INTERSECTION EVALUATION
FAIRVIEW ROAD AND CHAPEL HILL ROAD

COLUMBIA, MISSOURI
April 21, 2023

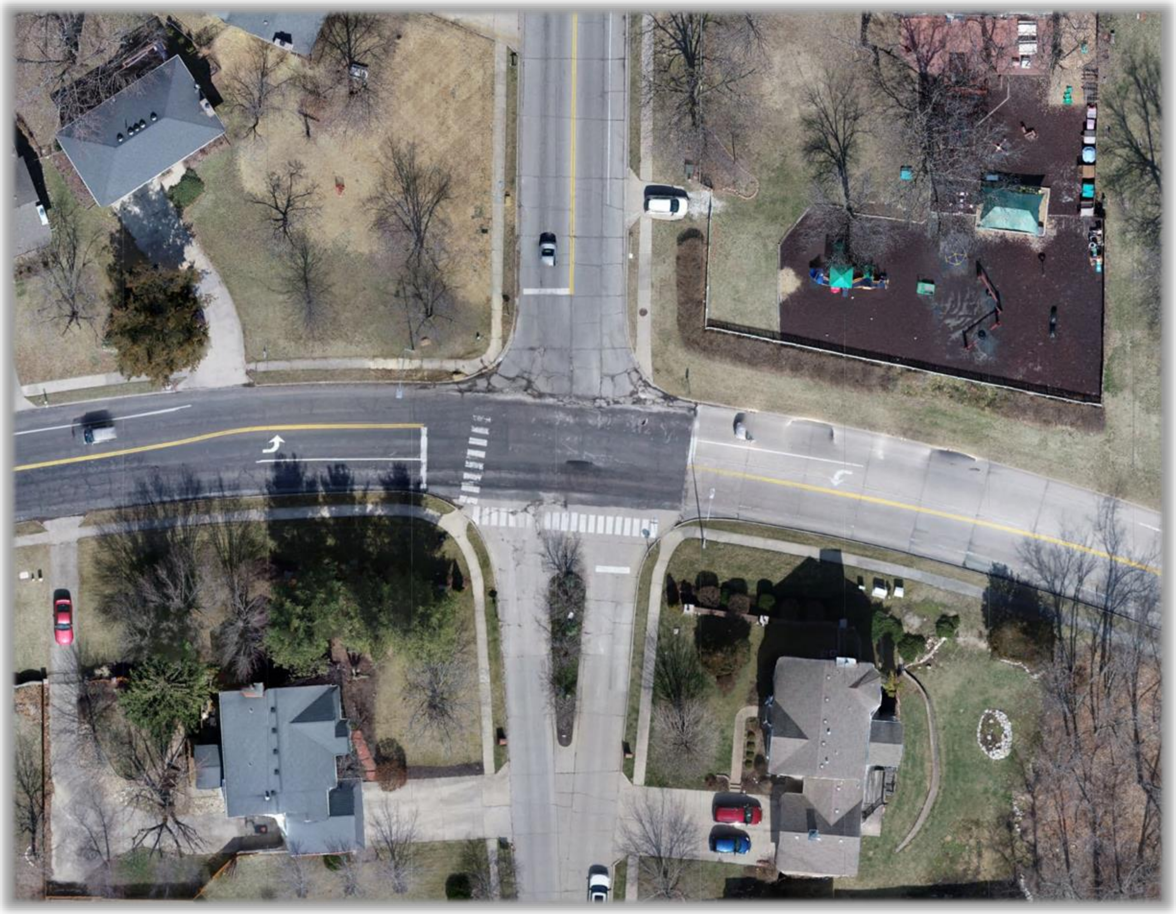

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TABLE OF CONTENTS

TABLES AND FIGURES

LIST OF TABLES

INTRODUCTION

OBJECTIVES:

This report is a summary of the traffic analysis performed for the City of Columbia on the intersection of Fairview Road and Chapel Hill Road.

The objectives of this study are:

1. Analyze the existing and anticipated traffic flow through the intersection.
2. Evaluate options for traffic control and/or geometric improvements to reduce intersection delay and improve safety.

PROJECT BACKGROUND:

In the past 12 years, the City of Columbia has reviewed varying traffic control options at the intersection of Fairview Road and Chapel Hill Road. The intersection currently experiences significant queuing during the peak hours each day and congestion related to the current all-way stop controlled intersection has created concern in the community as well with city staff and the city council.

In 2011, Chapel Hill Road was the subject of a report titled “Evaluation of Chapel Hill Road for Transportation Issues and Potential Calming Features within Certain Zones”. This study was prepared by Richard L. Stone II, PE of the City of Columbia and was focused on the entire Chapel Hill corridor. A review of this study revealed that the study recommended the Fairview and Chapel Hill intersection be considered for a roundabout due to capacity issues and the roundabout’s ability to help control speeds along Chapel Hill as well as provide a “Gateway Effect” to the surrounding neighborhoods.

In 2012 the subject intersection was considered as part of a study titled “Evaluation for Placement of Span-wire Signal Equipment 2012” also prepared by Richard L. Stone II, PE of the City of Columbia. The general purpose of this study was to evaluate 5 intersections within Columbia for the suitability of repurposing existing span wire traffic signal equipment that the city had available. This study found that while the intersection was operating at a Level of Service (LOS) D at that time, it did not meet full warrants for traffic signal installation but did meet a reduced warrant for minimum volumes. The study also indicated that there was a relatively low collision rate. This study also pointed out that there are some limitations to signalizing this intersection due to its position at the crest of a hill that limits the sight distance. Due to the limited sight distance, permissive left turns would not be recommended along Chapel Hill. This study also recommended either operating the signal in a split-phase configuration or significantly lengthening the left turn lanes to allow for adequate storage. The study ultimately recommended against installing a traffic signal at this location due to geometric deficiencies.

In 2015 additional turning movements counts were conducted by the city and these counts were provided for review during this study.

In January of 2016 city staff conducted an Interested Parties meeting and in June of 2016 a public hearing was held with the City Council for the construction of a single lane roundabout at the intersection of Fairview Road and Chapel Hill Road. There were numerous speakers from the public and a majority of the speakers were not in favor of the roundabout. Among the reasons cited for opposing the roundabout were cost, pedestrian safety, need, and geometric issues related to grade and sight distance. After conducting the public hearing the City Council voted not to proceed with the roundabout at that time. However, Councilman Thomas made a motion for the city to proceed with a more detailed analysis of the intersection as well as an analysis of the nearby intersection of Fairview Road and Rollins Road.

PROJECT APPROACH:

In order to properly analyze current conditions at the subject intersection, this study followed these steps:

Establish and Analyze Existing Conditions. Manual Traffic counts were conducted via video for each intersection movement as well as pedestrian crossing volumes. These counts were tabulated for 15 minute increments for a 24 hour period on March 17, 2022. The traffic volumes were then analyzed utilizing Synchro 11 software that applies the methodologies for intersection analysis as outlined in the Highway Capacity Manual (HCM) published by the Transportation Research Board.

Project and Analyze Future Conditions. The existing traffic volumes were projected for 20 years at a rate of 1.5% increase per year to estimate future volumes in the year 2042. The 2010 traffic volumes just east of the intersection reported in the 2011 Report by public works were compared to the traffic counts collected in 2022 for this study and it was determined that traffic volumes were increasing at approximately 1.1 to 1.2% annually. This study utilized a 1.5% annual increase for future projections in order to provide a conservative estimate of growth.

Evaluate Potential Intersection Control Options. Varying intersection control methods and geometries were analyzed with the existing and projected traffic volumes to determine which options were feasible for this intersection.

Conduct a Traffic Signal Warrants Analysis. The traffic volumes and existing intersection geometry were reviewed using methods described in the Manual for Uniform Traffic Control Devices (MUTCD) published by U.S. Department of Transportation Federal Highway Administration to determine the appropriateness of a traffic signal at this location.

BASE CONDITIONS

EXISTING ROADWAY DATA:

Chapel Hill Road: Chapel Hill Road is a minor arterial consisting of one vehicle lane in each direction and bicycle lanes on both sides of the road. Left turn lanes at the intersection with Fairview Road and are approximately 60’ long which provides queue length for approximately 3 passenger vehicles. The westbound lanes approach up a long incline with approximately 8% grades. The eastbound approach is considerably flatter and the roadway crests approximately 100 feet west of the intersection. Sidewalks (5’ wide) exist on both sides to the west of the intersection and on the south side to the east of the intersection.

Chapel Hill Road (facing east)

Chapel Hill Road (facing west)

Fairview Road: Fairview Road is a major collector to the north of Chapel Hill Road and a residential cul-de-sac to the south of Chapel Hill Road. The south approach has a landscaped median island with 18’ wide single lanes on each side. The south approach does not have marked bicycle lanes but does have 5’ sidewalks on each side. The north approach is a 38’ wide pavement with a single driving lane in each direction as well as bicycle lanes. There are also 5’ sidewalks on each side of the street. Neither approach has left turn lanes.

Fairview Road (facing south)

Fairview Road (facing north)

All four approaches are currently stop sign controlled with posted speed limits of 30 mph on the North, East and West legs (no speed limit is posted on the south cul-de-sac).

EXISTING TRAFFIC DATA:

Allstate Consultants conducted manual traffic counts in March of 2022. The results of these traffic counts are shown in Appendix B.

INTERSECTION LEVEL OF SERVICE ANALYSIS:

The existing traffic volumes were analyzed using Synchro 11, a macroscopic traffic modeling software package. The Synchro 11 method of analysis used for this study is based on procedures detailed in the *Highway Capacity Manual* published by the Transportation Research Board. The *Highway Capacity Manual,* which is widely accepted as the standard method for determining roadway capacity, uses Levels of Service to rank facility performance. There are six Levels of Service ranging from ‘A’ representing the best operating conditions to ‘F’ which represents the worst operating conditions.

Level of Service directly corresponds to the amount of delay a driver experiences at an intersection (control delay). Tables 1 and 2 illustrate the ranges of control delay that constitute each Level of Service at unsignalized and signalized intersections. Drivers have different expectations of delay at signalized intersections vs. unsignalized intersections and thus the delay ranges differ between the two. For highway design, Level of Service C is generally used. However, during peak periods in urban and suburban areas, Level of Service D is normally considered acceptable.

Table 1

HCM Unsignalized Intersection Level of Service Criteria

Level of Service	*Delay Range (seconds)*
A	<10
B	>10 and <15
C	>15 and <25
D	>25 and <35
E	>35 and <50
F	>50

Table 2

HCM Signalized Intersection Level of Service Criteria

Level of Service	*Delay Range (seconds)*
A	<10
B	>10 and <20
C	>20 and <35
D	>35 and <55
E	>55 and <80
F	>80

The HCM Levels of Service and delay for the 2022 Existing Conditions and the 2042 Projected Conditions as calculated via Synchro 11 are reported in Tables 3 and 4. Level of Service is reported per approach as well as overall for this intersection.

Table 3
HCM Intersection Level of Service
Existing Volumes with All Way Stop Control (March 2022)

Intersection	Movement	AM Peak LOS (Delay)	PM Peak LOS (Delay)
Fairview Road and Chapel Hill Road	Eastbound Chapel Hill Rd.	C (21.9)	C (15.6)
	Westbound Chapel Hill Rd.	B (13.6)	**F (89.0)**
	Northbound Fairview Rd.	B (10.2)	B (11.6)
	Southbound Fairview Rd.	B (14.1)	C (23.7)
	Intersection	C (18.0)	**F(50.1)**

Table 4
HCM Intersection Level of Service
Projected Volumes with All Way Stop Control (2042)

Intersection	Movement	AM Peak LOS (Delay)	PM Peak LOS (Delay)
Fairview Road and Chapel Hill Road	Eastbound Chapel Hill Rd.	**F (93.3)**	D (28.8)
	Westbound Chapel Hill Rd.	C (23.1)	**F (337.4)**
	Northbound Fairview Rd.	B (12.1)	B (14.7)
	Southbound Fairview Rd.	D (22.9)	**F (67.4)**
	Intersection	**F (59.8)**	**F (175.2)**

As observed in the field, the Level of Service analysis shows undesirable delays and Levels of Service that are outside the accepted values for the existing traffic volumes. As traffic increases over time, delay times will increase. If traffic volumes increase annually at a rate of 1.5%, the 2042 analysis indicates that the overall intersection operates at LOS F in both the AM and PM Peaks. In addition, two of the four approaches in the PM Peak and one approach in the AM Peak will operate at LOS F. This condition is beyond the limits of what this intersection can reasonably carry with its existing geometry and control.

CAPACITY ANALYSIS OF ALTERNATIVES

In addition to the existing all-way stop control (AWSC), two additional intersection control options were reviewed for feasibility at this intersection: roundabout control and signal control.

ROUNDABOUT CONTROL:

This alternative involves the conversion of this intersection to a single-lane roundabout. Anticipated Level of Service is presented in the tables below.

Table 5
HCM Intersection Level of Service
Existing Volumes with Roundabout Control (March 2022)

Intersection	Movement	AM Peak LOS (Delay)	PM Peak LOS (Delay)
Fairview Road and Chapel Hill Road	Eastbound Chapel Hill Rd.	C (15.3)	A (9.2)
	Westbound Chapel Hill Rd.	A (7.0)	B (13.3)
	Northbound Fairview Rd.	A (8.0)	A (6.0)
	Southbound Fairview Rd.	A (6.6)	B (14.5)
	Intersection	B (11.3)	B (12.5)

Table 6
HCM Intersection Level of Service
Projected Volumes with Roundabout Control (2042)

Intersection	Movement	AM Peak LOS (Delay)	PM Peak LOS (Delay)
Fairview Road and Chapel Hill Road	Eastbound Chapel Hill Rd.	**E (48.7)**	B (14.6)
	Westbound Chapel Hill Rd.	A (9.2)	D (32.8)
	Northbound Fairview Rd.	B (11.4)	A (7.5)
	Southbound Fairview Rd.	A (8.4)	**E (41.9)**
	Intersection	D (29.9)	D (30.1)

TRAFFIC SIGNAL CONTROL:

This alternative involves the conversion of this intersection to signal control with left turn lanes on the eastbound and westbound approaches. Due to limited sight distance along Chapel Hill Road, the signals were analyzed utilizing protected left turns (permissive left turns would create a safety concern). Anticipated Level of Service is presented in the tables below.

Table 7
HCM Intersection Level of Service
Existing Volumes with Signal Control (March 2022)

Intersection	Movement	AM Peak LOS (Delay)	PM Peak LOS (Delay)
Fairview Road and Chapel Hill Road	Eastbound Chapel Hill Rd.	B (13.4)	B (19.5)
	Westbound Chapel Hill Rd.	B (14.1)	C (27.3)
	Northbound Fairview Rd.	A (10.0)	B (15.4)
	Southbound Fairview Rd.	B (12.4)	C (23.2)
	Intersection	B (13.2)	C (23.9)

Table 8
HCM Intersection Level of Service
Projected Volumes with Signal Control (2042)

Intersection	Movement	AM Peak LOS (Delay)	PM Peak LOS (Delay)
Fairview Road and Chapel Hill Road	Eastbound Chapel Hill Rd.	B (18.0)	D (37.9)
	Westbound Chapel Hill Rd.	B (19.6)	**F (80.7)**
	Northbound Fairview Rd.	B (12.4)	C (25.0)
	Southbound Fairview Rd.	B (17.0)	**E (66.6)**
	Intersection	B (18.0)	**E (64.6)**

TRAFFIC SIGNAL WARRANT ANALYSIS

Traffic signals are one of the methods of intersection control that typically are the next step after AWSC ceases to operate efficiently. However, traffic signals that are installed prior to need may create more problems than they solve. For instance, certain types of crashes such as rear-end collisions often increase when a traffic signal is installed. The Manual on Uniform Traffic Control Devices contains nine possible traffic signal warrants ensure that traffic signals are justified prior to installation.

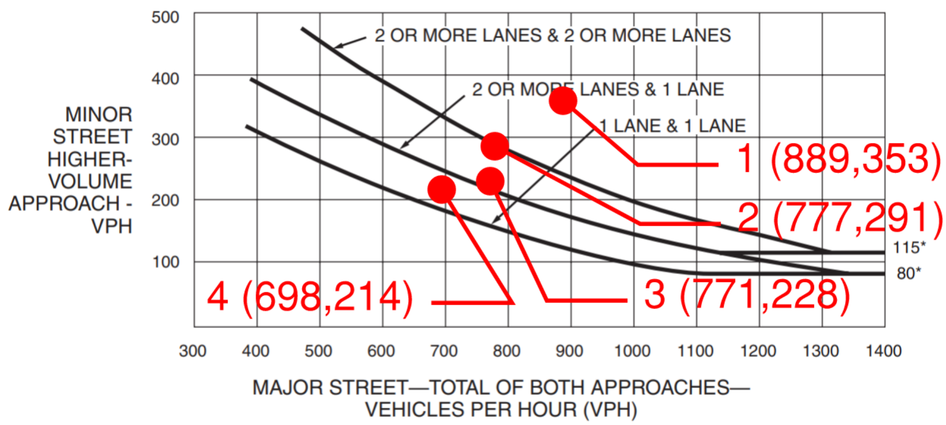
Warrant 1, Eight-Hour Vehicular Volume: This warrant identifies minimum volumes that must be met for a minimum of 8 hours during a day. This warrant has two conditions: Condition A – Minimum Vehicular Volume, and Condition B – Interruption of Continuous Traffic. This warrant is met if either condition is met or if both conditions are met to the 80% level. As can be seen in Table 9, the existing traffic meets the requirements of this warrant.

Table 9
MUTCD Traffic Signal Warrant 1

	Major Street (Total of Both Approaches)	**Minor Street** (Higher Approach)
Actual 8th Hour Volume	601	163
Required 8th Hour Volumes		
Condition A	500	150
Condition B	750	75
Combined Conditions A&B	600	120

Warrant 2, Four-Hour Vehicular Volume: This warrant identifies minimum volumes that must be met for each of the highest four hours of a day. This warrant is met when the plotted points of any of four hours of a day fall above the applicable curve in Figure 4C-1 of the MUTCD. This curve has been referenced and the applicable four points plotted in Figure 4C-1. As can be seen from Figure 1, this warrant is met for the "1 Lane & 1 Lane" curve that applies to the subject intersection.

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

Warrant 3, Peak Hour: This warrant is only intended to be applied to entrances of high peak hour generators such as large office complexes or manufacturing plants. Therefore, this warrant does not apply to the subject intersection.

Warrant 4, Pedestrian Volume: While there are pedestrian facilities at this intersection, there were not enough to meet this warrant. The lowest threshold for pedestrian volume is 107 pedestrians in an hour and the highest hourly pedestrian volume was 14 pedestrians.

Warrant 5, School Crossing: This warrant requires a minimum of 20 pedestrian crossings per hour that are generated from a nearby school. While Countryside Nursery School is located on the northeast quadrant of this intersection, we did not observe pedestrian volumes near the minimum 20 per hour necessary to meet this warrant. Therefore, this warrant is not met by to the subject intersection.

Warrant 6, Coordinated Signal System: This warrant is for intersections that are part of a coordinated signal system. This warrant does not apply to the subject intersection.

Warrant 7, Crash Experience: Warrant 7 requires five or more crashes susceptible to correction by a traffic signal within one year. This warrant was not met based on the traffic crash history that we reviewed.

Warrant 8, Roadway Network: This warrant is intended to encourage "concentration and organization of traffic flow on a roadway network." Since this is not a stated goal for this intersection, this warrant was not considered.

Warrant 9, Intersection near a Grade Crossing: This warrant is intended to be used when the intersection is adjacent to a railroad crossing and therefore does not apply to this intersection.

Based on our warrant analysis, the intersection meets Warrants 1 and 2 with existing traffic volumes. It is important to note that the MUTCD states "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal". Since traffic signal installations can have unintended consequences at least one warrant must be met before a signal can be considered at an intersection.

REVIEW OF ALTERNATIVES

This study has analyzed three basic traffic control configurations; all way stop control (existing), roundabout control, and signal control and presented Level of Service for each configuration. In addition to the Synchro 11 capacity analysis, this study also utilized a microsimulation program, SimTraffic 11, to estimate the potential queue lengths for each alternative. This capacity analysis confirmed current operational concerns (long queues) in the PM peak hours for the existing all way stop control configuration. Conversion of this intersection to roundabout control or signal control is anticipated to improve capacity significantly.

Projected volumes were analyzed and anticipated Levels of Service presented. The assumed 1.5% per year projection is likely conservative; historical data reviewed shows a rate of increase from approximately 8500 vpd in 2010 to approximately 9925 vpd in 2022 which is an annual increase of approximately 1.1 to 1.2%. Since both roundabout control and signalized control present favorably compared to all-way stop control regarding Level of Service, the following tables present additional measures of capacity for comparison: approach delay and queue length.

It should be noted that intersection capacity is one of several considerations that should be evaluated as a part of any intersection study. Additional considerations will be reviewed and discussed in the conclusions and recommendations section of this report.

Table 10
Approach Delay/Vehicle (seconds)
Peak Hour Existing Volumes (2022)

Movement	AWSC	Roundabout	Signal
AM Peak Hour			
Eastbound Chapel Hill Rd.	21.9	15.3	13.4
Westbound Chapel Hill Road	13.6	7.0	14.1
Northbound Fairview Road	10.2	8.0	10.0
Southbound Fairview Road	14.1	6.6	12.4
Intersection Total	18.0	11.3	13.2
PM Peak Hour			
Eastbound Chapel Hill Rd.	15.6	9.2	19.5
Westbound Chapel Hill Road	**89.0**	13.3	27.3
Northbound Fairview Road	11.6	6.0	15.4
Southbound Fairview Road	23.7	14.5	23.2
Intersection Total	**50.1**	12.5	23.9

Table 11
Approach Delay/Vehicle (seconds)
Peak Hour Projected Volumes (2042)

Movement	AWSC	Roundabout	Signal
AM Peak Hour			
Eastbound Chapel Hill Rd.	**93.3**	**48.7**	18.0
Westbound Chapel Hill Road	23.1	9.2	19.6
Northbound Fairview Road	12.1	11.4	12.4
Southbound Fairview Road	22.9	8.4	17.0
Intersection Total	**59.8**	29.9	18.0
PM Peak Hour			
Eastbound Chapel Hill Rd.	28.8	14.6	37.9
Westbound Chapel Hill Road	**337.4**	32.8	**80.7**
Northbound Fairview Road	14.7	7.5	25.0
Southbound Fairview Road	**67.4**	**41.9**	**66.6**
Intersection Total	**175.2**	30.1	**64.6**

Table 12
95% Queue Length (feet)
Peak Hour Existing Volumes (2022)

Movement	AWSC	Roundabout	Signal
AM Peak Hour			
Eastbound Thru/RT Chapel Hill Rd.	126	173	118
Westbound Thru/RT Chapel Hill Rd.	57	66	72
Northbound Fairview Rd.	43	37	26
Southbound Fairview Rd.	75	53	75
PM Peak Hour			
Eastbound Thru/RT Chapel Hill Rd.	72	45	135
Westbound Thru/RT Chapel Hill Rd.	145	104	188
Northbound Fairview Rd.	27	26	36
Southbound Fairview Rd.	98	63	156

Table 13
95% Queue Length (feet)
Peak Hour Projected Volumes (2042)

Movement	AWSC	Roundabout	Signal
AM Peak Hour			
Eastbound Thru/RT Chapel Hill Rd.	377	337	152
Westbound Thru/RT Chapel Hill Rd.	79	64	147
Northbound Fairview Rd.	50	43	44
Southbound Fairview Rd.	111	52	143
PM Peak Hour			
Eastbound Thru/RT Chapel Hill Rd.	143	101	143
Westbound Thru/RT Chapel Hill Rd.	510	473	660
Northbound Fairview Rd.	37	27	42
Southbound Fairview Rd.	410	123	362

CONCLUSIONS, OBSERVATIONS, AND RECOMMENDATIONS

This study presents capacity analysis confirming that the existing all way stop configuration is operating at a poor level of service and that, from a capacity standpoint, roundabout control or signal control are viable options that greatly improve level of service and decrease approach delay/queue lengths. A review of the delays and queues in Tables 10-13 reveal that the roundabout generally provides better results than the signal for the overall intersection.

In addition to capacity, the following should be considered:

1) **Safety:** This intersection does not have a significant history of numerous or serious crashes nor is there documentation of safety concerns in previous studies. In-field observation did not identify major safety concerns. Based on this, roundabout vs. signal safety can be discussed in general. As has been well documented, roundabouts offer safety benefits vs signal control in the form of reduced conflict points and reduced speeds due to the physical nature of the control. In addition, with this being a suburban location with a private preschool at the northeast corner of the intersection, roundabouts provide pedestrian and bicycle safety benefits in the form of reduced speeds and refuge islands. **Advantage roundabout.**

2) **Intersection Geometry:** This intersection's horizontal geometry is typical and neither configuration offers a significant advantage over the other. Vertically, the westbound approach is a long incline with a slope of approximately 8%. The roundabout's reduced queue lengths during peak hours and free flowing nature during off peak times present an advantage related to this long incline for all vehicles but offers a specific advantage for heavy vehicles as it reduces the number of stops that take place on the slope. **Advantage roundabout.**

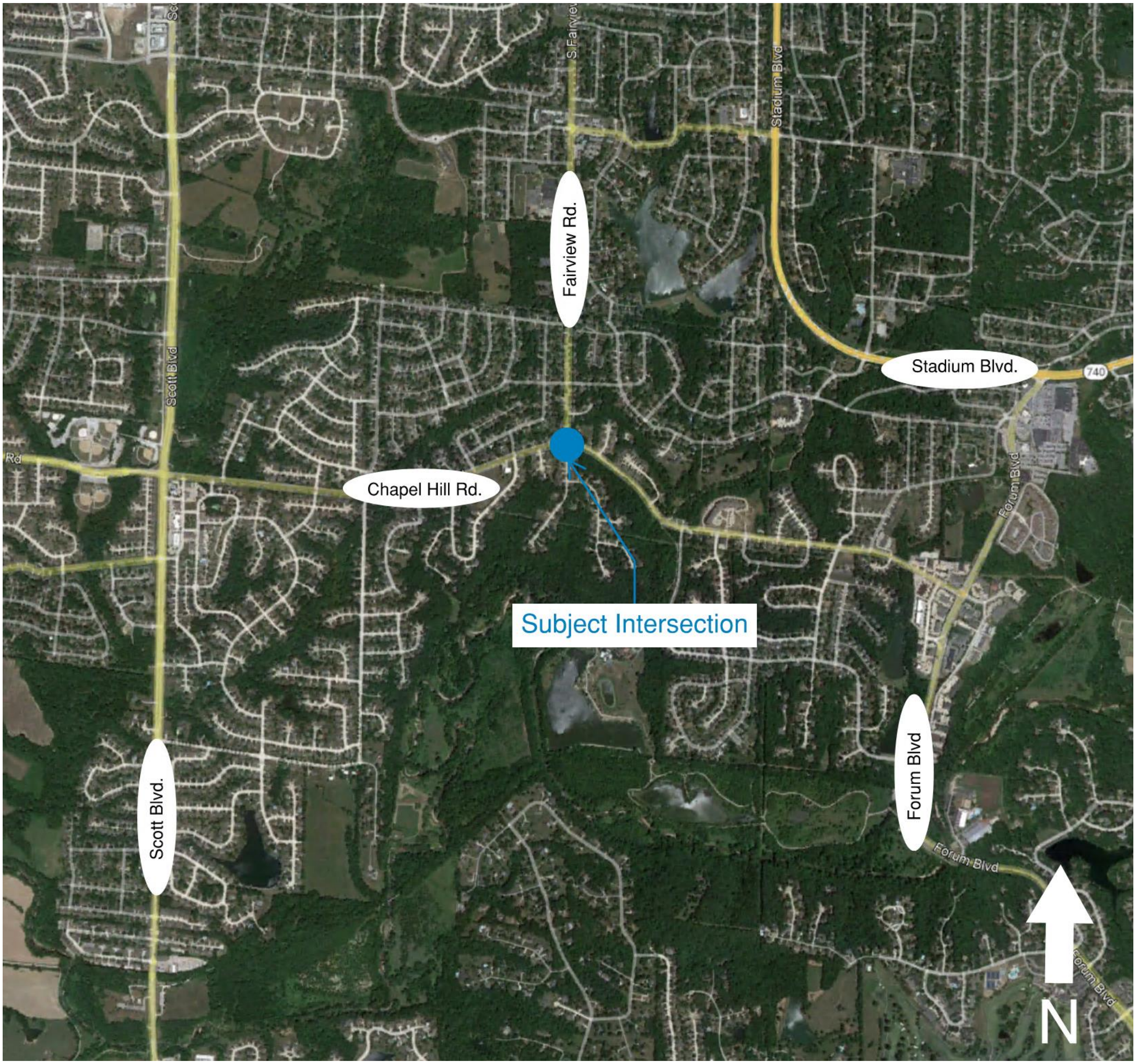
3) **Constructability:** Both options will require additional right of way and construction of additional pavement. The roundabout option is more focused at the intersection; widening at the corners to accommodate the circulating roadway will be required. The signal option will require the left turn lanes on Chapel Hill to be extended significantly in both directions to accommodate the turning volumes. Striping could extend these lanes but would require removing bicycle lanes which is not recommended, especially on the steep westbound approach. Which option is more feasible and/or less costly would be determined by a preliminary design phase. **Advantage unknown.**

4) **Operational Impacts to surrounding properties:** This consideration looks at the operational impacts to surrounding properties (construction impacts would be part of parameter three above). This area is considered suburban and the operational impacts at this type of location would generally focus on environmental impacts (noise, exhaust, etc). Capacity analysis generally focuses on the peak hour to determine the worst case scenario operationally. It is also important to consider off-peak times. Signals require vehicles to stop at off peak times. These stops and starts lead to additional noise and exhaust when compared to a vehicle traversing the intersection without stopping. Since roundabouts operate at free flow conditions unless there is a conflicting

vehicle, we anticipate significantly less noise and exhaust generated when compared to a signal. **Advantage roundabout.**

Field observation and analysis contained in this study confirms that the additional all way stop configuration is over capacity and causing significant delay/queuing. Conversion to roundabout control or signal control would significantly improve the operation of the intersection. Based on the additional considerations above, this study recommends the conversion of the existing all way stop controlled intersection to a roundabout assuming there is not a drastic disparity in challenge/cost as it relates to constructability.

APPENDIX A: SITE LOCATION MAP



<u>Site Location Map</u>

<u>Fairview Rd. and Chapel Hill Rd.</u>

APPENDIX B: TRAFFIC VOLUME DISPLAYS

Turning Movement Counts

Fairview and Chapel Hill

Columbia, MO

File Name: Fairview and Chapel Hill-3-17-22-Full
Location:

All Vehicles

Site Code:
Study Date: 03/17/2022

80	17	146	0
Right	Thru	Left	U-Turn

0	151	431	0
U-Turn	Left	Thru	Right

AM Peak Hour Statistics
AM Peak Hour Begins: 07:45
AM Peak Hour Volume: 1102
AM Peak Hour Factor: 0.940

Right	Thru	Left	U-Turn
121	122	3	0

U-Turn	Left	Thru	Right
0	7	11	13

Turning Movement Counts
Fairview and Chapel Hill
Columbia, MO

File Name: Fairview and Chapel Hill-3-17-22-Full
Location:

All Vehicles

Site Code:
Study Date: 03/17/2022

Right	Thru	Left	U-Turn
172	16	172	0

U-Turn	Left	Thru	Right
0	111	237	5

PM Peak Hour Statistics
PM Peak Hour Begins: 16:45
PM Peak Hour Volume: 1301
PM Peak Hour Factor: 0.965

Right	Thru	Left	U-Turn
154	408	11	0

U-Turn	Left	Thru	Right
0	3	8	4

Turning Movement Counts

Fairview and Chapel Hill

Columbia, MO

File Name:

Location:

All Vehicles

Site Code:

Study Date:

Southbound (north approach)

Right	Thru	Left	U-Turn
108	23	197	0

Eastbound (west approach)

U-Turn	Left	Thru	Right
0	203	580	1

Projected 2042
AM Peak Hour

Westbound (east approach)

Right	Thru	Left	U-Turn
180	164	4	0

Northbound (south approach)

U-Turn	Left	Thru	Right
0	9	15	18

Turning Movement Counts

Fairview and Chapel Hill

Columbia, MO

File Name:

Location:

All Vehicles

Site Code:

Study Date:

Projected 2042
PM Peak Hour

Southbound (north approach):

Right	Thru	Left	U-Turn
232	22	232	0

Westbound (east approach):

Right	Thru	Left	U-Turn
207	550	15	0

Eastbound (west approach):

U-Turn	Left	Thru	Right
0	165	352	7

Northbound (south approach):

U-Turn	Left	Thru	Right
0	4	11	5

APPENDIX C: SYNCHRO ANALYSIS

Intersection	
Intersection Delay, s/veh	18
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	151	431	0	3	122	121	7	11	13	146	17	80
Future Vol, veh/h	151	431	0	3	122	121	7	11	13	146	17	80
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	164	468	0	3	133	132	8	12	14	159	18	87
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	2	2
HCM Control Delay	21.9	13.6	10.2	14.1
HCM LOS	C	B	B	B

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1
Vol Left, %	23%	100%	0%	100%	0%	60%
Vol Thru, %	35%	0%	100%	0%	50%	7%
Vol Right, %	42%	0%	0%	0%	50%	33%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	31	151	431	3	243	243
LT Vol	7	151	0	3	0	146
Through Vol	11	0	431	0	122	17
RT Vol	13	0	0	0	121	80
Lane Flow Rate	34	164	468	3	264	264
Geometry Grp	2	7	7	7	7	2
Degree of Util (X)	0.062	0.292	0.767	0.006	0.443	0.45
Departure Headway (Hd)	6.65	6.399	5.892	6.9	6.035	6.127
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	534	561	614	517	594	586
Service Time	4.745	4.15	3.642	4.665	3.8	4.187
HCM Lane V/C Ratio	0.064	0.292	0.762	0.006	0.444	0.451
HCM Control Delay	10.2	11.8	25.5	9.7	13.6	14.1
HCM Lane LOS	B	B	D	A	B	B
HCM 95th-tile Q	0.2	1.2	7.1	0	2.3	2.3

Intersection: 3: Fairview Road & Chapel Hill Road

Movement	EB	EB	WB	NB	SB
Directions Served	L	TR	TR	LTR	LTR
Maximum Queue (ft)	84	120	56	31	73
Average Queue (ft)	57	83	54	18	53
95th Queue (ft)	96	126	57	43	75
Link Distance (ft)		355	412	462	341
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	60				
Storage Blk Time (%)	1	12	2		
Queuing Penalty (veh)	5	17	0		

Network Summary

Network wide Queuing Penalty: 22

Intersection	
Intersection Delay, s/veh	50.1
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	111	237	5	11	408	154	3	8	4	172	16	172
Future Vol, veh/h	111	237	5	11	408	154	3	8	4	172	16	172
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	121	258	5	12	443	167	3	9	4	187	17	187
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	2	2
HCM Control Delay	15.6	89	11.6	23.7
HCM LOS	C	F	B	C

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1
Vol Left, %	20%	100%	0%	100%	0%	48%
Vol Thru, %	53%	0%	98%	0%	73%	4%
Vol Right, %	27%	0%	2%	0%	27%	48%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	15	111	242	11	562	360
LT Vol	3	111	0	11	0	172
Through Vol	8	0	237	0	408	16
RT Vol	4	0	5	0	154	172
Lane Flow Rate	16	121	263	12	611	391
Geometry Grp	2	7	7	7	7	2
Degree of Util (X)	0.035	0.248	0.503	0.024	1.093	0.698
Departure Headway (Hd)	8.26	7.683	7.153	7.152	6.444	6.683
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	436	471	508	498	562	544
Service Time	6.26	5.383	4.853	4.924	4.216	4.683
HCM Lane V/C Ratio	0.037	0.257	0.518	0.024	1.087	0.719
HCM Control Delay	11.6	12.9	16.9	10.1	90.5	23.7
HCM Lane LOS	B	B	C	B	F	C
HCM 95th-tile Q	0.1	1	2.8	0.1	18.6	5.5

Intersection: 3: Fairview Road & Chapel Hill Road

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	31	74	30	142	31	102
Average Queue (ft)	31	59	6	108	6	68
95th Queue (ft)	31	72	26	145	27	98
Link Distance (ft)		355		412	462	341
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	60		60			
Storage Blk Time (%)		5		32		
Queuing Penalty (veh)		5		3		

Network Summary

Network wide Queuing Penalty: 9

Intersection	
Intersection Delay, s/veh	59.8
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	203	580	1	4	164	163	9	15	18	197	23	108
Future Vol, veh/h	203	580	1	4	164	163	9	15	18	197	23	108
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	221	630	1	4	178	177	10	16	20	214	25	117
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	2	2
HCM Control Delay	93.3	23.1	12.1	22.9
HCM LOS	F	C	B	C

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1
Vol Left, %	21%	100%	0%	100%	0%	60%
Vol Thru, %	36%	0%	100%	0%	50%	7%
Vol Right, %	43%	0%	0%	0%	50%	33%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	42	203	581	4	327	328
LT Vol	9	203	0	4	0	197
Through Vol	15	0	580	0	164	23
RT Vol	18	0	1	0	163	108
Lane Flow Rate	46	221	632	4	355	357
Geometry Grp	2	7	7	7	7	2
Degree of Util (X)	0.099	0.442	1.175	0.009	0.673	0.666
Departure Headway (Hd)	8.215	7.21	6.697	7.999	7.124	7.025
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	439	499	543	450	512	517
Service Time	6.215	4.976	4.462	5.699	4.824	5.025
HCM Lane V/C Ratio	0.105	0.443	1.164	0.009	0.693	0.691
HCM Control Delay	12.1	15.6	120.4	10.8	23.3	22.9
HCM Lane LOS	B	C	F	B	C	C
HCM 95th-tile Q	0.3	2.2	22.2	0	5	4.9

Intersection: 3: Fairview Road & Chapel Hill Road

Movement	EB	EB	WB	NB	SB
Directions Served	L	TR	TR	LTR	LTR
Maximum Queue (ft)	84	389	75	53	120
Average Queue (ft)	76	215	63	35	68
95th Queue (ft)	95	377	79	50	111
Link Distance (ft)		355	412	462	341
Upstream Blk Time (%)		5			
Queuing Penalty (veh)		0			
Storage Bay Dist (ft)	60				
Storage Blk Time (%)	10	59	7		
Queuing Penalty (veh)	61	120	0		

Network Summary

Network wide Queuing Penalty: 181

Intersection	
Intersection Delay, s/veh	175.2
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	150	319	7	15	550	207	4	11	5	232	22	232
Future Vol, veh/h	150	319	7	15	550	207	4	11	5	232	22	232
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	163	347	8	16	598	225	4	12	5	252	24	252
Number of Lanes	1	1	0	1	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	2	2
HCM Control Delay	28.8	337.4	14.7	67.4
HCM LOS	D	F	B	F

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1
Vol Left, %	20%	100%	0%	100%	0%	48%
Vol Thru, %	55%	0%	98%	0%	73%	5%
Vol Right, %	25%	0%	2%	0%	27%	48%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	20	150	326	15	757	486
LT Vol	4	150	0	15	0	232
Through Vol	11	0	319	0	550	22
RT Vol	5	0	7	0	207	232
Lane Flow Rate	22	163	354	16	823	528
Geometry Grp	2	7	7	7	7	2
Degree of Util (X)	0.055	0.371	0.755	0.037	1.703	0.988
Departure Headway (Hd)	11.064	9.326	8.785	8.164	7.449	7.876
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	326	388	415	436	485	465
Service Time	9.064	7.026	6.485	5.962	5.246	5.876
HCM Lane V/C Ratio	0.067	0.42	0.853	0.037	1.697	1.135
HCM Control Delay	14.7	17.4	34	11.3	343.9	67.4
HCM Lane LOS	B	C	D	B	F	F
HCM 95th-tile Q	0.2	1.7	6.2	0.1	48.2	12.7

Intersection: 3: Fairview Road & Chapel Hill Road

Movement	EB	EB	WB	NB	SB
Directions Served	L	TR	TR	LTR	LTR
Maximum Queue (ft)	84	133	427	31	356
Average Queue (ft)	62	95	391	12	267
95th Queue (ft)	105	143	510	37	410
Link Distance (ft)		355	412	462	341
Upstream Blk Time (%)			63		34
Queuing Penalty (veh)			0		0
Storage Bay Dist (ft)	60				
Storage Blk Time (%)	5	24	94		
Queuing Penalty (veh)	18	37	14		

Network Summary

Network wide Queuing Penalty: 68

Intersection	
Intersection Delay, s/veh	11.3
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	632	268	34	264
Demand Flow Rate, veh/h	644	274	34	269
Vehicles Circulating, veh/h	183	187	806	147
Vehicles Exiting, veh/h	233	653	21	314
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	4	4
Ped Cap Adj	1.000	1.000	0.999	0.999
Approach Delay, s/veh	15.3	7.0	8.0	6.6
Approach LOS	C	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	644	274	34	269
Cap Entry Lane, veh/h	941	937	505	975
Entry HV Adj Factor	0.981	0.979	0.993	0.980
Flow Entry, veh/h	632	268	34	264
Cap Entry, veh/h	923	918	501	956
V/C Ratio	0.684	0.292	0.067	0.276
Control Delay, s/veh	15.3	7.0	8.0	6.6
LOS	C	A	A	A
95th %tile Queue, veh	6	1	0	1

Intersection: 3: Fairview Road & Chapel Hill Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	143	55	31	53
Average Queue (ft)	57	27	12	17
95th Queue (ft)	173	66	37	53
Link Distance (ft)	329	387	443	320
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 0

Intersection	
Intersection Delay, s/veh	12.5
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	384	622	16	391
Demand Flow Rate, veh/h	391	634	16	399
Vehicles Circulating, veh/h	220	135	577	467
Vehicles Exiting, veh/h	646	458	34	302
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	8	8
Ped Cap Adj	1.000	1.000	0.999	0.999
Approach Delay, s/veh	9.2	13.3	6.0	14.5
Approach LOS	A	B	A	B

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	391	634	16	399
Cap Entry Lane, veh/h	907	987	635	708
Entry HV Adj Factor	0.982	0.981	0.989	0.979
Flow Entry, veh/h	384	622	16	391
Cap Entry, veh/h	890	969	627	693
V/C Ratio	0.431	0.642	0.025	0.564
Control Delay, s/veh	9.2	13.3	6.0	14.5
LOS	A	B	A	B
95th %tile Queue, veh	2	5	0	4

Intersection: 3: Fairview Road & Chapel Hill Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	32	93	31	54
Average Queue (ft)	25	70	6	44
95th Queue (ft)	45	104	26	63
Link Distance (ft)	329	387	443	320
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 0

Intersection	
Intersection Delay, s/veh	29.9
Intersection LOS	D

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	852	359	46	356
Demand Flow Rate, veh/h	869	367	46	363
Vehicles Circulating, veh/h	247	251	1086	196
Vehicles Exiting, veh/h	311	881	30	422
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	4	4
Ped Cap Adj	1.000	1.000	1.000	0.999
Approach Delay, s/veh	48.7	9.2	11.4	8.4
Approach LOS	E	A	B	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	869	367	46	363
Cap Entry Lane, veh/h	883	879	381	929
Entry HV Adj Factor	0.981	0.979	0.993	0.982
Flow Entry, veh/h	852	359	46	356
Cap Entry, veh/h	866	861	379	912
V/C Ratio	0.985	0.417	0.121	0.391
Control Delay, s/veh	48.7	9.2	11.4	8.4
LOS	E	A	B	A
95th %tile Queue, veh	17	2	0	2

Intersection: 3: Fairview Road & Chapel Hill Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	344	55	31	55
Average Queue (ft)	188	45	19	35
95th Queue (ft)	337	64	43	52
Link Distance (ft)	329	387	443	320
Upstream Blk Time (%)	2			
Queuing Penalty (veh)	0			
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 0

Intersection	
Intersection Delay, s/veh	30.1
Intersection LOS	D

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	518	839	21	528
Demand Flow Rate, veh/h	528	856	21	538
Vehicles Circulating, veh/h	297	182	777	630
Vehicles Exiting, veh/h	871	616	48	407
Follow-Up Headway, s	3.186	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	8	8
Ped Cap Adj	1.000	1.000	0.999	0.999
Approach Delay, s/veh	14.6	32.8	7.5	41.9
Approach LOS	B	D	A	E

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193	5.193
Entry Flow, veh/h	528	856	21	538
Cap Entry Lane, veh/h	840	942	520	602
Entry HV Adj Factor	0.981	0.980	0.989	0.981
Flow Entry, veh/h	518	839	21	528
Cap Entry, veh/h	824	923	513	589
V/C Ratio	0.629	0.909	0.040	0.895
Control Delay, s/veh	14.6	32.8	7.5	41.9
LOS	B	D	A	E
95th %tile Queue, veh	5	13	0	11

Intersection: 3: Fairview Road & Chapel Hill Road

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	81	390	31	122
Average Queue (ft)	53	261	6	81
95th Queue (ft)	101	473	27	123
Link Distance (ft)	329	387	443	320
Upstream Blk Time (%)		0		
Queuing Penalty (veh)		0		
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	151	431	0	3	122	121	7	11	13	146	17	80
Future Volume (veh/h)	151	431	0	3	122	121	7	11	13	146	17	80
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1825	1825	1862	1910	1872	1910	1919	1881	1919
Adj Flow Rate, veh/h	164	468	0	3	133	132	8	12	14	159	18	87
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	214	663	0	7	202	200	175	202	174	369	50	124
Arrive On Green	0.12	0.36	0.00	0.00	0.24	0.24	0.25	0.25	0.25	0.25	0.25	0.25
Sat Flow, veh/h	1774	1863	0	1739	842	836	187	812	700	809	203	497
Grp Volume(v), veh/h	164	468	0	3	0	265	34	0	0	264	0	0
Grp Sat Flow(s),veh/h/ln	1774	1863	0	1739	0	1678	1699	0	0	1510	0	0
Q Serve(g_s), s	3.1	7.5	0.0	0.1	0.0	4.9	0.0	0.0	0.0	4.6	0.0	0.0
Cycle Q Clear(g_c), s	3.1	7.5	0.0	0.1	0.0	4.9	0.5	0.0	0.0	5.4	0.0	0.0
Prop In Lane	1.00		0.00	1.00		0.50	0.24		0.41	0.60		0.33
Lane Grp Cap(c), veh/h	214	663	0	7	0	402	552	0	0	543	0	0
V/C Ratio(X)	0.77	0.71	0.00	0.42	0.00	0.66	0.06	0.00	0.00	0.49	0.00	0.00
Avail Cap(c_a), veh/h	488	1214	0	252	0	875	1031	0	0	990	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	14.7	9.6	0.0	17.1	0.0	11.9	9.9	0.0	0.0	11.7	0.0	0.0
Incr Delay (d2), s/veh	5.7	1.4	0.0	34.8	0.0	1.9	0.0	0.0	0.0	0.7	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	4.0	0.0	0.1	0.0	2.5	0.3	0.0	0.0	2.4	0.0	0.0
LnGrp Delay(d),s/veh	20.4	11.0	0.0	52.0	0.0	13.7	10.0	0.0	0.0	12.4	0.0	0.0
LnGrp LOS	C	B		D		B	A			B		
Approach Vol, veh/h		632			268			34			264	
Approach Delay, s/veh		13.4			14.1			10.0			12.4	
Approach LOS		B			B			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		13.1	4.6	16.8		13.1	8.7	12.8
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		19.0	5.0	22.5		19.0	9.5	18.0
Max Q Clear Time (g_c+I1), s		2.5	2.1	9.5		7.4	5.1	6.9
Green Ext Time (p_c), s		0.1	0.0	2.4		1.2	0.2	1.2

Intersection Summary	
HCM 2010 Ctrl Delay	13.2
HCM 2010 LOS	B

Intersection: 3: Fairview Road & Chapel Hill Road

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	111	94	30	70	30	76
Average Queue (ft)	62	71	6	46	6	55
95th Queue (ft)	118	102	25	72	26	75
Link Distance (ft)		1233		1029	462	403
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	300		300			
Storage Blk Time (%)						
Queuing Penalty (veh)						

Network Summary

Network wide Queuing Penalty: 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	111	237	5	11	408	154	3	8	4	172	16	172
Future Volume (veh/h)	111	237	5	11	408	154	3	8	4	172	16	172
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1825	1825	1862	1910	1872	1910	1919	1881	1919
Adj Flow Rate, veh/h	121	258	5	12	443	167	3	9	4	187	17	187
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	155	854	17	26	502	189	125	328	128	289	34	217
Arrive On Green	0.09	0.47	0.47	0.02	0.40	0.40	0.30	0.30	0.30	0.30	0.30	0.30
Sat Flow, veh/h	1774	1821	35	1739	1265	477	188	1102	430	681	114	729
Grp Volume(v), veh/h	121	0	263	12	0	610	16	0	0	391	0	0
Grp Sat Flow(s),veh/h/ln	1774	0	1856	1739	0	1741	1720	0	0	1525	0	0
Q Serve(g_s), s	4.1	0.0	5.4	0.4	0.0	20.1	0.0	0.0	0.0	13.9	0.0	0.0
Cycle Q Clear(g_c), s	4.1	0.0	5.4	0.4	0.0	20.1	0.4	0.0	0.0	15.0	0.0	0.0
Prop In Lane	1.00		0.02	1.00		0.27	0.19		0.25	0.48		0.48
Lane Grp Cap(c), veh/h	155	0	871	26	0	691	581	0	0	540	0	0
V/C Ratio(X)	0.78	0.00	0.30	0.46	0.00	0.88	0.03	0.00	0.00	0.72	0.00	0.00
Avail Cap(c_a), veh/h	215	0	956	143	0	830	740	0	0	688	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	27.7	0.0	10.2	30.2	0.0	17.3	15.4	0.0	0.0	20.5	0.0	0.0
Incr Delay (d2), s/veh	11.7	0.0	0.2	12.0	0.0	9.7	0.0	0.0	0.0	2.8	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.5	0.0	2.8	0.3	0.0	11.5	0.2	0.0	0.0	6.7	0.0	0.0
LnGrp Delay(d),s/veh	39.4	0.0	10.4	42.2	0.0	27.0	15.4	0.0	0.0	23.2	0.0	0.0
LnGrp LOS	D		B	D		C	B			C		
Approach Vol, veh/h		384			622			16			391	
Approach Delay, s/veh		19.5			27.3			15.4			23.2	
Approach LOS		B			C			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		22.9	5.4	33.5		22.9	9.9	29.1
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		24.5	5.1	31.9		24.5	7.5	29.5
Max Q Clear Time (g_c+I1), s		2.4	2.4	7.4		17.0	6.1	22.1
Green Ext Time (p_c), s		0.0	0.0	1.5		1.5	0.0	2.4

Intersection Summary	
HCM 2010 Ctrl Delay	23.9
HCM 2010 LOS	C

Intersection: 3: Fairview Road & Chapel Hill Road

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	137	112	30	180	30	158
Average Queue (ft)	78	83	6	150	15	126
95th Queue (ft)	135	117	25	188	36	156
Link Distance (ft)		1233		1029	462	403
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	300		300			
Storage Blk Time (%)						
Queuing Penalty (veh)						

Network Summary

Network wide Queuing Penalty: 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	203	580	1	4	164	163	9	15	18	197	23	108
Future Volume (veh/h)	203	580	1	4	164	163	9	15	18	197	23	108
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1825	1825	1862	1910	1872	1910	1919	1881	1919
Adj Flow Rate, veh/h	221	630	1	4	178	177	10	16	20	214	25	117
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	279	786	1	9	228	226	154	220	217	367	45	142
Arrive On Green	0.16	0.42	0.42	0.01	0.27	0.27	0.29	0.29	0.29	0.29	0.29	0.29
Sat Flow, veh/h	1774	1859	3	1739	841	837	214	760	750	850	154	491
Grp Volume(v), veh/h	221	0	631	4	0	355	46	0	0	356	0	0
Grp Sat Flow(s),veh/h/ln	1774	0	1862	1739	0	1678	1725	0	0	1495	0	0
Q Serve(g_s), s	5.7	0.0	14.1	0.1	0.0	9.4	0.0	0.0	0.0	9.6	0.0	0.0
Cycle Q Clear(g_c), s	5.7	0.0	14.1	0.1	0.0	9.4	0.9	0.0	0.0	10.5	0.0	0.0
Prop In Lane	1.00		0.00	1.00		0.50	0.22		0.43	0.60		0.33
Lane Grp Cap(c), veh/h	279	0	787	9	0	454	591	0	0	554	0	0
V/C Ratio(X)	0.79	0.00	0.80	0.43	0.00	0.78	0.08	0.00	0.00	0.64	0.00	0.00
Avail Cap(c_a), veh/h	427	0	1032	182	0	702	795	0	0	744	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	19.4	0.0	12.1	23.7	0.0	16.1	12.4	0.0	0.0	15.7	0.0	0.0
Incr Delay (d2), s/veh	5.6	0.0	3.5	27.6	0.0	3.1	0.1	0.0	0.0	1.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.2	0.0	7.9	0.1	0.0	4.6	0.4	0.0	0.0	4.5	0.0	0.0
LnGrp Delay(d),s/veh	25.0	0.0	15.5	51.3	0.0	19.2	12.4	0.0	0.0	17.0	0.0	0.0
LnGrp LOS	C		B	D		B	B			B		
Approach Vol, veh/h		852			359			46			356	
Approach Delay, s/veh		18.0			19.6			12.4			17.0	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		18.3	4.8	24.7		18.3	12.0	17.4
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		20.0	5.0	26.5		20.0	11.5	20.0
Max Q Clear Time (g_c+I1), s		2.9	2.1	16.1		12.5	7.7	11.4
Green Ext Time (p_c), s		0.1	0.0	3.1		1.3	0.2	1.4

Intersection Summary	
HCM 2010 Ctrl Delay	18.0
HCM 2010 LOS	B

3: Fairview Road & Chapel Hill Road Performance by movement

Movement	EBL	EBT	WBT	WBR	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	2.7	1.0	0.3	0.2	0.1	0.1	0.2	1.9	0.2	0.9
Total Del/Veh (s)	18.4	7.6	10.2	8.1	18.1	3.4	18.0	26.0	7.7	10.9

Total Network Performance

Denied Del/Veh (s)	0.9
Total Del/Veh (s)	12.3

Intersection: 3: Fairview Road & Chapel Hill Road

Movement	EB	EB	WB	NB	SB
Directions Served	L	TR	TR	LTR	LTR
Maximum Queue (ft)	122	146	136	30	137
Average Queue (ft)	104	100	87	24	91
95th Queue (ft)	128	152	147	44	143
Link Distance (ft)		1233	1029	462	403
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	300				
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	150	319	7	15	550	207	4	11	5	232	22	232
Future Volume (veh/h)	150	319	7	15	550	207	4	11	5	232	22	232
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1825	1825	1862	1910	1872	1910	1919	1881	1919
Adj Flow Rate, veh/h	163	347	8	16	598	225	4	12	5	252	24	252
Adj No. of Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	182	960	22	31	563	212	114	329	126	287	23	239
Arrive On Green	0.10	0.53	0.53	0.02	0.44	0.44	0.33	0.33	0.33	0.33	0.33	0.33
Sat Flow, veh/h	1774	1813	42	1739	1265	476	228	997	383	724	69	724
Grp Volume(v), veh/h	163	0	355	16	0	823	21	0	0	528	0	0
Grp Sat Flow(s),veh/h/ln	1774	0	1855	1739	0	1741	1608	0	0	1517	0	0
Q Serve(g_s), s	10.0	0.0	12.2	1.0	0.0	48.9	0.0	0.0	0.0	35.4	0.0	0.0
Cycle Q Clear(g_c), s	10.0	0.0	12.2	1.0	0.0	48.9	0.9	0.0	0.0	36.3	0.0	0.0
Prop In Lane	1.00		0.02	1.00		0.27	0.19		0.24	0.48		0.48
Lane Grp Cap(c), veh/h	182	0	983	31	0	774	570	0	0	549	0	0
V/C Ratio(X)	0.89	0.00	0.36	0.52	0.00	1.06	0.04	0.00	0.00	0.96	0.00	0.00
Avail Cap(c_a), veh/h	182	0	983	81	0	774	570	0	0	549	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	48.8	0.0	15.0	53.6	0.0	30.6	25.0	0.0	0.0	37.7	0.0	0.0
Incr Delay (d2), s/veh	38.5	0.0	0.2	13.2	0.0	50.4	0.0	0.0	0.0	28.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.8	0.0	6.3	0.6	0.0	34.3	0.4	0.0	0.0	20.4	0.0	0.0
LnGrp Delay(d),s/veh	87.3	0.0	15.3	66.8	0.0	81.0	25.0	0.0	0.0	66.6	0.0	0.0
LnGrp LOS	F		B	E		F	C			E		
Approach Vol, veh/h		518			839			21			528	
Approach Delay, s/veh		37.9			80.7			25.0			66.6	
Approach LOS		D			F			C			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		40.8	6.4	62.8		40.8	15.8	53.4
Change Period (Y+Rc), s		4.5	4.5	4.5		4.5	4.5	4.5
Max Green Setting (Gmax), s		36.3	5.1	55.1		36.3	11.3	48.9
Max Q Clear Time (g_c+I1), s		2.9	3.0	14.2		38.3	12.0	50.9
Green Ext Time (p_c), s		0.1	0.0	2.4		0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	64.6
HCM 2010 LOS	E

3: Fairview Road & Chapel Hill Road Performance by movement

Movement	EBL	EBT	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	2.8	0.6	4.2	0.6	0.6	0.1	0.1	0.4	1.2	0.5	0.8
Total Del/Veh (s)	40.7	12.1	49.6	50.2	39.1	29.9	0.4	26.7	47.8	23.5	33.2

Total Network Performance

Denied Del/Veh (s)	0.8
Total Del/Veh (s)	34.7

Intersection: 3: Fairview Road & Chapel Hill Road

Movement	EB	EB	WB	WB	NB	SB
Directions Served	L	TR	L	TR	LTR	LTR
Maximum Queue (ft)	163	133	29	585	30	368
Average Queue (ft)	116	97	9	389	18	234
95th Queue (ft)	177	143	28	660	42	362
Link Distance (ft)		1233		1029	462	403
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	300		300			
Storage Blk Time (%)				34		
Queuing Penalty (veh)				5		

Network Summary

Network wide Queuing Penalty: 5