	0		0		0					
4:00 PM	32	165	25	108	57	273	4:00 AM	0	0	1	2	1	2				
4:15 PM	45		23		68		4:15 AM	0		0		0					
4:30 PM	39		28		67		4:30 AM	0		0		0					
4:45 PM	49		32		81		4:45 AM	0		1		1					
5:00 PM	55	219	21	120	76	339	5:00 AM	0	2	3	17	3	19				
5:15 PM	61		38		99		5:15 AM	1		7		8					
5:30 PM	58		37		95		5:30 AM	1		3		4					
5:45 PM	45		24		69		5:45 AM	0		4		4					
6:00 PM	43	138	22	97	65	235	6:00 AM	1	30	3	43	4	73				
6:15 PM	32		28		60		6:15 AM	3		6		9					
6:30 PM	36		16		52		6:30 AM	8		15		23					
6:45 PM	27		31		58		6:45 AM	18		19		37					
7:00 PM	38	106	16	74	54	180	7:00 AM	45	320	33	204	78	524				
7:15 PM	28		29		57		7:15 AM	72		56		128					
7:30 PM	13		16		29		7:30 AM	109		67		176					
7:45 PM	27		13		40		7:45 AM	94		48		142					
8:00 PM	14	62	6	40	20	102	8:00 AM	24	78	32	109	56	187				
8:15 PM	15		16		31		8:15 AM	19		28		47					
8:30 PM	11		8		19		8:30 AM	14		25		39					
8:45 PM	22		10		32		8:45 AM	21		24		45					
9:00 PM	11	31	6	13	17	44	9:00 AM	8	48	19	77	27	125				
9:15 PM	6		4		10		9:15 AM	16		21		37					
9:30 PM	8		2		10		9:30 AM	12		14		26					
9:45 PM	6		1		7		9:45 AM	12		23		35					
10:00 PM	6	13	5	6	11	19	10:00 AM	13	57	15	62	28	119				
10:15 PM	4		0		4		10:15 AM	21		13		34					
10:30 PM	0		0		0		10:30 AM	8		17		25					
10:45 PM	3		1		4		10:45 AM	15		17		32					
24 Hour Volume						24 Hour Volume						24 Hour Volume					
						EB 1763 (53.7%)						WB 1519 (46.3%)					
						Combined 3282											

12:00 AM - 12:00 PM

12:00 PM - 12:00 AM

	EB	WB	Combined	EB	WB	Combined
Count	599	592	1191	1164	927	2091
Peak Hour	50.3 %	49.7 %		55.7 %	44.3 %	
Volume	7:00 AM	7:00 AM	7:00 AM	4:45 PM	2:30 PM	2:45 PM
Factor	320	204	524	223	200	366
	0.73	0.76	0.74	0.91	0.63	0.68

TRAFFIC DATA, LLC
1409 Turnham Lane, Birmingham, AL 35216
205-824-0125

Location: : CROSSHILL RD east of BROOKWOOD RD
City, State: : MOUNTAIN BROOK, AL

Date: 3/11/2015
Wednesday

24 Hour Volume							24 Hour Volume						
Begin	EB	WB	Combined	Begin	EB	WB	Combined	Begin	EB	WB	Combined		
11:00 AM	17	77	25	100	42	177	11:00 PM	3	9	0	3	12	
11:15 AM	20		19		39		11:15 PM	3		0	3		
11:30 AM	22		31		53		11:30 PM	1		2	3		
11:45 AM	18		25		43		11:45 PM	2		1	3		
12:00 PM	32	107	13	100	45	207	3/12/2015 12:00 AM	1	3	2	5	3	8
12:15 PM	23		23		46		12:15 AM	1		1	2		
12:30 PM	20		34		54		12:30 AM	1		0	1		
12:45 PM	32		30		62		12:45 AM	0		2	2		
1:00 PM	28	115	22	101	50	216	1:00 AM	0	0	0	0	0	0
1:15 PM	33		25		58		1:15 AM	0		0	0		
1:30 PM	29		37		66		1:30 AM	0		0	0		
1:45 PM	25		17		42		1:45 AM	0		0	0		
2:00 PM	28	117	23	240	51	357	2:00 AM	2	3	0	3	2	6
2:15 PM	33		31		64		2:15 AM	0		1	1		
2:30 PM	19		122		141		2:30 AM	0		0	0		
2:45 PM	37		64		101		2:45 AM	1		2	3		
3:00 PM	76	245	48	252	124	497	3:00 AM	0	0	0	0	0	0
3:15 PM	64		63		127		3:15 AM	0		0	0		
3:30 PM	62		96		158		3:30 AM	0		0	0		
3:45 PM	43		45		88		3:45 AM	0		0	0		
4:00 PM	44	230	37	153	81	383	4:00 AM	0	0	1	3	1	3
4:15 PM	53		34		87		4:15 AM	0		0	0		
4:30 PM	64		41		105		4:30 AM	0		0	0		
4:45 PM	69		41		110		4:45 AM	0		2	2		
5:00 PM	67	291	41	194	108	485	5:00 AM	1	2	3	20	4	22
5:15 PM	78		58		136		5:15 AM	0		8	8		
5:30 PM	72		44		116		5:30 AM	1		4	5		
5:45 PM	74		51		125		5:45 AM	0		5	5		
6:00 PM	46	191	33	142	79	333	6:00 AM	1	36	4	61	5	97
6:15 PM	52		33		85		6:15 AM	6		9	15		
6:30 PM	52		27		79		6:30 AM	8		21	29		
6:45 PM	41		49		90		6:45 AM	21		27	48		
7:00 PM	48	151	28	105	76	256	7:00 AM	55	419	47	341	102	760
7:15 PM	41		33		74		7:15 AM	83		100	183		
7:30 PM	30		22		52		7:30 AM	143		121	264		
7:45 PM	32		22		54		7:45 AM	138		73	211		
8:00 PM	22	97	12	69	34	166	8:00 AM	32	106	49	169	81	275
8:15 PM	25		31		56		8:15 AM	26		47	73		
8:30 PM	17		14		31		8:30 AM	23		45	68		
8:45 PM	33		12		45		8:45 AM	25		28	53		
9:00 PM	19	51	10	26	29	77	9:00 AM	17	73	29	103	46	176
9:15 PM	11		8		19		9:15 AM	21		30	51		
9:30 PM	14		6		20		9:30 AM	17		15	32		
9:45 PM	7		2		9		9:45 AM	18		29	47		
10:00 PM	11	26	5	9	16	35	10:00 AM	13	73	22	96	35	169
10:15 PM	6		1		7		10:15 AM	21		21	42		
10:30 PM	3		0		3		10:30 AM	17		29	46		
10:45 PM	6		3		9		10:45 AM	22		24	46		
24 Hour Volume		EB		WB		Combined		EB		WB		Combined	
		2422 (51.3%)		2295 (48.7%)		4717							

12:00 AM - 12:00 PM

12:00 PM - 12:00 AM

	EB	WB	Combined	EB	WB	Combined
Count	792	901	1693	1630	1394	3024
	46.8 %	53.2 %		53.9 %	46.1 %	
Peak Hour	7:00 AM	7:15 AM	7:00 AM	5:00 PM	2:30 PM	2:45 PM
Volume	419	343	760	291	297	510
Factor	0.73	0.71	0.72	0.93	0.61	0.81

TRAFFIC DATA, LLC
1409 Turnham Lane, Birmingham, AL 35216
205-824-0125

Location: : BROOKWOOD RD south of CROSSHILL RD
 City, State: : MOUNTAIN BROOK, AL
 Speed Limit: : 30 mph

Date: 3/11/2015
 Wednesday

24 Hour Volume						24 Hour Volume							
Begin	NB	SB	Combined	Begin	NB	SB	Combined	Begin	NB	SB	Combined		
11:00 AM	10	44	8	49	18	93	11:00 PM	1	5	0	2	1	7
11:15 AM	14		11		25		11:15 PM	1		0		1	
11:30 AM	11		13		24		11:30 PM	2		2		4	
11:45 AM	9		17		26		11:45 PM	1		0		1	
12:00 PM	12	46	8	53	20	99	12:00 AM	1	2	0	1	1	3
12:15 PM	7		12		19		12:15 AM	0		1		1	
12:30 PM	13		14		27		12:30 AM	1		0		1	
12:45 PM	14		19		33		12:45 AM	0		0		0	
1:00 PM	25	83	11	46	36	129	1:00 AM	0	0	0	1	0	1
1:15 PM	17		11		28		1:15 AM	0		0		0	
1:30 PM	19		13		32		1:30 AM	0		0		0	
1:45 PM	22		11		33		1:45 AM	0		1		1	
2:00 PM	16	69	7	42	23	111	2:00 AM	0	0	0	2	0	2
2:15 PM	16		13		29		2:15 AM	0		1		1	
2:30 PM	20		13		33		2:30 AM	0		1		1	
2:45 PM	17		9		26		2:45 AM	0		0		0	
3:00 PM	25	83	33	107	58	190	3:00 AM	0	0	0	0	0	0
3:15 PM	17		29		46		3:15 AM	0		0		0	
3:30 PM	22		29		51		3:30 AM	0		0		0	
3:45 PM	19		16		35		3:45 AM	0		0		0	
4:00 PM	20	76	13	75	33	151	4:00 AM	0	0	0	1	0	1
4:15 PM	17		17		34		4:15 AM	0		1		1	
4:30 PM	21		21		42		4:30 AM	0		0		0	
4:45 PM	18		24		42		4:45 AM	0		0		0	
5:00 PM	23	75	21	71	44	146	5:00 AM	0	2	0	4	0	6
5:15 PM	13		16		29		5:15 AM	1		2		3	
5:30 PM	24		17		41		5:30 AM	1		0		1	
5:45 PM	15		17		32		5:45 AM	0		2		2	
6:00 PM	22	64	19	55	41	119	6:00 AM	1	14	3	24	4	38
6:15 PM	9		14		23		6:15 AM	6		5		11	
6:30 PM	22		11		33		6:30 AM	4		10		14	
6:45 PM	11		11		22		6:45 AM	3		6		9	
7:00 PM	16	46	10	32	26	78	7:00 AM	5	75	20	112	25	187
7:15 PM	13		7		20		7:15 AM	19		16		35	
7:30 PM	10		9		19		7:30 AM	34		30		64	
7:45 PM	7		6		13		7:45 AM	17		46		63	
8:00 PM	10	35	7	16	17	51	8:00 AM	8	25	26	91	34	116
8:15 PM	9		1		10		8:15 AM	7		17		24	
8:30 PM	5		3		8		8:30 AM	6		29		35	
8:45 PM	11		5		16		8:45 AM	4		19		23	
9:00 PM	8	20	7	10	15	30	9:00 AM	15	38	26	79	41	117
9:15 PM	6		2		8		9:15 AM	10		16		26	
9:30 PM	5		1		6		9:30 AM	8		19		27	
9:45 PM	1		0		1		9:45 AM	5		18		23	
10:00 PM	3	9	1	6	4	15	10:00 AM	5	40	12	54	17	94
10:15 PM	1		1		2		10:15 AM	14		13		27	
10:30 PM	1		3		4		10:30 AM	4		14		22	
10:45 PM	4		1		5		10:45 AM	13		15		28	
24 Hour Volume			NB	SB	Combined		24 Hour Volume	NB	SB	Combined			
			851 (47.7%)	933 (52.3%)			1784						

12:00 AM - 12:00 PM

12:00 PM - 12:00 AM

Count	NB	SB	Combined	Count	NB	SB	Combined
	240	418	658		611	515	1126
	36.5 %	63.5 %			54.3 %	45.7 %	
Peak Hour	7:15 AM	7:30 AM	7:15 AM	1:00 PM	3:00 PM	3:00 PM	
Volume	78	119	196	83	107	190	
Factor	0.57	0.65	0.77	0.83	0.81	0.82	

Appendix G

Traffic Signal Warrant Analysis Worksheet

Brookwood Road at Crosshill Road

Existing Traffic Volumes

Signal Warrants - Summary

Major Street Approaches

Eastbound: Crosshill Road
 Number of Lanes: 1
 85% Speed < 40 MPH.
 Total Approach Volume: 1,763

Westbound: Crosshill Road
 Number of Lanes: 1
 85% Speed < 40 MPH.
 Total Approach Volume: 2,295

Minor Street Approaches

Northbound: Brookwood Road
 Number of Lanes: 1
 Total Approach Volume: 851

Southbound: Brookwood Road
 Number of Lanes: 1
 Total Approach Volume: 933

Warrant Summary (Urban values apply.)

Warrant 1 - Eight Hour Vehicular Volumes	Not Satisfied
Warrant 1A - Minimum Vehicular Volume Not Satisfied Required volumes reached for 0 hours, 8 are needed	
Warrant 1B - Interruption of Continuous Traffic Not Satisfied Required volumes reached for 0 hours, 8 are needed	
Warrant 1 A&B - Combination of Warrants Not Satisfied Required volumes reached for 0 hours, 8 are needed	
Warrant 2 - Four Hour Volumes	Not Satisfied
Number of hours (0) volumes exceed minimum < minimum required (4).	
Warrant 3 - Peak Hour	Not Evaluated
Warrant 3A - Peak Hour Delay	Not Evaluated
Warrant 3B - Peak Hour Volumes	Not Evaluated
Warrant 4 - Pedestrian Volumes	Not Evaluated
Warrant 5 - School Crossing	Not Evaluated
Warrant 6 - Coordinated Signal System	Not Evaluated
Warrant 7 - Crash Experience	Not Evaluated
Warrant 8 - Roadway Network	Not Evaluated
Warrant 9 - Intersection Near a Grade Crossing	Not Evaluated

Appendix H

Intersection Capacity and Queue Analysis Worksheets Recommended Improvements

1: Crosshill Road WB & Brookwood Road Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Delay / Veh (s)	57.7	22.5	7.7	5.4	136.8	90.7	42.0

2: Crosshill Road EB & Brookwood Road Performance by movement

Movement	EBL	EBR	NBL	NBT	SBT	SBR	All
Delay / Veh (s)	23.4	13.2	8.8	11.7	7.5	7.9	15.9

Total Network Performance

Delay / Veh (s)	60.7
-----------------	------

Intersection: 1: Crosshill Road WB & Brookwood Road

Movement	WB	NB	SB	SB
Directions Served	LR	TR	L	T
Maximum Queue (ft)	874	22	56	608
Average Queue (ft)	226	4	55	311
95th Queue (ft)	552	17	56	605
Link Distance (ft)	2693	1591		2765
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			30	
Storage Blk Time (%)			0.92	0.14
Queuing Penalty (veh)			111	29

Intersection: 2: Crosshill Road EB & Brookwood Road

Movement	EB	NB	NB	SB
Directions Served	LR	L	T	TR
Maximum Queue (ft)	309	55	92	97
Average Queue (ft)	150	14	48	65
95th Queue (ft)	247	47	75	88
Link Distance (ft)	2848		3458	1591
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		30		
Storage Blk Time (%)		0.02	0.15	
Queuing Penalty (veh)		2	2	

Network Summary

Network wide Queuing Penalty: 144

1: Crosshill Road WB & Brookwood Road Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Delay / Veh (s)	14.6	5.0	3.7	3.4	10.4	10.0	8.1

2: Crosshill Road EB & Brookwood Road Performance by movement

Movement	EBL	EBR	NBL	NBT	SBT	SBR	All
Delay / Veh (s)	11.0	7.4	8.7	7.9	7.2	6.4	8.7

Total Network Performance

Delay / Veh (s)	20.7
-----------------	------

Intersection: 1: Crosshill Road WB & Brookwood Road

Movement	WB	SB	SB
Directions Served	LR	L	T
Maximum Queue (ft)	138	55	118
Average Queue (ft)	66	41	40
95th Queue (ft)	105	64	79
Link Distance (ft)	2693		2765
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		30	
Storage Blk Time (%)		0.12	0.06
Queuing Penalty (veh)		8	6

Intersection: 2: Crosshill Road EB & Brookwood Road

Movement	EB	NB	NB	SB
Directions Served	LR	L	T	TR
Maximum Queue (ft)	109	55	55	100
Average Queue (ft)	63	14	35	56
95th Queue (ft)	96	44	54	86
Link Distance (ft)	2848		3458	1591
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		30		
Storage Blk Time (%)		0.01	0.05	
Queuing Penalty (veh)		1	1	

Network Summary

Network wide Queuing Penalty: 16