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CHICK-FIL-A

Hardin Valley Road, Knoxville, Tennessee

TRAFFIC IMPACT STUDY AUGUST 2023

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1.0 Executive Summary

This report presents the results of a traffic impact analysis for the Chick-fil-A to be located adjacent to Hardin Valley Road, Greenland Way, and Spring Bluff Way in Knox County, Tennessee. The closest major roadway is Highway 162, 0.6 miles Northwest of the site location. There will be one proposed access point on Spring Bluff Way

The proposed Chick-fil-A consist of two drive through lanes, 62 interior seats, 20 exterior seats and 72 parking spots. This study shows the analysis for the existing condition and full build-out of the development. The study projection is for the full-build out year in 2025. An auxiliary lane analysis was performed and a southbound right turn lane 100 feet long with a 100-foot taper was warranted for the Greenland Way intersection with Spring Bluff Way. If this could not be achieved due to not obtaining the right-of-way, there would be an increased back up on Greenland Way toward Hardin Valley Road. It is not anticipated that the queue would block traffic on Hardin Valley Road. Reviewing the intersection capacity analysis, it is also suggests to add an eastbound right turn lane 100 foot long with 100 foot taper that the same intersection. If this could not be achieved due to not obtaining the right-of-way, there would be an increased back up on Spring Bluff Way toward Chick-fil-A entrance. It is also suggested to reconfigure and reoptimize the timing for the intersection with Hardin Valley Road with Greenland Way. If this were not done due to being a private drive, there would be longer queues for the northbound left turn traffic. It is estimated that the new facility will slightly increase the amount of delay for the existing traffic, but it is anticipated that it will be insignificant. This amount of increase is not anticipated to significantly impact the motoring public.

2.0 Introduction

On behalf of Carter Engineering Consultants, TWM, Inc. completed this traffic impact study analyzing the potential impacts of a proposed development to be located adjacent to Hardin Valley Road, Spring Bluff Way, and Greenland Way in Knoxville, Tennessee. The Area Map showing the location of the new development is provided below in Figure 1.

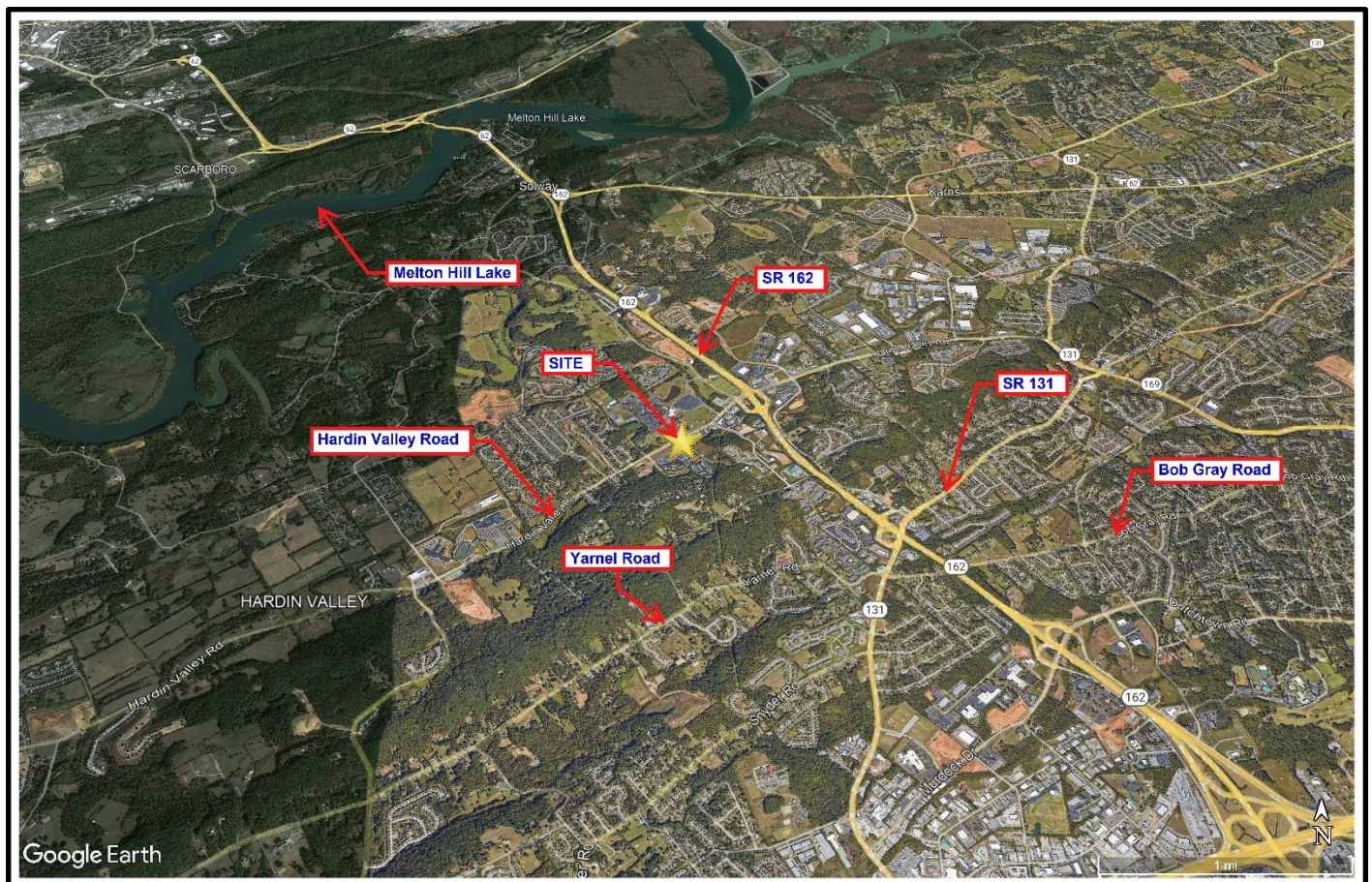


Figure 1 - Area Map

The proposed site entrance is to be located on Spring Bluff Way, utilizing the existing entrance into the King College Parking. The proposed full access entrance on Spring Bluff Way is approximately 155 feet west of Greenland Way and 440 feet south of the intersection Hardin Valley Road & Greenland Way.

Hardin Valley Road at this location is a two-lane segment of roadway with a shoulder on either side. This segment has a 40 mile per hour posted speed limit. Hardin Valley Road is classified by the Tennessee Department of Transportation as a Minor Arterial. This roadway is under the jurisdiction of the Knox County Department of Engineering and Public Works.

The Site Location Map is shown in **Figure 2**.



Figure 2 - Site Location Map

The development is anticipated to consist of a 5,433 square foot Chick-fil-A building and two drive-through lanes. The developer plans to have the development fully constructed and functioning in 2025.

The proposed Development Site Plan is shown in **Figure 3**.

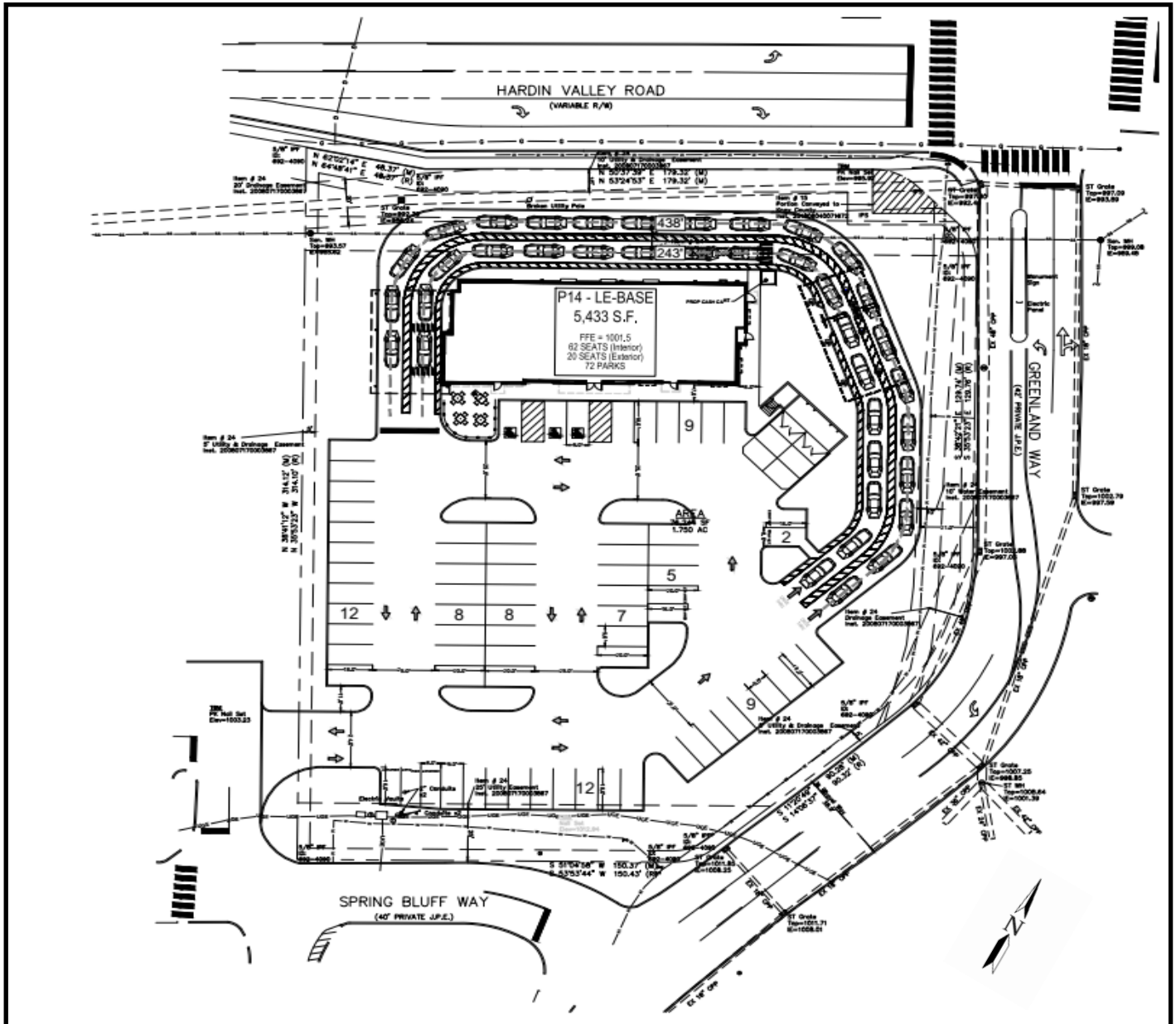


Figure 3 - Development Site Plan

This study analyzes the estimated traffic impacts of the proposed development to Hardin Valley Road and Spring Bluff Way. This study also analyzes the operating level of service of the existing intersections of Hardin Valley Road with Greenland Way, as well as the operating level of service of the intersection of Greenland Way with Spring Bluff Way.

3.0 Existing Traffic Patterns

To establish a basis for the determination of need for any necessary improvements to Hardin Valley Road and Greenland Way borne by the projected automobile trips generated by the proposed development, the existing traffic volumes and directional distributions were first established.

Turning movements counts were conducted on Thursday, May 4, 2023, between 7:00 AM – 9:00 AM, 11:00 AM – 1:00 PM, and from 4:00 - 6:00 PM at the intersections at Hardin Valley Road with Greenland Way and at Greenland Way with Spring Bluff Way. These counts were taken to determine the peak hour design volumes and directional split of the traffic along Hardin Valley Road at Greenland Way and Greenland Way at Spring Bluff Way.

The results of the traffic counts at the intersection of Hardin Valley Road with Greenland Way indicated that the morning peak hour occurred between 7:30-8:30 AM. The noon peak hour occurred between 11:30 AM – 12:30 PM while the evening peak hour occurred between 4:45 – 5:45 PM. The results of the traffic counts at the intersection of Greenland Way with Spring Bluff Way indicated that the morning peak hour occurred between 7:15-8:15 AM. The noon peak hour occurred between 11:15 AM – 12:15 PM while the evening peak hour occurred between 5:00 – 6:00 PM. The following analysis in subsequent sections of this report will be based on the highest volumes observed for each respective intersection as a conservative measurement. The summary of the traffic counts is included in **Appendix 1**.

The 2023 AM, noon and PM peak hour traffic count volumes are shown in **Figure 4**.

The traffic count was completed just after King University had commenced for the summer. Therefore, additional traffic was included in the existing traffic counts based on a portion of the parking lot utilizing the intersection of Spring Bluff Way with Greenland Way. Reviewing the layout of the King University parking lot, it was assumed that the following percentages of each parking lot segment would utilize the Greenland Way at Spring Bluff Way intersection.

- 0% West Parking Lot
- 18% Middle Parking Lot
- 58% East Parking Lot

The increased 2023 AM, noon, and PM peak hour traffic count volumes as shown in **Figure 5** as 2023 Background Traffic.

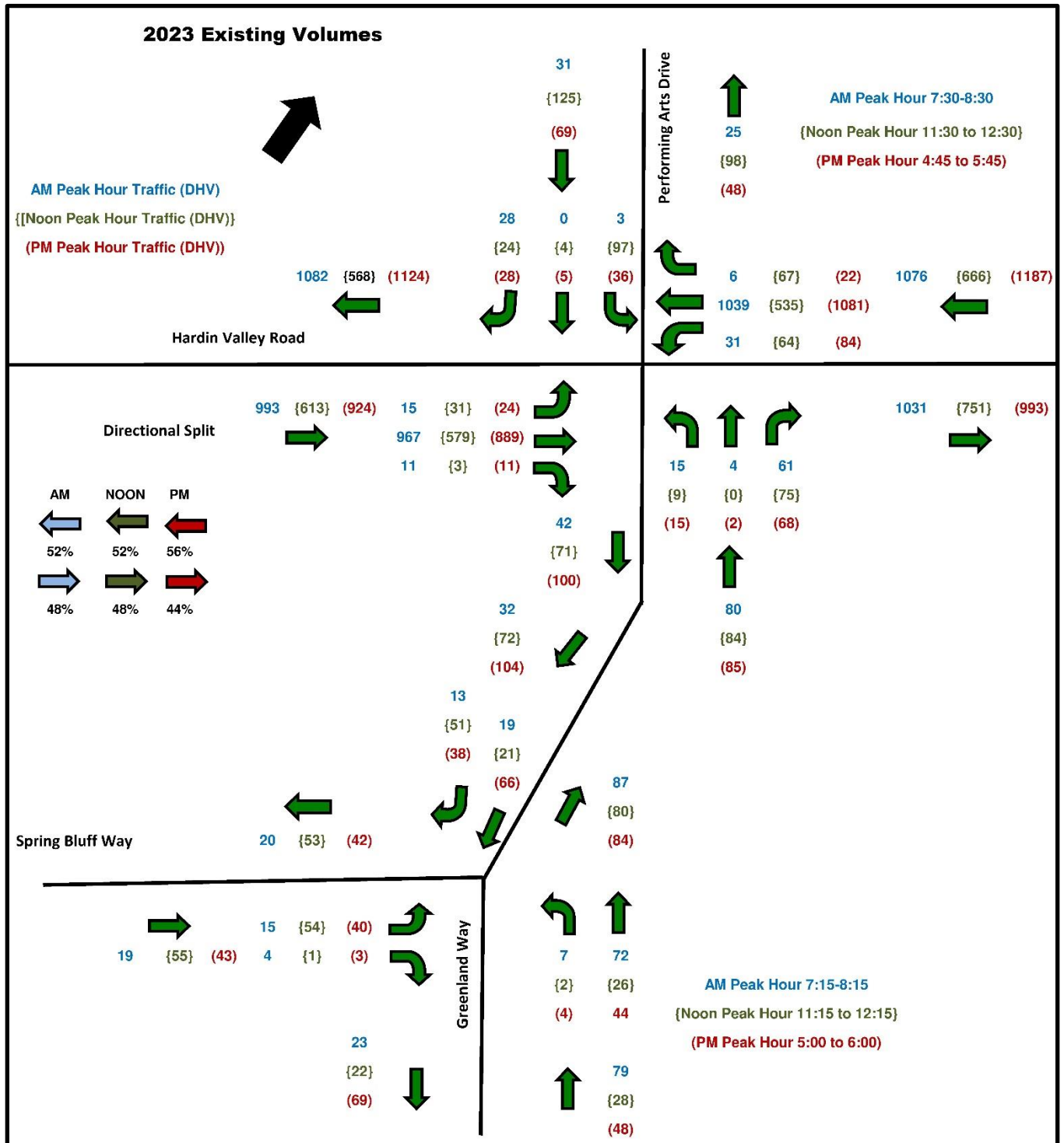


Figure 4 - 2023 Existing Volumes

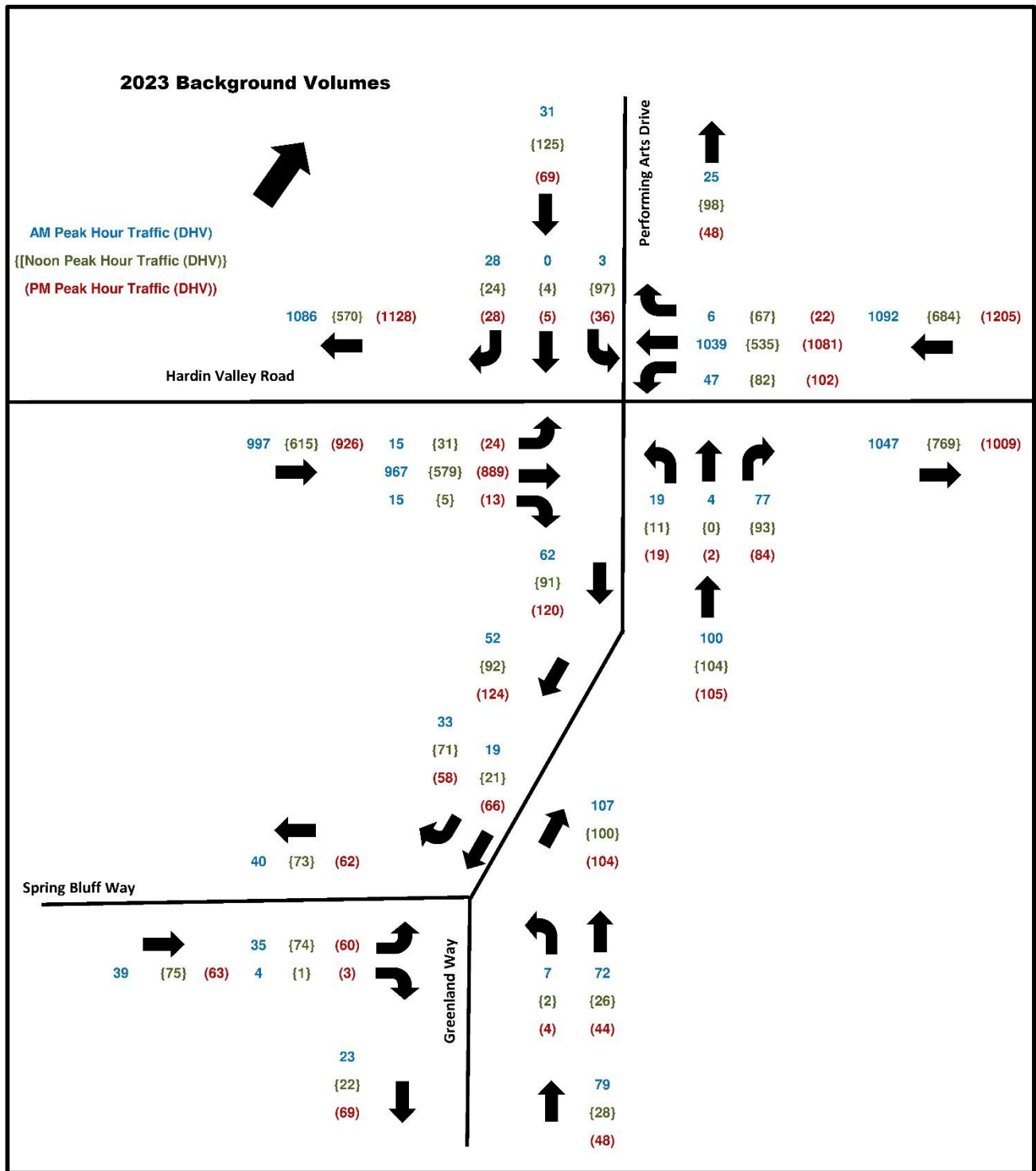


Figure 5 – 2023 Background Volumes

Traffic projection for future growth is difficult considering how traffic has changed from 2012 to 2021 as shown in **Table 1**. The TDOT count station 47000084 is located approximately 1300 feet east of the intersection between Hardin Valley Road and Greenland Way. 2020 was drastically affected by the COVID-19 virus. Even with that impact, the previous ten years showed no specific pattern. This area is growing thus an expansion rate of 3% per year was used.

Table 1 - Count History on Hardin Valley Road
COUNT STATION 47000084 - 1300 feet Northeast of Greenland Way

Year	Traffic Count	% Change
2022	17,402	5%
2021	16,495	11%
2020	14,864	-11%
2019	16,739	-8%
2018	18,120	1%
2017	17,969	1%
2016	17,791	1%
2015	17,615	1%
2014	17,441	12%
2013	15,642	-12%

Utilizing the anticipated growth factor mentioned prior, the peak hour background traffic was estimated to the buildout year of 2025 are shown in **Figure 6**.

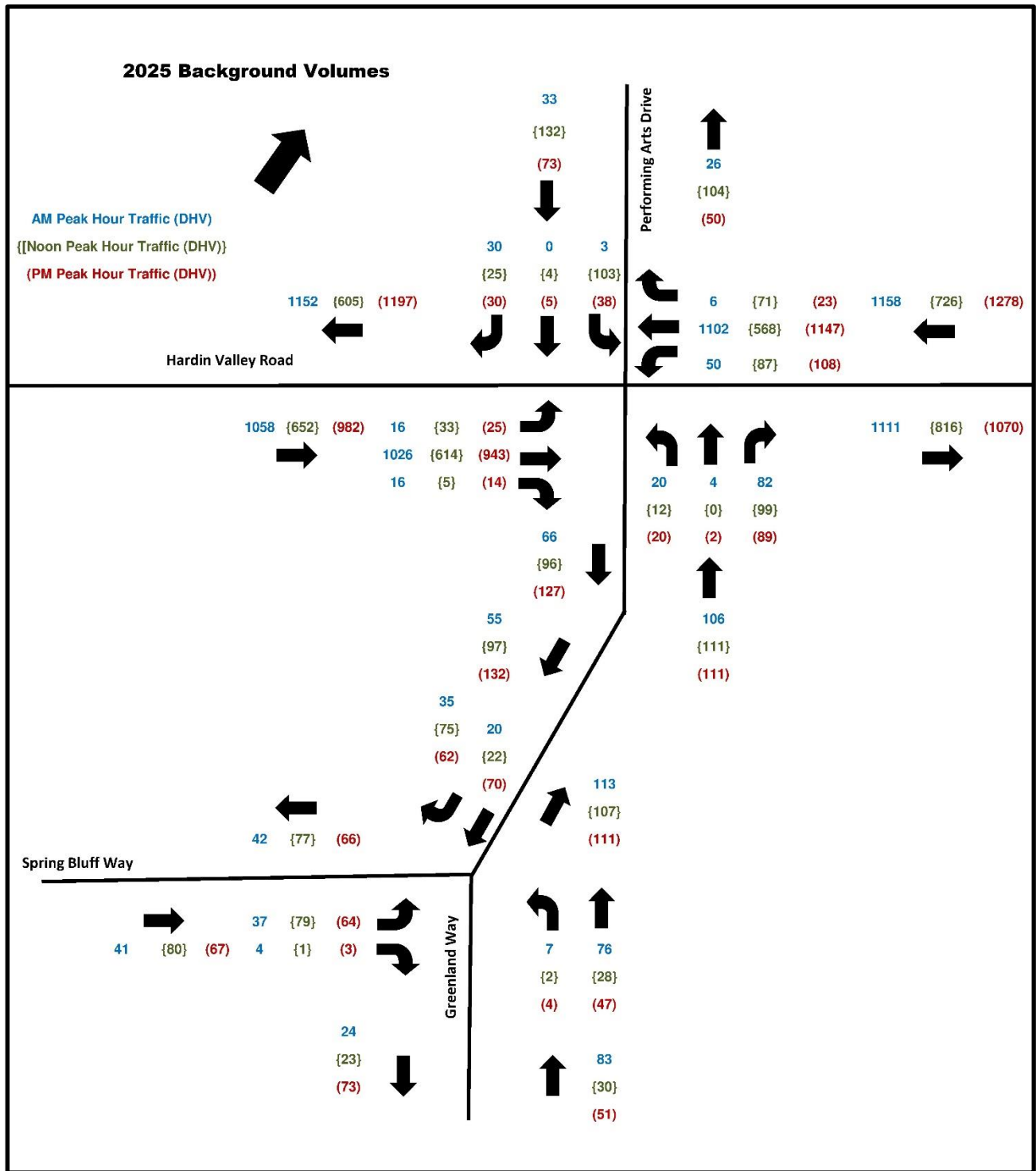


Figure 6 - 2025 Background Volumes

4.0 Existing Intersection Operational Conditions

The existing operational characteristics of the intersection of Hardin Valley Road with Greenland Way as well as Greenland Way with Spring Bluff Way were evaluated using SYNCHRO 11®, software by CUBIC. SYNCHRO utilizes the study procedures outlined in the *Highway Capacity Manual*, published by the Transportation Research Board in

2016. The manual, which is used universally by highway and traffic engineers to measure roadway capacity, establishes six levels of traffic service: Level A (“Free Flow”) to Level F (“Breakdown Flow”). Levels of Service (LOS) are measures of traffic flow that consider factors such as speed, delay time, traffic interruptions, safety, driving comfort, and convenience. LOS C or higher is considered acceptable for peak operating conditions for highway design. LOS D or higher is considered acceptable for peak operating conditions in urban areas.

LOS is not reported for unsignalized intersection with partial (side street) stop controlled since vehicles on the main road are not required to stop or yield. In this case, LOS is only provided for the secondary movements (main road left-turs and minor street improvements). Since drivers are not guaranteed service at regular intervals, LOS data for unsignalized intersections are lower than those for signalized intersections.

The May 4, 2023, traffic counts with the estimated parking lot traffic volumes were used to analyze 2023 existing conditions. The results of 2023 existing operational analyses are summarized in **Table 2. The current estimated AM, Mid and PM peak hour LOS for each approach is D or higher** at the intersection of Hardin Valley Road at Greenland Way. **The current estimated AM, Mid and PM peak hour LOS for each approach is B or higher** at the intersection of Greenland Way at Spring Bluff Way. The full SYNCHRO reports for the 2023 volumes are included in **Appendix 2.**

Table 2 - 2023 Synchro Background Intersection Operating Conditions Chick-fil-A Hardin Valley Road – Knox County, TN						
Traffic Movement	AM Peak Hour		Mid Peak Hour		PM Peak Hour	
	Level Of Service	Vehicular Delay (sec)	Level Of Service	Vehicular Delay (sec)	Level Of Service	Vehicular Delay (sec)
Hardin Valley Road at Greenland Way						
Eastbound Approach	C	23.2	C	21.4	C	20.5
Westbound Approach	B	18.5	B	16.3	B	17.3
Northbound Approach	C	20.9	A	3.7	B	18.7
Southbound Approach	A	7.8	D	35.0	C	30.6
TOTAL INTERSECTION	C	20.5	B	19.2	B	19.1
Greenland Way at Spring Bluff Way						
Eastbound Approach	B	10.1	A	9.9	B	10.2
Northbound Left-Turn	A	7.4	A	7.4	A	7.5

Considering the development is anticipated to be full buildout in 2025, the existing background traffic volumes described prior were used to project traffic for the 2025 background (pre-development) condition. The results of the background 2025 operational analyses are summarized in **Table 3.** The estimated AM, Mid and PM peak hour approach LOS for the intersection of Hardin Valley Road at Greenland Way is a value of D or greater, and B or greater at Greenland Way at Spring Bluff Way. The full SYNCHRO reports for the background volumes are included in **Appendix 3.**

**Table 3 - 2025 Synchro Background Intersection Operating Conditions
Chick-fil-A Hardin Valley Road – Knox County, TN**

Traffic Movement	AM Peak Hour		Mid Peak Hour		PM Peak Hour	
	Level Of Service	Vehicular Delay (sec)	Level Of Service	Vehicular Delay (sec)	Level Of Service	Vehicular Delay (sec)
Hardin Valley Road at Greenland Way						
Eastbound Approach	C	29.3	C	22.7	C	23.8
Westbound Approach	C	22.7	B	17.5	C	20.8
Northbound Approach	C	20.8	A	4.0	B	18.5
Southbound Approach	A	8.2	D	37.0	C	31.4
TOTAL INTERSECTION	C	25.3	C	20.4	C	22.2
Greenland Way at Spring Bluff Way						
Eastbound Approach	B	10.2	B	10.0	B	10.3
Northbound Left-Turn	A	7.4	A	7.4	A	7.5

5.0 Future Traffic Generated

To begin determining the potential full extent of traffic impacts to Hardin Valley Road and Greenland Way, the magnitude of the anticipated vehicular trips generated from the proposed development must be quantified.

Typically, the Eleventh Edition of the *Trip Generation Manual*, published by the Institute of Traffic Engineers, would be utilized to estimate the number of vehicle trips which may be reasonably expected to be generated by the proposed development during the peak hours. The *Trip Generation Manual* defines the peak hour trip rate as the one-hour weighted average vehicle trip rate generated at a site between 7 AM and 9 AM and between 4 PM and 6 PM, when the combination of the site's traffic and the traffic on the adjacent street is the highest. There is also a Trip Generator Peak hour, which is the peak hour trip rate for the site itself. The rates provided in the manual represent weighted averages of studies collected throughout the United States and Canada since the 1980s. From these rates, the volume of forecasted traffic was determined and split between those entering and exiting the site according to the percentages provided in the manual.

There was some concern that the value of trips generated per this manual were not indicative of a Chick-fil-A, therefore additional research was conducted to determine the trip generation for this land use. Traffic counts were conducted at recently renovated similar sized Chick-fil-A located at 9646 Kington Pike in Knoxville. The trip generation comparison between the actual traffic counts taken at a similar store and the ITE calculations are shown in **Table 4**.

**Table 4 - Forecasted Trips
Chick-fil-A Hardin Valley Road – Knox County, TN**

Land Use	ITE Code	Unit	Size	Forecasted Trips								
				AM Peak Hour			Mid Peak Hour			PM Peak Hour		
				In	Out	Total	In	Out	Total	In	Out	Total
Fast Food Rest. w/Drive Through Window	934	1000 Sq Ft GFA	5.433	124	118	242	141	136	277	93	86	179
Kington Pike Chick-fil-A	-	1000 Sq Ft GFA	5.308	137	122	259	242	214	456	115	90	205

Based on the comparison of the ITE Manual with the traffic counts of a similar store, the vehicular trips were forecasts to utilize the similar store traffic counts for this study.

Due to the fast-food restaurant land use of the proposed development, it is assumed that not all the traffic generated by this land use will be new traffic added to the external street system. According to the *ITE Handbook*, restaurant orientated developments attract a portion of their trips from passing motorists (*Trip Generation Handbook*, 91). Due to the traffic volume and the close proximity of the college, residential and the interstate, it is estimated that a certain number of trips entering and leaving the development during the peak hours would come from commuters already traveling Hardin Valley Road and Greenland Way. The *ITE Handbook* states a pass-by reduction of 49% for the AM peak hour and 50% for the PM peak hour. Knox County states that the maximum pass-by for the fast-food restaurant land use is 40%. For a conservative approach, this project is utilizing a 25% pass-by reduction for each of the peak hours.

**Table 5 - Forecasted Trips – Development including the Trip Reductions
Chick-fil-A Hardin Valley Road – Knox County, TN**

	Forecasted Trips								
	AM Peak Hour			Mid Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total	In	Out	Total
Development Trip Generation Traffic	137	122	259	242	214	456	115	90	205
Pass-by Trips	34	30	64	60	53	113	29	22	51
Total "New Trips"	103	92	195	182	161	343	86	68	154

Trip distribution for the proposed development was based on the location of the development and the estimated driver routes. First, the traffic was estimated how it would reach the development from traffic entering and exiting to/from Hardin Valley Road and Greenland Way.

New Traffic						
Hardin Valley Road West and East Legs						
Enter	AM Peak Hour		Mid Peak Hour		PM Peak Hour	
	57%	EB	20%	EB	35%	EB
	35%	WB	65%	WB	45%	WB
Performing Arts Drive North Leg						
Enter	AM Peak Hour		Mid Peak Hour		PM Peak Hour	
	3%	SB	10%	SB	11%	SB
Greenland Way South Leg						
Enter	AM Peak Hour		Mid Peak Hour		PM Peak Hour	
	5%	NB	5%	NB	9%	NB
Hardin Valley Road West and East Legs						
Exit	AM Peak Hour		Mid Peak Hour		PM Peak Hour	
	25%	EB	32%	EB	45%	EB
	60%	WB	51%	WB	40%	WB
Performing Arts Drive North Leg						
Exit	AM Peak Hour		Mid Peak Hour		PM Peak Hour	
	10%	SB	7%	SB	9%	SB
Greenland Way South Leg						
Exit	AM Peak Hour		Mid Peak Hour		PM Peak Hour	
	5%	NB	10%	NB	6%	NB

Pass-by Traffic						
Hardin Valley Road						
Enter/Exit	AM Peak Hour		Mid Peak Hour		PM Peak Hour	
	45.3%	EB	46.9%	EB	41.5%	EB
	48.6%	WB	43.4%	WB	50.5%	WB
Greenland Way						
Enter/Exit	AM Peak Hour		Mid Peak Hour		PM Peak Hour	
	2.4%	SB	7.4%	SB	5.8%	SB
	3.7%	NB	2.3%	NB	2.2%	NB

The total number of trips generated by the proposed development with the trip distribution percentages were used to produce the development turning movement diagram as shown in **Figure 7**.

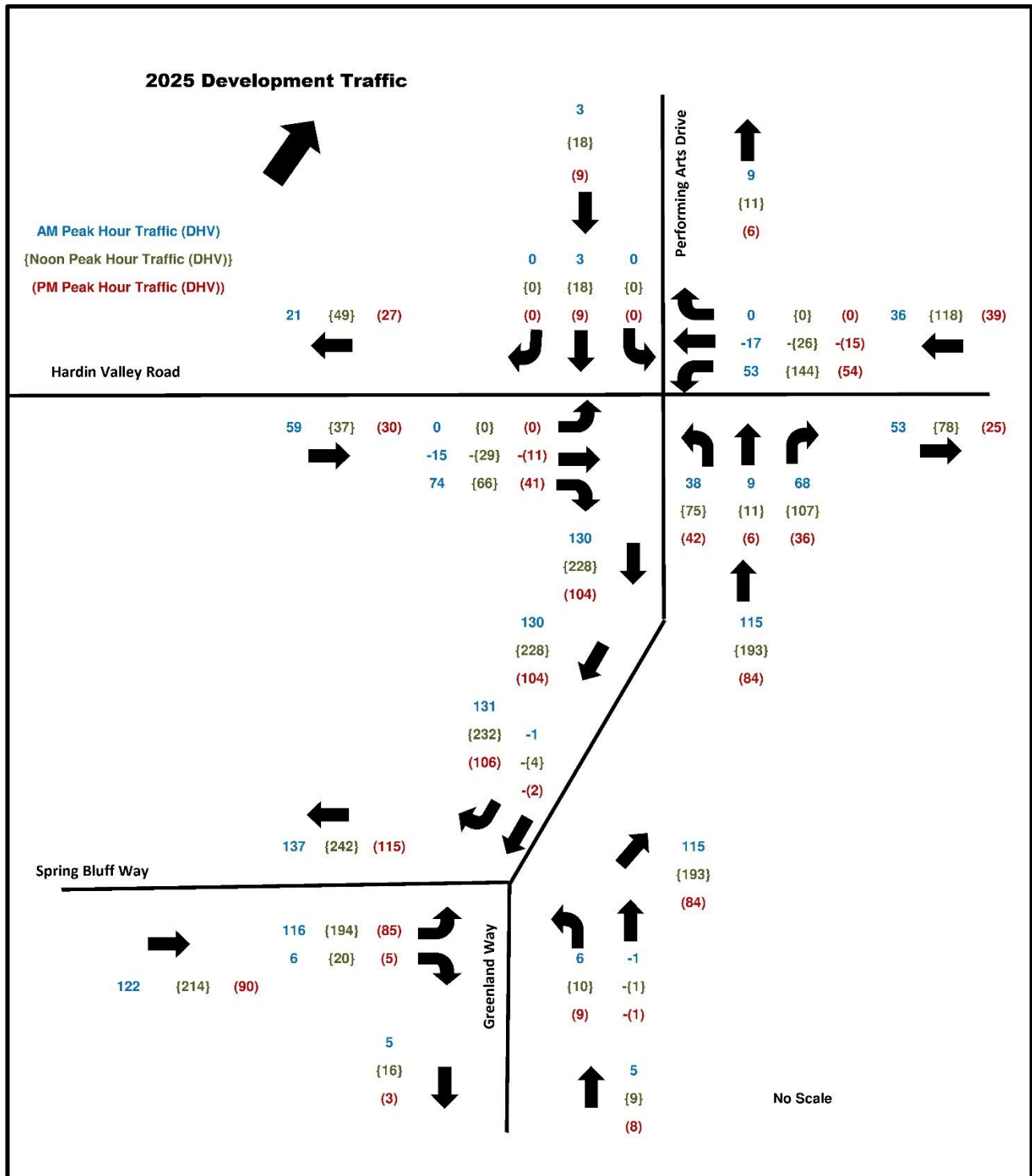


Figure 7 - 2025 Development Volumes

When the volumes in **Figure 6** are added to the volumes in **Figure 7** the result is the total amount of traffic anticipated to occur after the development is fully built out. The result is seen in **Figure 8**.

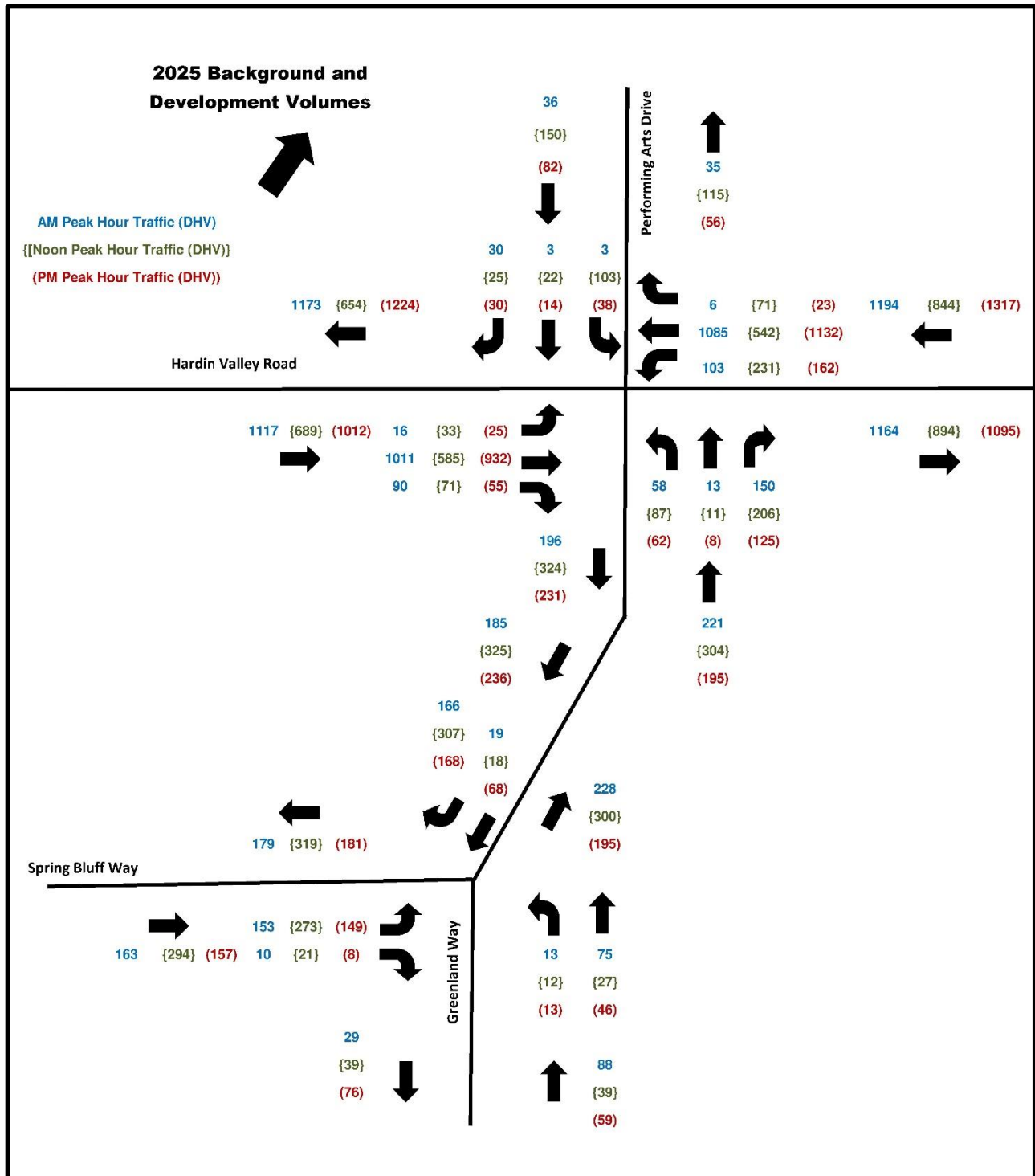


Figure 8 - 2025 Background & Development Traffic Volumes

6.0 Auxiliary Lane Analysis

The need for the installation of a left turn lane along Greenland Way at Spring Bluff Way was not evaluated as current roadway configurations already includes a northbound left-turn lane.

For the right-turn auxiliary lane analysis, an article by L.B. Willey entitled *Traffic Volume Warrants for Right Turn Auxiliary Lanes at Unsignalized Intersections*, in Vermont Agency of Transportation Guidelines for Engineering Issues, Attachment G, 1994 is used in the analysis. **Figure 9** illustrates the result of the warrant conditions for a southbound right turn lane for Greenland Way at Spring Bluff Way. It should be noted that the anticipated number of right-turning vehicles for each of the peak hours is over the 140 vehicle threshold per the Hearshstone matrix. **Therefore, the projected traffic volumes satisfy the minimum recommendations for the installation of an exclusive southbound right-turn lane along Greenland Way at Spring Bluff Way.**

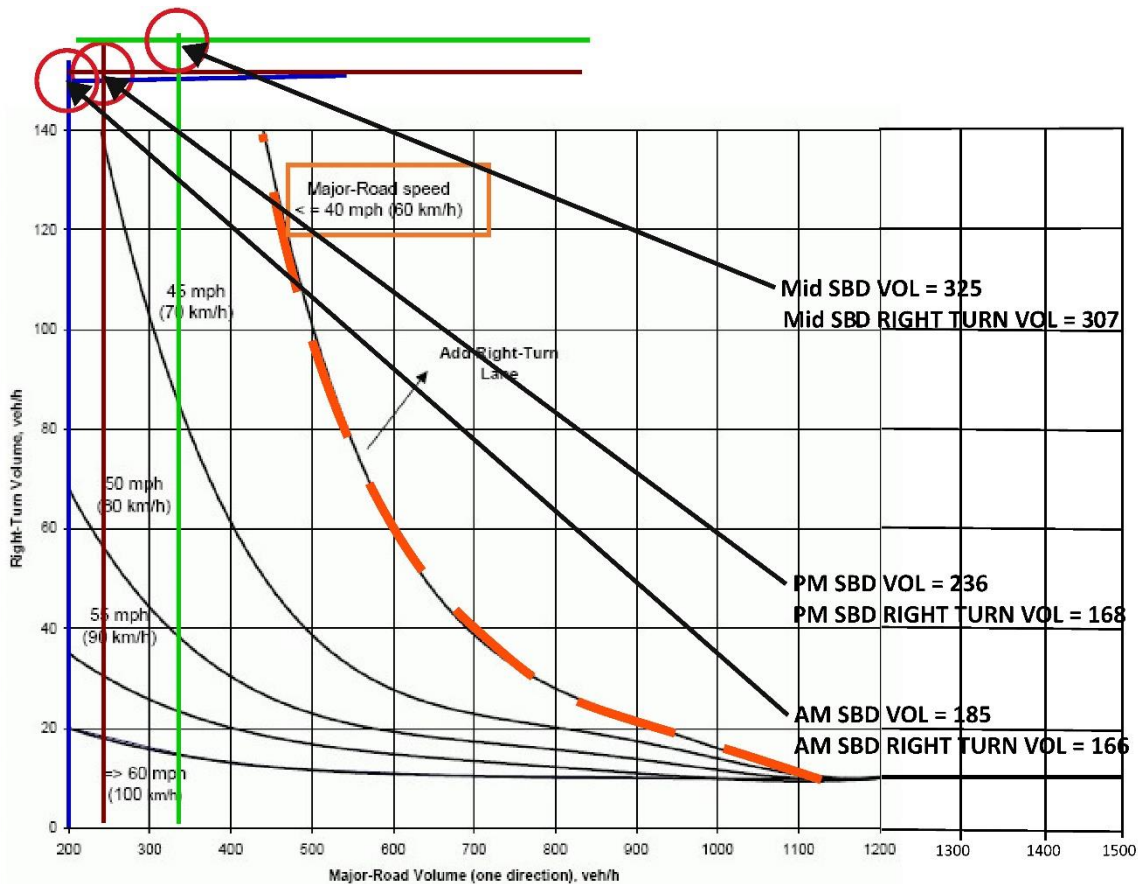


Figure 9– 2025 Peak Rt Turn Ln Warrant Greenland Way at Spring Bluff Way

7.0 Future Traffic Conditions – Intersection Operational Analysis

A highway capacity analysis was performed on the two intersections as previously noted. This analysis was performed in order to determine the estimated impacts of the traffic generated by the proposed development. Analysis parameters include the AM, Mid and PM peak hours for the anticipated design year 2025. The intersection of Hardin Vally Road at Greenland Way was analyzed as a signalized intersection and Greenland Way at Spring Bluff Way was analyzed as non-signalized intersection with the stop control on the minor leg. Results are shown in **Table 6**. The SYNCHRO reports are shown in **Appendix 5**.

**Table 6 - 2025 Synchro Post Development Intersection Operating Conditions
Chick-fil-A Hardin Valley Road – Knox County, TN**

Traffic Movement	AM Peak Hour		Mid Peak Hour		PM Peak Hour	
	Level Of Service	Vehicular Delay (sec)	Level Of Service	Vehicular Delay (sec)	Level Of Service	Vehicular Delay (sec)
Hardin Valley Road at Greenland Way						
Eastbound Approach	D	43.5	C	32.8	C	28.9
Westbound Approach	C	30.7	C	28.0	C	29.1
Northbound Approach	C	24.4	C	23.1	C	32.1
Southbound Approach	C	29.2	D	36.8	D	43.8
TOTAL INTERSECTION	D	35.6	C	29.6	C	29.8
Greenland Way at Spring Bluff Way						
Eastbound Approach	B	12.2	B	12.2	B	11.1
Northbound Left-Turn	A	7.8	A	8.1	A	7.8

Each approach at both intersections is estimated to operate at a level of service D or greater for all periods analyzed after the development is fully occupied. The overall operation at the signalized intersection of Hardin Valley Road at Greenland Way is estimated at a LOS of C & D.

8.0 Internal Site Capacity

The similar Chick-fil-A located at 8646 Kingston Pike was also evaluated for the number of cars becoming queued during the miscellaneous peak hours analyzed. Based on the information received, the distance from the pickup window to the order board is approximately 207 feet. There is an additional 215 feet from the order window to the beginning of the drive through lanes. The drive through consists of two lanes this entire distance. There is an approximate additional 153' feet from the start of the drive through to the closest entrance to the development. Reviewing the queuing snapshot for this site, the maximum number of cars that located from the pickup window to the order window was 15 vehicles. Even with a conservative 25 foot spacing for each car that would allow for all the vehicles to queue within this space. For the queued vehicles from the order window to the end of the drive through lane appeared to be 12 vehicles. Once again, assuming drivers are utilizing both lanes, this would fit within the queuing storage available. It should also be noted that no vehicles were seen queued onto the street for this particular development.

Next, we take this information and compare it to the proposed site layout. The objective is to include two lanes the entire drive through area. From the end of the drive through to the order window is anticipated to include 243 feet. An additional 195 feet will be included from the order window to the beginning of the drive through lanes. Overall, the allotted amount of queue storage space is slightly greater than the one the study completed. Therefore, it is estimated the development would not incur vehicle queuing onto the street.

9.0 Roadway Improvements

From the discussion above, the following is recommended:

- Reconfigure signal timing for optimization on lane restriping, Update signals, as necessary.
- Install a southbound right turn bay a length of 100 feet with a 100-foot taper along Greenland Way at Spring Bluff Way. If this could not be achieved due to not obtaining the right-of-way, there would be an increased back up on Greenland Way toward Hardin Valley Road. It is not anticipated that the queue would block traffic on Hardin Valley Road
- Install an eastbound right turn bay a length of 100 feet with a 100-foot taper along Spring Bluff Way at

Greenland Way. If this could not be achieved due to not obtaining the right-of-way, there would be an increased back up on Spring Bluff Way toward Chick-fil-A entrance.

- Install a development entrance to connect into the entrance off Spring Bluff Way.

10.0 Summary of Traffic Impact Analysis

Based upon the analyses as completed herein, there should be no anticipation of excessive delays at Hardin Valley Road at Greenland Way or at Greenland Way at Spring Bluff Way. Additional roadway improvements for Greenland Way would be the construction of a southbound right turn lane at Spring Bluff Way with the full buildout of the Chick-fil-A. Would also suggest an eastbound right turn lane along Spring Bluff Way at Greenland Way. Intersection capacity also suggests reconfiguring and reoptimizing the signals for the intersection of Hardin Valley Road at Greenland Way.

On behalf of our client, this study is being submitted for your review and approval. Should you have any questions or need any additional information, please do not hesitate to contact me at (423) 242-7844.

Respectfully,

Thouvenot, Wade & Moerchen, Inc.



Stephen E. Meyer, PE
Chattanooga Branch Manager and Chief Traffic Engineer

CC: Mark Campbell, Carter Engineering Consultants
File – TWM

APPENDIX 1
TRAFFIC COUNTS

National Data & Surveying Services Intersection Turning Movement Count

Location: Greenland Way & Spring Bluff Way
 City: Hardin Valley
 Control: 1-Way Stop(EB)

Project ID: 23-190024-002
 Date: 5/4/2023

Data - Total

NS/EW Streets:	Greenland Way						Spring Bluff Way						Spring Bluff Way					
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			EASTBOUND			WESTBOUND		
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL	
AM	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	22
7:00 AM	2	14	0	0	0	1	2	0	3	0	0	0	0	0	0	0	0	40
7:15 AM	5	24	0	0	0	3	2	0	4	0	2	0	0	0	0	0	0	40
7:30 AM	1	20	0	0	0	6	5	0	6	0	2	0	0	0	0	0	0	25
7:45 AM	0	13	0	0	0	5	3	0	4	0	0	0	0	0	0	0	0	25
8:00 AM	1	15	0	0	0	5	3	0	1	0	0	0	0	0	0	0	0	23
8:15 AM	0	11	0	0	0	5	4	0	2	0	1	0	0	0	0	0	0	22
8:30 AM	1	10	0	0	0	5	3	0	3	0	0	0	0	0	0	0	0	22
8:45 AM	0	7	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	12
TOTAL VOLUMES :	10	114	0	0	0	30	27	0	23	0	5	0	0	0	0	0	0	209
APPROACH %'s :	8.06%	91.94%	0.00%	0.00%	0.00%	52.63%	47.37%	0.00%	82.14%	0.00%	17.86%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.813
PEAK HR :	7	72	0	0	0	19	13	0	15	0	4	0	0	0	0	0	0	130
PEAK HR VOL :	0.350	0.750	0.000	0.000	0.000	0.792	0.650	0.000	0.625	0.000	0.500	0.000	0.000	0.000	0.000	0.000	0.000	0.813
PEAK HR FACTOR :																		0.594

NS/EW Streets:	Greenland Way						Spring Bluff Way						Spring Bluff Way					
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			EASTBOUND			WESTBOUND		
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL	
NOON	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	28
11:00 AM	0	4	0	0	0	6	12	0	6	0	0	0	0	0	0	0	0	47
11:15 AM	1	7	0	0	0	4	18	0	16	0	1	0	0	0	0	0	0	40
11:30 AM	0	3	0	0	0	2	16	0	19	0	0	0	0	0	0	0	0	38
11:45 AM	1	6	0	0	0	9	12	0	10	0	0	0	0	0	0	0	0	30
12:00 PM	0	10	0	0	0	6	5	0	9	0	0	0	0	0	0	0	0	21
12:15 PM	0	2	0	0	0	4	5	0	10	0	0	0	0	0	0	0	0	37
12:30 PM	2	9	0	0	0	5	5	0	16	0	0	0	0	0	0	0	0	26
12:45 PM	1	5	0	0	0	8	9	0	3	0	0	0	0	0	0	0	0	26
TOTAL VOLUMES :	5	46	0	0	0	44	82	0	89	0	1	0	0	0	0	0	0	267
APPROACH %'s :	9.89%	90.20%	0.00%	0.00%	0.00%	34.92%	65.08%	0.00%	98.89%	0.00%	1.11%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.824
PEAK HR :	2	26	0	0	0	21	51	0	54	0	1	0	0	0	0	0	0	155
PEAK HR VOL :	0.500	0.650	0.000	0.000	0.000	0.583	0.708	0.000	0.711	0.000	0.250	0.000	0.000	0.000	0.000	0.000	0.000	0.824
PEAK HR FACTOR :																		0.724

NS/EW Streets:	Greenland Way						Spring Bluff Way						Spring Bluff Way					
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			EASTBOUND			WESTBOUND		
	NL	NT	NR	NU	SL	ST	SR	SU	EL	ET	ER	EU	WL	WT	WR	WU	TOTAL	
PM	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	25
4:00 PM	2	5	0	0	0	6	5	0	5	0	2	0	0	0	0	0	0	33
4:15 PM	0	6	0	0	0	7	10	0	8	0	2	0	0	0	0	0	0	23
4:30 PM	0	6	0	0	0	10	2	0	5	0	0	0	0	0	0	0	0	32
4:45 PM	1	5	0	0	0	7	8	0	11	0	0	0	0	0	0	0	0	44
5:00 PM	0	9	0	0	0	15	12	0	8	0	0	0	0	0	0	0	0	53
5:15 PM	1	12	0	0	0	15	11	0	12	0	2	0	0	0	0	0	0	54
5:30 PM	0	13	0	0	0	23	7	0	11	0	0	0	0	0	0	0	0	44
5:45 PM	3	10	0	0	0	13	8	0	9	0	1	0	0	0	0	0	0	44
TOTAL VOLUMES :	7	66	0	0	0	96	63	0	69	0	7	0	0	0	0	0	0	308
APPROACH %'s :	9.59%	90.41%	0.00%	0.00%	0.00%	60.28%	39.62%	0.00%	90.79%	0.00%	9.21%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.903
PEAK HR :	4	44	0	0	0	66	38	0	40	0	3	0	0	0	0	0	0	195
PEAK HR VOL :	0.333	0.846	0.000	0.000	0.000	0.717	0.792	0.000	0.833	0.000	0.375	0.000	0.000	0.000	0.000	0.000	0.000	0.903
PEAK HR FACTOR :																		0.768

APPENDIX 2

SYNCHRO REPORTS
2023 EXISTING

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

Timing Plan: AM Peak

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	3	0	28	19	4	77	15	967	15	47	1039	6
Future Volume (vph)	3	0	28	19	4	77	15	967	15	47	1039	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		7%			-3%			1%			-2%	
Storage Length (ft)	0		0	100		0	80		190	90		90
Storage Lanes	0		1	1		0	1		1	1		1
Taper Length (ft)	25			25			101			102		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t			0.850		0.857				0.850			0.850
Fl _t Protected		0.950		0.950			0.950			0.950		
Satd. Flow (prot)	0	1725	1543	1814	1636	0	1778	1853	1591	1787	1828	1615
Fl _t Permitted		0.689		0.754			0.104			0.089		
Satd. Flow (perm)	0	1251	1543	1440	1636	0	195	1853	1591	167	1828	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			83		100				83			83
Link Speed (mph)		20			30			40			40	
Link Distance (ft)		619			477			833			1404	
Travel Time (s)		21.1			10.8			14.2			23.9	
Peak Hour Factor	0.65	0.65	0.65	0.77	0.77	0.77	0.88	0.88	0.88	0.92	0.92	0.92
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	2%	1%	2%	5%	1%
Adj. Flow (vph)	5	0	43	25	5	100	17	1099	17	51	1129	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	5	43	25	105	0	17	1099	17	51	1129	7
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8			2		2	6		6
Detector Phase	4	4	4	8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	8.0	8.0	8.0	8.0	8.0		6.0	15.0	15.0	6.0	15.0	15.0
Minimum Split (s)	14.0	14.0	14.0	14.0	14.0		12.0	21.0	21.0	12.0	21.0	21.0
Total Split (s)	31.0	31.0	31.0	31.0	31.0		21.0	66.0	66.0	21.0	66.0	66.0
Total Split (%)	26.3%	26.3%	26.3%	26.3%	26.3%		17.8%	55.9%	55.9%	17.8%	55.9%	55.9%
Maximum Green (s)	25.0	25.0	25.0	25.0	25.0		15.0	60.0	60.0	15.0	60.0	60.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	6.0	6.0	3.0	6.0	6.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0		3.0	4.0	4.0	3.0	4.0	4.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	20.0	20.0	0.0	20.0	20.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	10.0	10.0	0.0	10.0	10.0
Recall Mode	None	None	None	None	None		None	Min	Min	None	Min	Min
Walk Time (s)	7.0	7.0	7.0	7.0	7.0		0.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)	20.0	20.0	20.0	20.0	20.0		0.0	15.0	15.0		22.0	22.0
Pedestrian Calls (#/hr)	0	0	0	0	0		0	0	0		0	0
Act Effct Green (s)		8.4	8.4	8.4	8.4		67.8	63.0	63.0	70.7	68.1	68.1

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

Timing Plan: AM Peak



Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Actuated g/C Ratio		0.09	0.09	0.09	0.09		0.73	0.68	0.68	0.76	0.73	0.73
v/c Ratio		0.04	0.20	0.19	0.44		0.07	0.88	0.02	0.22	0.85	0.01
Control Delay		39.3	4.1	42.7	15.7		3.3	23.8	0.0	4.8	19.3	0.0
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		39.3	4.1	42.7	15.7		3.3	23.8	0.0	4.8	19.3	0.0
LOS		D	A	D	B		A	C	A	A	B	A
Approach Delay		7.8			20.9		23.2				18.5	
Approach LOS		A			C		C				B	
Queue Length 50th (ft)		3	0	14	3		2	489	0	5	289	0
Queue Length 95th (ft)		10	0	34	35		6	#857	0	13	#933	0
Internal Link Dist (ft)		539			397		753				1324	
Turn Bay Length (ft)				100			80		190	90		90
Base Capacity (vph)		335	474	386	512		406	1250	1101	390	1333	1200
Starvation Cap Reductn		0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn		0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn		0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio		0.01	0.09	0.06	0.21		0.04	0.88	0.02	0.13	0.85	0.01

Intersection Summary












Area Type:	Other
Cycle Length:	118
Actuated Cycle Length:	93.3
Natural Cycle:	90
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.88
Intersection Signal Delay:	20.5
Intersection LOS:	C
Intersection Capacity Utilization:	83.0%
ICU Level of Service:	E
Analysis Period (min):	15
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.	

Splits and Phases: 3: Hardin Valley Road & Greenland Way/Performing Arts Way

Ø1 21 s	Ø2 66 s	Ø4 31 s
Ø5 21 s	Ø6 66 s	Ø8 31 s

Lanes, Volumes, Timings
 11: Greenland Way & Spring Bluff Way

Timing Plan: AM Peak

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	35	4	7	72	19	33
Future Volume (vph)	35	4	7	72	19	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	13	12	12	13	13	12
Grade (%)	8%			-8%	7%	
Storage Length (ft)	0	0	90			0
Storage Lanes	1	0	1			0
Taper Length (ft)	25		74			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.986				0.914	
Flt Protected	0.957		0.950			
Satd. Flow (prot)	1730	0	1859	2022	1715	0
Flt Permitted	0.957		0.950			
Satd. Flow (perm)	1730	0	1859	2022	1715	0
Link Speed (mph)	20			30	30	
Link Distance (ft)	419			830	477	
Travel Time (s)	14.3			18.9	10.8	
Peak Hour Factor	0.59	0.59	0.68	0.68	0.73	0.73
Heavy Vehicles (%)	3%	1%	1%	1%	1%	1%
Adj. Flow (vph)	59	7	10	106	26	45
Shared Lane Traffic (%)						
Lane Group Flow (vph)	66	0	10	106	71	0
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	15.8% ICU Level of Service A
Analysis Period (min)	15

HCM 6th TWSC
 11: Greenland Way & Spring Bluff Way

Timing Plan: AM Peak

Intersection						
Int Delay, s/veh	3					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y		Y	↑	↑	↑
Traffic Vol, veh/h	35	4	7	72	19	33
Future Vol, veh/h	35	4	7	72	19	33
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	- None		- None		- None	
Storage Length	0	-	90	-	-	-
Veh in Median Storage#	-	-	0	0	-	-
Grade, %	8	-	-	-8	7	-
Peak Hour Factor	59	59	68	68	73	73
Heavy Vehicles, %	3	1	1	1	1	1
Mvmt Flow	59	7	10	106	26	45

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	175	49	71	0	-	0
Stage 1	49	-	-	-	-	-
Stage 2	126	-	-	-	-	-
Critical Hdwy	8.03	7.01	4.11	-	-	-
Critical Hdwy Stg 1	7.03	-	-	-	-	-
Critical Hdwy Stg 2	7.03	-	-	-	-	-
Follow-up Hdwy	3.527	3.309	2.209	-	-	-
Pot Cap-1 Maneuver	752	1011	1536	-	-	-
Stage 1	950	-	-	-	-	-
Stage 2	848	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	747	1011	1536	-	-	-
Mov Cap-2 Maneuver	747	-	-	-	-	-
Stage 1	943	-	-	-	-	-
Stage 2	848	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.1	0.7	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1536	-	768	-	-
HCM Lane V/C Ratio	0.007	-	0.086	-	-
HCM Control Delay (s)	7.4	-	10.1	-	-
HCM Lane LOS	A	-	B	-	-
HCM 95th %tile Q(veh)	0	-	0.3	-	-

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

Timing Plan: Mid Peak

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	97	4	24	11	0	93	31	579	5	82	535	67
Future Volume (vph)	97	4	24	11	0	93	31	579	5	82	535	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		7%			-3%			1%			-2%	
Storage Length (ft)	0		0	100		0	80		190	90		90
Storage Lanes	0		1	1		0	1		1	1		1
Taper Length (ft)	25			25			101			102		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t			0.850			0.850			0.850			0.850
Fl _t Protected		0.954		0.950			0.950			0.950		
Satd. Flow (prot)	0	1732	1543	1814	1576	0	1778	1835	1591	1787	1828	1615
Fl _t Permitted		0.650		0.659			0.275			0.244		
Satd. Flow (perm)	0	1180	1543	1258	1576	0	515	1835	1591	459	1828	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			83			394			83			83
Link Speed (mph)		20			30			40			40	
Link Distance (ft)		619			477			833			1404	
Travel Time (s)		21.1			10.8			14.2			23.9	
Peak Hour Factor	0.65	0.65	0.65	0.78	0.78	0.78	0.93	0.93	0.93	0.82	0.82	0.82
Heavy Vehicles (%)	1%	1%	1%	1%	1%	4%	1%	3%	1%	2%	5%	1%
Adj. Flow (vph)	149	6	37	14	0	119	33	623	5	100	652	82
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	155	37	14	119	0	33	623	5	100	652	82
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8			5	2		1	6
Permitted Phases	4		4	8			2		2	6		6
Detector Phase	4	4	4	8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	8.0	8.0	8.0	8.0	8.0		6.0	15.0	15.0	6.0	15.0	15.0
Minimum Split (s)	14.0	14.0	14.0	14.0	14.0		12.0	21.0	21.0	12.0	21.0	21.0
Total Split (s)	31.0	31.0	31.0	31.0	31.0		21.0	66.0	66.0	21.0	66.0	66.0
Total Split (%)	26.3%	26.3%	26.3%	26.3%	26.3%		17.8%	55.9%	55.9%	17.8%	55.9%	55.9%
Maximum Green (s)	25.0	25.0	25.0	25.0	25.0		15.0	60.0	60.0	15.0	60.0	60.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	6.0	6.0	3.0	6.0	6.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0		3.0	4.0	4.0	3.0	4.0	4.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	20.0	20.0	0.0	20.0	20.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	10.0	10.0	0.0	10.0	10.0
Recall Mode	None	None	None	None	None		None	Min	Min	None	Min	Min
Walk Time (s)	7.0	7.0	7.0	7.0	7.0		0.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)	20.0	20.0	20.0	20.0	20.0		0.0	15.0	15.0		22.0	22.0
Pedestrian Calls (#/hr)	0	0	0	0	0		0	0	0		0	0
Act Effct Green (s)		16.6	16.6	16.6	16.6		42.2	37.4	37.4	45.4	41.2	41.2

2023 Existing Mid Peak Hour
TWM

Synchro 11 Report
Page 1

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

Timing Plan: Mid Peak



Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Actuated g/C Ratio		0.21	0.21	0.21	0.21		0.54	0.48	0.48	0.59	0.53	0.53
v/c Ratio		0.61	0.09	0.05	0.18		0.08	0.70	0.01	0.25	0.67	0.09
Control Delay		43.3	0.5	30.2	0.6		6.9	22.3	0.0	7.8	19.3	3.1
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		43.3	0.5	30.2	0.6		6.9	22.3	0.0	7.8	19.3	3.1
LOS		D	A	C	A		A	C	A	A	B	A
Approach Delay		35.0			3.7		21.4				16.3	
Approach LOS		D			A		C				B	
Queue Length 50th (ft)		69	0	5	0		5	236	0	17	245	0
Queue Length 95th (ft)		111	0	22	0		18	431	0	38	376	17
Internal Link Dist (ft)		539			397		753				1324	
Turn Bay Length (ft)				100			80		190	90		90
Base Capacity (vph)		419	602	447	814		585	1427	1256	565	1421	1274
Starvation Cap Reductn		0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn		0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn		0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio		0.37	0.06	0.03	0.15		0.06	0.44	0.00	0.18	0.46	0.06

Intersection Summary












Area Type:	Other
Cycle Length:	118
Actuated Cycle Length:	77.5
Natural Cycle:	60
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.70
Intersection Signal Delay:	19.2
Intersection LOS:	B
Intersection Capacity Utilization:	62.7%
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 3: Hardin Valley Road & Greenland Way/Performing Arts Way

Ø1	Ø2	Ø4
21 s	66 s	31 s
Ø5	Ø6	Ø8
21 s	66 s	31 s

Lanes, Volumes, Timings
 11: Greenland Way & Spring Bluff Way

Timing Plan: Mid Peak

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	74	1	2	26	21	71
Future Volume (vph)	74	1	2	26	21	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	13	12	12	13	13	12
Grade (%)	8%			-8%	7%	
Storage Length (ft)	0	0	90			0
Storage Lanes	1	0	1			0
Taper Length (ft)	25		74			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.999				0.896	
Flt Protected	0.953		0.950			
Satd. Flow (prot)	1776	0	1859	1891	1666	0
Flt Permitted	0.953		0.950			
Satd. Flow (perm)	1776	0	1859	1891	1666	0
Link Speed (mph)	20			30	30	
Link Distance (ft)	419			830	477	
Travel Time (s)	14.3			18.9	10.8	
Peak Hour Factor	0.72	0.72	0.70	0.70	0.82	0.82
Heavy Vehicles (%)	1%	2%	1%	8%	5%	1%
Adj. Flow (vph)	103	1	3	37	26	87
Shared Lane Traffic (%)						
Lane Group Flow (vph)	104	0	3	37	113	0
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	16.3% ICU Level of Service A
Analysis Period (min)	15

HCM 6th TWSC
 11: Greenland Way & Spring Bluff Way

Timing Plan: Mid Peak

Intersection						
Int Delay, s/veh	4.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	74	1	2	26	21	71
Future Vol, veh/h	74	1	2	26	21	71
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	- None		- None		- None	
Storage Length	0	-	90	-	-	-
Veh in Median Storage#	-	-	0	0	-	-
Grade, %	8	-	-	-8	7	-
Peak Hour Factor	72	72	70	70	82	82
Heavy Vehicles, %	1	2	1	8	5	1
Mvmt Flow	103	1	3	37	26	87

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	113	70	113	0	-	0
Stage 1	70	-	-	-	-	-
Stage 2	43	-	-	-	-	-
Critical Hdwy	8.01	7.02	4.11	-	-	-
Critical Hdwy Stg 1	7.01	-	-	-	-	-
Critical Hdwy Stg 2	7.01	-	-	-	-	-
Follow-up Hdwy	3.509	3.318	2.209	-	-	-
Pot Cap-1 Maneuve	843	977	1483	-	-	-
Stage 1	926	-	-	-	-	-
Stage 2	963	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuve	841	977	1483	-	-	-
Mov Cap-2 Maneuve	841	-	-	-	-	-
Stage 1	924	-	-	-	-	-
Stage 2	963	-	-	-	-	-























Approach	EB	NB	SB
HCM Control Delay, s	9.9	0.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBTEBLn1	SBT	SBR
Capacity (veh/h)	1483	-	843	-
HCM Lane V/C Ratio	0.002	-	0.124	-
HCM Control Delay (s)	7.4	-	9.9	-
HCM Lane LOS	A	-	A	-
HCM 95th %tile Q(veh)	0	-	0.4	-

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

Timing Plan: PM Peak

												
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	36	5	28	19	2	84	24	889	13	102	1081	22
Future Volume (vph)	36	5	28	19	2	84	24	889	13	102	1081	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		7%			-3%			1%			-2%	
Storage Length (ft)	0		0	100		0	80		190	90		90
Storage Lanes	0		1	1		0	1		1	1		1
Taper Length (ft)	25			25			101			102		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor			0.850		0.853			0.850			0.850	
Flt Protected		0.958		0.950			0.950			0.950		
Satd. Flow (prot)	0	1709	1543	1814	1629	0	1778	1835	1591	1805	1900	1553
Flt Permitted		0.678		0.723			0.095			0.151		
Satd. Flow (perm)	0	1210	1543	1381	1629	0	178	1835	1591	287	1900	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			83			102			83			83
Link Speed (mph)		20			30			40			40	
Link Distance (ft)		619			477			833			1404	
Travel Time (s)		21.1			10.8			14.2			23.9	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.78	0.78	0.78	0.82	0.82	0.82	0.96	0.96	0.96	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	3%	1%	1%	1%	1%	1%	1%	3%	1%	1%	1%	5%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	46	6	36	23	2	102	25	926	14	107	1138	23
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	52	36	23	104	0	25	926	14	107	1138	23
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8			5		2		6
Permitted Phases	4		4	8			2		2	6		6
Detector Phase	4	4	4	8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	8.0	8.0	8.0	8.0	8.0		6.0	15.0	15.0	6.0	15.0	15.0
Minimum Split (s)	14.0	14.0	14.0	14.0	14.0		12.0	21.0	21.0	12.0	21.0	21.0
Total Split (s)	31.0	31.0	31.0	31.0	31.0		21.0	66.0	66.0	21.0	66.0	66.0
Total Split (%)	26.3%	26.3%	26.3%	26.3%	26.3%		17.8%	55.9%	55.9%	17.8%	55.9%	55.9%
Maximum Green (s)	25.0	25.0	25.0	25.0	25.0		15.0	60.0	60.0	15.0	60.0	60.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	6.0	6.0	3.0	6.0	6.0

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

Timing Plan: PM Peak

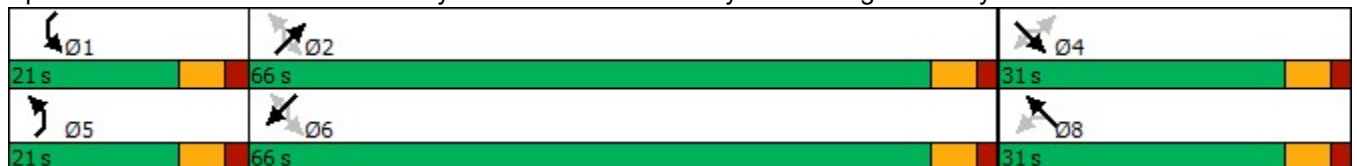


Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0		3.0	4.0	4.0	3.0	4.0	4.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	20.0	20.0	0.0	20.0	20.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	10.0	10.0	0.0	10.0	10.0
Recall Mode	None	None	None	None	None		None	Min	Min	None	Min	Min
Walk Time (s)	7.0	7.0	7.0	7.0	7.0		0.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)	20.0	20.0	20.0	20.0	20.0		0.0	15.0	15.0		22.0	22.0
Pedestrian Calls (#/hr)	0	0	0	0	0		0	0	0		0	0
Act Effct Green (s)		9.9	9.9	9.9	9.9		66.2	60.1	60.1	72.6	69.0	69.0
Actuated g/C Ratio		0.10	0.10	0.10	0.10		0.69	0.63	0.63	0.76	0.72	0.72
v/c Ratio		0.42	0.15	0.16	0.40		0.11	0.80	0.01	0.32	0.83	0.02
Control Delay		50.9	1.4	41.9	13.6		4.5	21.2	0.0	5.5	18.8	0.0
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		50.9	1.4	41.9	13.6		4.5	21.2	0.0	5.5	18.8	0.0
LOS		D	A	D	B		A	C	A	A	B	A
Approach Delay		30.6			18.7		20.5				17.3	
Approach LOS		C			B		C				B	
Queue Length 50th (ft)		30	0	13	1		3	364	0	12	301	0
Queue Length 95th (ft)		59	0	34	38		10	#772	0	29	#990	0
Internal Link Dist (ft)		539			397		753				1324	
Turn Bay Length (ft)				100			80		190	90		90
Base Capacity (vph)		316	465	361	502		388	1157	1033	459	1371	1143
Starvation Cap Reductn		0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn		0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn		0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio		0.16	0.08	0.06	0.21		0.06	0.80	0.01	0.23	0.83	0.02

Intersection Summary











Area Type: Other
 Cycle Length: 118
 Actuated Cycle Length: 95.6
 Natural Cycle: 90
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.83
 Intersection Signal Delay: 19.1 Intersection LOS: B
 Intersection Capacity Utilization 85.8% ICU Level of Service E
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 3: Hardin Valley Road & Greenland Way/Performing Arts Way



Lanes, Volumes, Timings
 11: Greenland Way & Spring Bluff Way

Timing Plan: PM Peak

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	60	3	4	44	66	58
Future Volume (vph)	60	3	4	44	66	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	13	12	12	13	13	12
Grade (%)	8%			-8%	7%	
Storage Length (ft)	0	0	90			0
Storage Lanes	1	0	1			0
Taper Length (ft)	25		74			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.993				0.937	
Flt Protected	0.955		0.950			
Satd. Flow (prot)	1770	0	1859	2002	1758	0
Flt Permitted	0.955		0.950			
Satd. Flow (perm)	1770	0	1859	2002	1758	0
Link Speed (mph)	20			30	30	
Link Distance (ft)	419			830	477	
Travel Time (s)	14.3			18.9	10.8	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.77	0.77	0.92	0.92	0.87	0.87
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	1%	1%	2%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	78	4	4	48	76	67
Shared Lane Traffic (%)						
Lane Group Flow (vph)	82	0	4	48	143	0
Sign Control	Stop			Free	Free	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	17.2%			ICU Level of Service A		
Analysis Period (min)	15					

HCM 6th TWSC
 11: Greenland Way & Spring Bluff Way

Timing Plan: PM Peak

Intersection						
Int Delay, s/veh	3.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y		Y	↑	↑	↑
Traffic Vol, veh/h	60	3	4	44	66	58
Future Vol, veh/h	60	3	4	44	66	58
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	- None		- None		- None	
Storage Length	0	-	90	-	-	-
Veh in Median Storage#	-	-	0	0	-	-
Grade, %	8	-	-	-8	7	-
Peak Hour Factor	77	77	92	92	87	87
Heavy Vehicles, %	1	1	1	2	1	1
Mvmt Flow	78	4	4	48	76	67

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	166	110	143	0	-	0
Stage 1	110	-	-	-	-	-
Stage 2	56	-	-	-	-	-
Critical Hdwy	8.01	7.01	4.11	-	-	-
Critical Hdwy Stg 1	7.01	-	-	-	-	-
Critical Hdwy Stg 2	7.01	-	-	-	-	-
Follow-up Hdwy	3.509	3.309	2.209	-	-	-
Pot Cap-1 Maneuver	768	923	1446	-	-	-
Stage 1	873	-	-	-	-	-
Stage 2	945	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	766	923	1446	-	-	-
Mov Cap-2 Maneuver	766	-	-	-	-	-
Stage 1	870	-	-	-	-	-
Stage 2	945	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.2	0.6	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1446	-	772	-	-
HCM Lane V/C Ratio	0.003	-	0.106	-	-
HCM Control Delay (s)	7.5	-	10.2	-	-
HCM Lane LOS	A	-	B	-	-
HCM 95th %tile Q(veh)	0	-	0.4	-	-























APPENDIX 3

SYNCHRO REPORTS 2025 BACKGROUND

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

Timing Plan: AM Peak

												
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	3	0	30	20	4	82	16	1026	16	50	1102	6
Future Volume (vph)	3	0	30	20	4	82	16	1026	16	50	1102	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		7%			-3%			1%			-2%	
Storage Length (ft)	0		0	100		0	80		190	90		90
Storage Lanes	0		1	1		0	1		1	1		1
Taper Length (ft)	25			25			101			102		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t			0.850			0.857			0.850			0.850
Fl _t Protected		0.950		0.950			0.950			0.950		
Satd. Flow (prot)	0	1725	1543	1814	1636	0	1778	1853	1591	1787	1828	1615
Fl _t Permitted		0.685		0.754			0.063			0.059		
Satd. Flow (perm)	0	1244	1543	1440	1636	0	118	1853	1591	111	1828	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			83			106			83			83
Link Speed (mph)		20			30			40			40	
Link Distance (ft)		619			477			833			1404	
Travel Time (s)		21.1			10.8			14.2			23.9	
Peak Hour Factor	0.65	0.65	0.65	0.77	0.77	0.77	0.88	0.88	0.88	0.92	0.92	0.92
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	2%	1%	2%	5%	1%
Adj. Flow (vph)	5	0	46	26	5	106	18	1166	18	54	1198	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	5	46	26	111	0	18	1166	18	54	1198	7
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8			5	2		1	6
Permitted Phases	4		4	8			2		2	6		6
Detector Phase	4	4	4	8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	8.0	8.0	8.0	8.0	8.0		6.0	15.0	15.0	6.0	15.0	15.0
Minimum Split (s)	14.0	14.0	14.0	14.0	14.0		12.0	21.0	21.0	12.0	21.0	21.0
Total Split (s)	31.0	31.0	31.0	31.0	31.0		21.0	66.0	66.0	21.0	66.0	66.0
Total Split (%)	26.3%	26.3%	26.3%	26.3%	26.3%		17.8%	55.9%	55.9%	17.8%	55.9%	55.9%
Maximum Green (s)	25.0	25.0	25.0	25.0	25.0		15.0	60.0	60.0	15.0	60.0	60.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	6.0	6.0	3.0	6.0	6.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0		3.0	4.0	4.0	3.0	4.0	4.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	20.0	20.0	0.0	20.0	20.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	10.0	10.0	0.0	10.0	10.0
Recall Mode	None	None	None	None	None		None	Min	Min	None	Min	Min
Walk Time (s)	7.0	7.0	7.0	7.0	7.0		0.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)	20.0	20.0	20.0	20.0	20.0		0.0	15.0	15.0		22.0	22.0
Pedestrian Calls (#/hr)	0	0	0	0	0		0	0	0		0	0
Act Effct Green (s)		8.5	8.5	8.5	8.5		67.8	62.9	62.9	70.7	68.1	68.1

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

Timing Plan: AM Peak



Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Actuated g/C Ratio		0.09	0.09	0.09	0.09		0.73	0.67	0.67	0.76	0.73	0.73
v/c Ratio		0.04	0.21	0.20	0.45		0.09	0.93	0.02	0.28	0.90	0.01
Control Delay		39.3	4.9	42.9	15.6		3.8	30.1	0.0	8.2	23.5	0.0
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		39.3	4.9	42.9	15.6		3.8	30.1	0.0	8.2	23.5	0.0
LOS		D	A	D	B		A	C	A	A	C	A
Approach Delay		8.2			20.8		29.3				22.7	
Approach LOS		A			C		C				C	
Queue Length 50th (ft)		3	0	14	3		2	571	0	5	339	0
Queue Length 95th (ft)		10	0	34	35		6	#946	0	20	#1026	0
Internal Link Dist (ft)		539			397		753				1324	
Turn Bay Length (ft)				100			80		190	90		90
Base Capacity (vph)		333	474	385	515		359	1250	1100	356	1333	1200
Starvation Cap Reductn		0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn		0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn		0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio		0.02	0.10	0.07	0.22		0.05	0.93	0.02	0.15	0.90	0.01

Intersection Summary












Area Type:	Other
Cycle Length:	118
Actuated Cycle Length:	93.3
Natural Cycle:	90
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.93
Intersection Signal Delay:	25.3
Intersection LOS:	C
Intersection Capacity Utilization:	86.3%
ICU Level of Service:	E
Analysis Period (min):	15
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.	

Splits and Phases: 3: Hardin Valley Road & Greenland Way/Performing Arts Way

Ø1 21 s	Ø2 66 s	Ø4 31 s
Ø5 21 s	Ø6 66 s	Ø8 31 s

Lanes, Volumes, Timings
 11: Greenland Way & Spring Bluff Way

Timing Plan: AM Peak

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	37	4	7	76	20	35
Future Volume (vph)	37	4	7	76	20	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	13	12	12	13	13	12
Grade (%)	8%			-8%	7%	
Storage Length (ft)	0	0	90			0
Storage Lanes	1	0	1			0
Taper Length (ft)	25		74			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.986				0.914	
Flt Protected	0.957		0.950			
Satd. Flow (prot)	1730	0	1859	2022	1715	0
Flt Permitted	0.957		0.950			
Satd. Flow (perm)	1730	0	1859	2022	1715	0
Link Speed (mph)	20			30	30	
Link Distance (ft)	419			830	477	
Travel Time (s)	14.3			18.9	10.8	
Peak Hour Factor	0.59	0.59	0.68	0.68	0.73	0.73
Heavy Vehicles (%)	3%	1%	1%	1%	1%	1%
Adj. Flow (vph)	63	7	10	112	27	48
Shared Lane Traffic (%)						
Lane Group Flow (vph)	70	0	10	112	75	0
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	15.8% ICU Level of Service A
Analysis Period (min)	15

HCM 6th TWSC
 11: Greenland Way & Spring Bluff Way

Timing Plan: AM Peak

Intersection						
Int Delay, s/veh	2.9					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	WT		WT	↑	↑	↑
Traffic Vol, veh/h	37	4	7	76	20	35
Future Vol, veh/h	37	4	7	76	20	35
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	- None		- None		- None	
Storage Length	0	-	90	-	-	-
Veh in Median Storage#	-	-	0	0	-	-
Grade, %	8	-	-	-8	7	-
Peak Hour Factor	59	59	68	68	73	73
Heavy Vehicles, %	3	1	1	1	1	1
Mvmt Flow	63	7	10	112	27	48

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	183	51	75	0	-	0
Stage 1	51	-	-	-	-	-
Stage 2	132	-	-	-	-	-
Critical Hdwy	8.03	7.01	4.11	-	-	-
Critical Hdwy Stg 1	7.03	-	-	-	-	-
Critical Hdwy Stg 2	7.03	-	-	-	-	-
Follow-up Hdwy	3.527	3.309	2.209	-	-	-
Pot Cap-1 Maneuver	741	1008	1531	-	-	-
Stage 1	947	-	-	-	-	-
Stage 2	841	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	736	1008	1531	-	-	-
Mov Cap-2 Maneuver	736	-	-	-	-	-
Stage 1	940	-	-	-	-	-
Stage 2	841	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.2	0.6	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1531	-	756	-	-
HCM Lane V/C Ratio	0.007	-	0.092	-	-
HCM Control Delay (s)	7.4	-	10.2	-	-
HCM Lane LOS	A	-	B	-	-
HCM 95th %tile Q(veh)	0	-	0.3	-	-

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

Timing Plan: Mid Peak

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	103	4	25	12	0	99	33	614	5	87	568	71
Future Volume (vph)	103	4	25	12	0	99	33	614	5	87	568	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		7%			-3%			1%			-2%	
Storage Length (ft)	0		0	100		0	80		190	90		90
Storage Lanes	0		1	1		0	1		1	1		1
Taper Length (ft)	25			25			101			102		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected		0.954		0.950			0.950			0.950		
Satd. Flow (prot)	0	1732	1543	1814	1576	0	1778	1835	1591	1787	1828	1615
Flt Permitted		0.644		0.632			0.245			0.219		
Satd. Flow (perm)	0	1169	1543	1207	1576	0	459	1835	1591	412	1828	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			83			378			83			83
Link Speed (mph)		20			30			40			40	
Link Distance (ft)		619			477			833			1404	
Travel Time (s)		21.1			10.8			14.2			23.9	
Peak Hour Factor	0.65	0.65	0.65	0.78	0.78	0.78	0.93	0.93	0.93	0.82	0.82	0.82
Heavy Vehicles (%)	1%	1%	1%	1%	1%	4%	1%	3%	1%	2%	5%	1%
Adj. Flow (vph)	158	6	38	15	0	127	35	660	5	106	693	87
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	164	38	15	127	0	35	660	5	106	693	87
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8			5	2		1	6
Permitted Phases	4		4	8			2		2	6		6
Detector Phase	4	4	4	8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	8.0	8.0	8.0	8.0	8.0		6.0	15.0	15.0	6.0	15.0	15.0
Minimum Split (s)	14.0	14.0	14.0	14.0	14.0		12.0	21.0	21.0	12.0	21.0	21.0
Total Split (s)	31.0	31.0	31.0	31.0	31.0		21.0	66.0	66.0	21.0	66.0	66.0
Total Split (%)	26.3%	26.3%	26.3%	26.3%	26.3%		17.8%	55.9%	55.9%	17.8%	55.9%	55.9%
Maximum Green (s)	25.0	25.0	25.0	25.0	25.0		15.0	60.0	60.0	15.0	60.0	60.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	6.0	6.0	3.0	6.0	6.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0		3.0	4.0	4.0	3.0	4.0	4.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	20.0	20.0	0.0	20.0	20.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	10.0	10.0	0.0	10.0	10.0
Recall Mode	None	None	None	None	None		None	Min	Min	None	Min	Min
Walk Time (s)	7.0	7.0	7.0	7.0	7.0		0.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)	20.0	20.0	20.0	20.0	20.0		0.0	15.0	15.0		22.0	22.0
Pedestrian Calls (#/hr)	0	0	0	0	0		0	0	0		0	0
Act Effct Green (s)		18.3	18.3	18.3	18.3		45.3	40.5	40.5	48.7	44.4	44.4

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

Timing Plan: Mid Peak



Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Actuated g/C Ratio		0.22	0.22	0.22	0.22		0.55	0.49	0.49	0.59	0.54	0.54
v/c Ratio		0.63	0.09	0.06	0.20		0.10	0.73	0.01	0.28	0.70	0.10
Control Delay		45.5	0.4	31.8	0.7		7.2	23.7	0.0	8.5	20.6	3.4
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		45.5	0.4	31.8	0.7		7.2	23.7	0.0	8.5	20.6	3.4
LOS		D	A	C	A		A	C	A	A	C	A
Approach Delay		37.0			4.0			22.7			17.5	
Approach LOS		D			A			C			B	
Queue Length 50th (ft)		79	0	6	0		6	276	0	19	289	1
Queue Length 95th (ft)		123	0	23	0		18	469	0	39	409	19
Internal Link Dist (ft)		539			397			753			1324	
Turn Bay Length (ft)				100			80		190	90		90
Base Capacity (vph)		390	570	402	777		547	1360	1201	529	1360	1223
Starvation Cap Reductn		0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn		0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn		0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio		0.42	0.07	0.04	0.16		0.06	0.49	0.00	0.20	0.51	0.07

Intersection Summary












Area Type:	Other
Cycle Length:	118
Actuated Cycle Length:	82.4
Natural Cycle:	65
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.73
Intersection Signal Delay:	20.4
Intersection LOS:	C
Intersection Capacity Utilization:	64.9%
ICU Level of Service:	C
Analysis Period (min):	15

Splits and Phases: 3: Hardin Valley Road & Greenland Way/Performing Arts Way

Ø1	Ø2	Ø4
21 s	66 s	31 s
Ø5	Ø6	Ø8
21 s	66 s	31 s

Lanes, Volumes, Timings
 11: Greenland Way & Spring Bluff Way

Timing Plan: Mid Peak

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	79	1	2	28	22	75
Future Volume (vph)	79	1	2	28	22	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	13	12	12	13	13	12
Grade (%)	8%			-8%	7%	
Storage Length (ft)	0	0	90			0
Storage Lanes	1	0	1			0
Taper Length (ft)	25		74			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.999				0.896	
Flt Protected	0.953		0.950			
Satd. Flow (prot)	1776	0	1859	1891	1666	0
Flt Permitted	0.953		0.950			
Satd. Flow (perm)	1776	0	1859	1891	1666	0
Link Speed (mph)	20			30	30	
Link Distance (ft)	419			830	477	
Travel Time (s)	14.3			18.9	10.8	
Peak Hour Factor	0.72	0.72	0.70	0.70	0.82	0.82
Heavy Vehicles (%)	1%	2%	1%	8%	5%	1%
Adj. Flow (vph)	110	1	3	40	27	91
Shared Lane Traffic (%)						
Lane Group Flow (vph)	111	0	3	40	118	0
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	16.9% ICU Level of Service A
Analysis Period (min)	15

HCM 6th TWSC
 11: Greenland Way & Spring Bluff Way

Timing Plan: Mid Peak

Intersection						
Int Delay, s/veh	4.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y		Y	↑	↑	
Traffic Vol, veh/h	79	1	2	28	22	75
Future Vol, veh/h	79	1	2	28	22	75
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	- None		- None		- None	
Storage Length	0	-	90	-	-	-
Veh in Median Storage#	-	-	0	0	-	-
Grade, %	8	-	-	-8	7	-
Peak Hour Factor	72	72	70	70	82	82
Heavy Vehicles, %	1	2	1	8	5	1
Mvmt Flow	110	1	3	40	27	91

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	119	73	118	0	-	0
Stage 1	73	-	-	-	-	-
Stage 2	46	-	-	-	-	-
Critical Hdwy	8.01	7.02	4.11	-	-	-
Critical Hdwy Stg 1	7.01	-	-	-	-	-
Critical Hdwy Stg 2	7.01	-	-	-	-	-
Follow-up Hdwy	3.509	3.318	2.209	-	-	-
Pot Cap-1 Maneuve	834	973	1476	-	-	-
Stage 1	922	-	-	-	-	-
Stage 2	959	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuve	832	973	1476	-	-	-
Mov Cap-2 Maneuve	832	-	-	-	-	-
Stage 1	920	-	-	-	-	-
Stage 2	959	-	-	-	-	-























Approach	EB	NB	SB
HCM Control Delay, s10		0.5	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1476	-	834	-	-
HCM Lane V/C Ratio	0.002	-	0.133	-	-
HCM Control Delay (s)	7.4	-	10	-	-
HCM Lane LOS	A	-	B	-	-
HCM 95th %tile Q(veh)	0	-	0.5	-	-

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

Timing Plan: PM Peak

												
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	38	5	30	20	2	89	25	943	14	108	1147	23
Future Volume (vph)	38	5	30	20	2	89	25	943	14	108	1147	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		7%			-3%			1%			-2%	
Storage Length (ft)	0		0	100		0	80		190	90		90
Storage Lanes	0		1	1		0	1		1	1		1
Taper Length (ft)	25			25			101			102		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor			0.850		0.853			0.850			0.850	
Frt			0.850		0.853			0.850			0.850	
Flt Protected		0.957		0.950			0.950			0.950		
Satd. Flow (prot)	0	1707	1543	1814	1629	0	1778	1835	1591	1805	1900	1553
Flt Permitted		0.672		0.721			0.062			0.120		
Satd. Flow (perm)	0	1199	1543	1377	1629	0	116	1835	1591	228	1900	1553
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			83			109			83			83
Link Speed (mph)		20			30			40			40	
Link Distance (ft)		619			477			833			1404	
Travel Time (s)		21.1			10.8			14.2			23.9	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.78	0.78	0.78	0.82	0.82	0.82	0.96	0.96	0.96	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	3%	1%	1%	1%	1%	1%	1%	3%	1%	1%	1%	5%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	49	6	38	24	2	109	26	982	15	114	1207	24
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	55	38	24	111	0	26	982	15	114	1207	24
Turn Type	Perm	NA	Perm	Perm	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8			5		2		6
Permitted Phases	4		4	8			2		2	6		6
Detector Phase	4	4	4	8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	8.0	8.0	8.0	8.0	8.0		6.0	15.0	15.0	6.0	15.0	15.0
Minimum Split (s)	14.0	14.0	14.0	14.0	14.0		12.0	21.0	21.0	12.0	21.0	21.0
Total Split (s)	31.0	31.0	31.0	31.0	31.0		21.0	66.0	66.0	21.0	66.0	66.0
Total Split (%)	26.3%	26.3%	26.3%	26.3%	26.3%		17.8%	55.9%	55.9%	17.8%	55.9%	55.9%
Maximum Green (s)	25.0	25.0	25.0	25.0	25.0		15.0	60.0	60.0	15.0	60.0	60.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	6.0	6.0	3.0	6.0	6.0

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

Timing Plan: PM Peak



Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0		3.0	4.0	4.0	3.0	4.0	4.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	20.0	20.0	0.0	20.0	20.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0		0.0	10.0	10.0	0.0	10.0	10.0
Recall Mode	None	None	None	None	None		None	Min	Min	None	Min	Min
Walk Time (s)	7.0	7.0	7.0	7.0	7.0		0.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)	20.0	20.0	20.0	20.0	20.0		0.0	15.0	15.0		22.0	22.0
Pedestrian Calls (#/hr)	0	0	0	0	0		0	0	0		0	0
Act Effct Green (s)		10.2	10.2	10.2	10.2		67.1	61.0	61.0	73.9	70.1	70.1
Actuated g/C Ratio		0.11	0.11	0.11	0.11		0.69	0.63	0.63	0.76	0.72	0.72
v/c Ratio		0.44	0.16	0.17	0.41		0.14	0.85	0.01	0.38	0.88	0.02
Control Delay		51.9	1.8	42.1	13.4		5.4	24.7	0.0	6.7	22.5	0.0
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		51.9	1.8	42.1	13.4		5.4	24.7	0.0	6.7	22.5	0.0
LOS		D	A	D	B		A	C	A	A	C	A
Approach Delay		31.4			18.5			23.8			20.8	
Approach LOS		C			B			C			C	
Queue Length 50th (ft)		32	0	13	1		3	418	0	13	360	0
Queue Length 95th (ft)		63	0	35	40		10	#869	0	31	#1104	0
Internal Link Dist (ft)		539			397			753			1324	
Turn Bay Length (ft)				100			80		190	90		90
Base Capacity (vph)		309	460	355	501		346	1153	1030	419	1372	1144
Starvation Cap Reductn		0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn		0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn		0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio		0.18	0.08	0.07	0.22		0.08	0.85	0.01	0.27	0.88	0.02

Intersection Summary

Area Type: Other
 Cycle Length: 118
 Actuated Cycle Length: 97
 Natural Cycle: 90
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.88
 Intersection Signal Delay: 22.2 Intersection LOS: C
 Intersection Capacity Utilization 89.4% ICU Level of Service E
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 3: Hardin Valley Road & Greenland Way/Performing Arts Way

Ø1	Ø2	Ø4
21 s	66 s	31 s
Ø5	Ø6	Ø8
21 s	66 s	31 s

Lanes, Volumes, Timings
 11: Greenland Way & Spring Bluff Way

Timing Plan: PM Peak



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	64	3	4	47	70	62
Future Volume (vph)	64	3	4	47	70	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	13	12	12	13	13	12
Grade (%)	8%			-8%	7%	
Storage Length (ft)	0	0	90			0
Storage Lanes	1	0	1			0
Taper Length (ft)	25		74			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.994				0.937	
Flt Protected	0.954		0.950			
Satd. Flow (prot)	1770	0	1859	2002	1758	0
Flt Permitted	0.954		0.950			
Satd. Flow (perm)	1770	0	1859	2002	1758	0
Link Speed (mph)	20			30	30	
Link Distance (ft)	419			830	477	
Travel Time (s)	14.3			18.9	10.8	
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.77	0.77	0.92	0.92	0.87	0.87
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	1%	1%	2%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Adj. Flow (vph)	83	4	4	51	80	71
Shared Lane Traffic (%)						
Lane Group Flow (vph)	87	0	4	51	151	0
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	17.9%
	ICU Level of Service A
Analysis Period (min)	15

HCM 6th TWSC
 11: Greenland Way & Spring Bluff Way

Timing Plan: PM Peak

Intersection						
Int Delay, s/veh	3.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y		Y	↑	↑	
Traffic Vol, veh/h	64	3	4	47	70	62
Future Vol, veh/h	64	3	4	47	70	62
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	- None		- None		- None	
Storage Length	0	-	90	-	-	-
Veh in Median Storage#	-	-	0	0	-	-
Grade, %	8	-	-	-8	7	-
Peak Hour Factor	77	77	92	92	87	87
Heavy Vehicles, %	1	1	1	2	1	1
Mvmt Flow	83	4	4	51	80	71

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	175	116	151	0	-	0
Stage 1	116	-	-	-	-	-
Stage 2	59	-	-	-	-	-
Critical Hdwy	8.01	7.01	4.11	-	-	-
Critical Hdwy Stg 1	7.01	-	-	-	-	-
Critical Hdwy Stg 2	7.01	-	-	-	-	-
Follow-up Hdwy	3.509	3.309	2.209	-	-	-
Pot Cap-1 Maneuver	756	915	1436	-	-	-
Stage 1	866	-	-	-	-	-
Stage 2	941	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	754	915	1436	-	-	-
Mov Cap-2 Maneuver	754	-	-	-	-	-
Stage 1	863	-	-	-	-	-
Stage 2	941	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.3	0.6	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1436	-	760	-	-
HCM Lane V/C Ratio	0.003	-	0.114	-	-
HCM Control Delay (s)	7.5	-	10.3	-	-
HCM Lane LOS	A	-	B	-	-
HCM 95th %tile Q(veh)	0	-	0.4	-	-

APPENDIX 4

Similar Site Trip Generation Counts and Snapshot Queue

Trip Gen

Location: Chick-Fil-A Dwy N/O Kingston Overlook Pkg
City: Knoxville

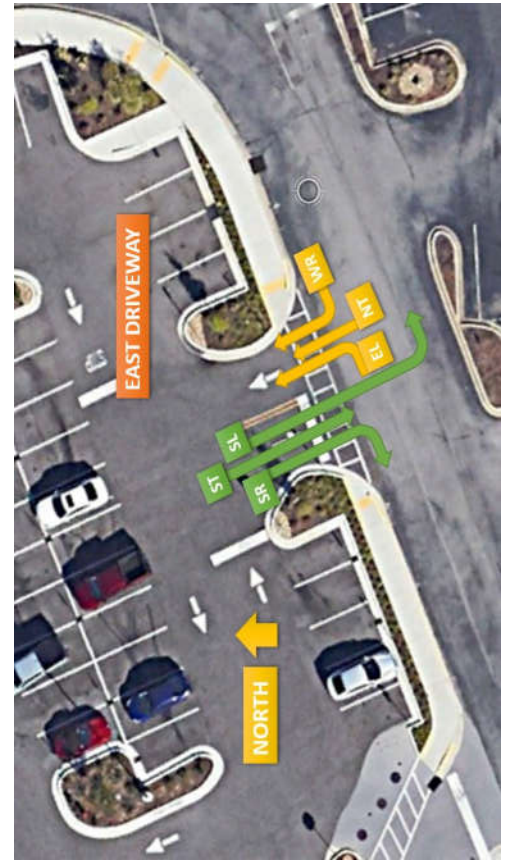
Date: 5/4/2023
Day: Thursday

TIME	East Driveway										West Driveway										Trip OUT	OUTCOME
	NT	In EL	WR	SL	Out ST	SR	NT	In EL	WR	SL	Out ST	SR	NT	In EL	WR	SL	Out ST	SR	IN	OUT		
7:00 AM	0	0	32	3	1	0	0	1	18	0	0	0	0	0	1	0	0	0	33	22	11	
7:15 AM	0	0	32	6	0	0	0	0	26	0	0	0	0	0	0	0	0	0	32	32	0	
7:30 AM	0	1	22	5	0	0	0	0	13	0	0	0	0	0	0	0	0	0	23	18	5	
7:45 AM	1	0	29	8	0	0	0	0	24	0	0	0	0	0	0	0	0	0	30	34	-4	
8:00 AM	1	0	44	6	0	0	0	0	25	0	0	0	0	0	0	0	0	0	45	31	14	
8:15 AM	0	0	39	9	0	0	0	0	30	0	0	0	0	0	0	0	0	0	39	39	0	
8:30 AM	0	0	41	5	0	0	0	0	32	0	0	0	0	0	0	0	0	0	41	38	3	
8:45 AM	0	0	39	7	0	0	0	0	31	0	0	0	0	0	0	0	0	0	39	40	-1	
11:00 AM	0	2	38	8	0	0	0	0	20	0	0	0	0	0	0	0	0	0	40	28	12	
11:15 AM	0	0	44	12	0	0	0	0	32	0	0	0	0	0	0	0	0	0	44	48	-4	
11:30 AM	0	0	47	9	1	0	0	0	35	2	0	0	0	0	0	0	0	0	47	47	0	
11:45 AM	1	0	59	15	0	0	0	0	39	0	0	0	0	0	0	0	0	0	60	57	3	
12:00 PM	0	2	74	8	0	0	0	0	37	4	1	2	0	0	0	0	0	0	76	50	26	
12:15 PM	1	1	57	10	1	0	0	0	45	2	2	0	0	0	0	0	0	0	59	60	-1	
12:30 PM	1	0	72	11	1	0	0	0	50	2	2	0	0	0	0	0	0	0	73	66	7	
12:45 PM	1	1	49	18	1	0	0	0	41	1	1	0	0	0	0	0	0	0	51	62	-11	
4:00 PM	0	0	27	7	0	0	0	0	19	0	0	0	0	0	0	0	0	0	27	27	0	
4:15 PM	0	0	23	7	0	0	0	0	19	0	0	0	0	0	0	0	0	0	23	27	-4	
4:30 PM	0	2	14	6	0	0	0	0	17	1	0	0	0	0	0	0	0	0	16	24	-8	
4:45 PM	1	2	22	2	0	0	0	0	11	1	0	0	0	0	0	0	0	0	26	14	12	
5:00 PM	0	0	24	5	0	0	0	0	22	0	0	0	0	0	0	0	0	0	24	28	-4	
5:15 PM	0	1	29	6	0	0	0	0	21	0	0	0	0	0	0	0	0	0	30	27	3	
5:30 PM	0	1	34	3	0	0	0	0	16	2	0	0	0	0	0	0	0	0	35	21	14	
5:45 PM	0	1	26	8	0	0	0	0	27	2	0	0	0	0	0	0	0	0	27	37	-10	
Totals	7	14	917	184	5	3	0	0	650	24	11	0	0	0	2	24	11	940	877	63		

IN 137
OUT 122

IN 242
OUT 214

IN 115
OUT 90



Snapshot Queue

Location: Chick-fil-A, 9646 Kingston Pike

City: Knoxville, TN

Date: 5/4/2023 (Thu)

Time	Snapshot Queue Length (# of Vehicles)		
	QUEUE 1	QUEUE 2	QUEUE 3
	From Pick Up Window to Order Window/Order Board (2 lanes combined)	From Order Window/Order Board to the End of the Queue OR Driveway Entrance/Street (if Queue continues onto street)	From Driveway entrance/street to the end of the queue ** Applies only if Queue reaches street
7:00 AM	3	4	0
7:05 AM	3	1	0
7:10 AM	2	3	0
7:15 AM	4	1	0
7:20 AM	4	2	0
7:25 AM	4	4	0
7:30 AM	8	2	0
7:35 AM	9	3	0
7:40 AM	8	1	0
7:45 AM	7	2	0
7:50 AM	4	1	0
7:55 AM	6	2	0
8:00 AM	9	5	0
8:05 AM	7	5	0
8:10 AM	8	5	0
8:15 AM	8	6	0
8:20 AM	10	7	0
8:25 AM	6	6	0
8:30 AM	9	7	0
8:35 AM	8	6	0
8:40 AM	8	7	0
8:45 AM	8	4	0
8:50 AM	6	3	0
8:55 AM	7	2	0
9:00 AM	7	7	0
11:00 AM	6	2	0
11:05 AM	7	1	0
11:10 AM	8	3	0
11:15 AM	8	4	0
11:20 AM	9	3	0
11:25 AM	8	0	0
11:30 AM	8	5	0
11:35 AM	9	3	0
11:40 AM	5	2	0
11:45 AM	10	5	0
11:50 AM	12	3	0
11:55 AM	6	3	0
12:00 PM	8	4	0
12:05 PM	4	6	0
12:10 PM	10	7	0
12:15 PM	10	9	0
12:20 PM	13	7	0
12:25 PM	14	6	0
12:30 PM	14	6	0
12:35 PM	15	7	0
12:40 PM	14	4	0
12:45 PM	14	12	0

12:50 PM	12	10	0
12:55 PM	13	10	0
1:00 PM	13	7	0
4:00 PM	5	1	0
4:05 PM	0	2	0
4:10 PM	5	1	0
4:15 PM	4	1	0
4:20 PM	1	1	0
4:25 PM	5	0	0
4:30 PM	4	0	0
4:35 PM	5	1	0
4:40 PM	2	1	0
4:45 PM	1	0	0
4:50 PM	3	1	0
4:55 PM	6	1	0
5:00 PM	7	1	0
5:05 PM	8	2	0
5:10 PM	7	4	0
5:15 PM	5	5	0
5:20 PM	6	3	0
5:25 PM	8	2	0
5:30 PM	5	2	0
5:35 PM	7	3	0
5:40 PM	7	2	0
5:45 PM	6	2	0
5:50 PM	5	2	0
5:55 PM	6	1	0
6:00 PM	3	2	0
Totals	534	266	0

APPENDIX 5

SYNCHRO REPORTS POST-DEVELOPMENT

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

Timing Plan: AM Peak

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	3	3	30	58	13	150	16	1011	90	103	1085	6
Future Volume (vph)	3	3	30	58	13	150	16	1011	90	103	1085	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		7%			-3%			1%				-2%
Storage Length (ft)	0		0	100		0	80		190	90		90
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (ft)	25			25			101			102		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t		0.865			0.862				0.850			0.850
Fl _t Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1725	1570	0	1814	1646	0	1778	1853	1591	1787	1828	1615
Fl _t Permitted	0.559			0.452			0.045			0.042		
Satd. Flow (perm)	1015	1570	0	863	1646	0	84	1853	1591	79	1828	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		46			195				91			91
Link Speed (mph)		20			30			40				40
Link Distance (ft)		619			477			833				1404
Travel Time (s)		21.1			10.8			14.2				23.9
Peak Hour Factor	0.65	0.65	0.65	0.77	0.77	0.77	0.88	0.88	0.88	0.92	0.92	0.92
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	2%	1%	2%	5%	1%
Adj. Flow (vph)	5	5	46	75	17	195	18	1149	102	112	1179	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	51	0	75	212	0	18	1149	102	112	1179	7
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2		2	6		6
Detector Phase	7	4		3	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	6.0	8.0		6.0	8.0		6.0	15.0	15.0	6.0	15.0	15.0
Minimum Split (s)	12.0	33.0		12.0	33.0		12.0	28.0	28.0	12.0	35.0	35.0
Total Split (s)	40.0	33.0		40.0	33.0		12.0	90.0	90.0	17.0	95.0	95.0
Total Split (%)	22.2%	18.3%		22.2%	18.3%		6.7%	50.0%	50.0%	9.4%	52.8%	52.8%
Maximum Green (s)	34.0	27.0		34.0	27.0		6.0	84.0	84.0	11.0	89.0	89.0
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	6.0	6.0	3.0	6.0	6.0
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	4.0	4.0	3.0	4.0	4.0
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	20.0	20.0	0.0	20.0	20.0
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	10.0	10.0	0.0	10.0	10.0
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Walk Time (s)		7.0			7.0			0.0	7.0	7.0		7.0
Flash Dont Walk (s)		20.0			20.0			0.0	15.0	15.0		22.0
Pedestrian Calls (#/hr)		0			0			0	0	0		0
Act Effct Green (s)	12.7	8.4		21.7	19.3		90.4	84.4	84.4	99.3	95.1	95.1

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

Timing Plan: AM Peak



Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Actuated g/C Ratio	0.10	0.06		0.16	0.14		0.68	0.63	0.63	0.74	0.71	0.71
v/c Ratio	0.04	0.36		0.35	0.52		0.14	0.98	0.10	0.63	0.90	0.01
Control Delay	47.0	27.4		52.7	14.4		8.4	47.6	3.2	42.7	29.7	0.0
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.0	27.4		52.7	14.4		8.4	47.6	3.2	42.7	29.7	0.0
LOS	D	C		D	B		A	D	A	D	C	A
Approach Delay		29.2			24.4			43.5			30.7	
Approach LOS		C			C			D			C	
Queue Length 50th (ft)	4	4		58	13		4	~994	4	47	700	0
Queue Length 95th (ft)	11	23		90	53		12	#1370	28	120	#1436	0
Internal Link Dist (ft)		539			397			753			1324	
Turn Bay Length (ft)				100			80		190	90		90
Base Capacity (vph)	441	355		464	490		133	1172	1040	200	1303	1177
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.14		0.16	0.43		0.14	0.98	0.10	0.56	0.90	0.01

Intersection Summary













Area Type:	Other
Cycle Length:	180
Actuated Cycle Length:	133.4
Natural Cycle:	145
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.98
Intersection Signal Delay:	35.6
Intersection LOS:	D
Intersection Capacity Utilization:	87.1%
ICU Level of Service:	E
Analysis Period (min):	15
~ Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.	
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.	

Splits and Phases: 3: Hardin Valley Road & Greenland Way/Performing Arts Way

17 s	90 s	40 s	33 s
12 s	95 s	40 s	33 s

Lanes, Volumes, Timings
 11: Greenland Way & Spring Bluff Way

Timing Plan: AM Peak

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	153	10	13	75	19	166
Future Volume (vph)	153	10	13	75	19	166
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	13	12	12	13	13	12
Grade (%)	8%			-8%	7%	
Storage Length (ft)	0	100	90			100
Storage Lanes	1	1	1			1
Taper Length (ft)	25		74			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t		0.850				0.850
Fl _t Protected	0.950		0.950			
Satd. Flow (prot)	1738	1535	1859	2022	1876	1543
Fl _t Permitted	0.950		0.950			
Satd. Flow (perm)	1738	1535	1859	2022	1876	1543
Link Speed (mph)	20			30	30	
Link Distance (ft)	419			830	477	
Travel Time (s)	14.3			18.9	10.8	
Peak Hour Factor	0.59	0.59	0.68	0.68	0.73	0.73
Heavy Vehicles (%)	3%	1%	1%	1%	1%	1%
Adj. Flow (vph)	259	17	19	110	26	227
Shared Lane Traffic (%)						
Lane Group Flow (vph)	259	17	19	110	26	227
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	22.5% ICU Level of Service A
Analysis Period (min)	15

Intersection						
Int Delay, s/veh	5.3					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↗	↗	↖
Traffic Vol, veh/h	153	10	13	75	19	166
Future Vol, veh/h	153	10	13	75	19	166
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	- None		- None		- None	
Storage Length	0	100	90	-	-	100
Veh in Median Storage#	-	-	0	0	-	-
Grade, %	8	-	-	-8	7	-
Peak Hour Factor	59	59	68	68	73	73
Heavy Vehicles, %	3	1	1	1	1	1
Mvmt Flow	259	17	19	110	26	227

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	174	26	253	0	-	0
Stage 1	26	-	-	-	-	-
Stage 2	148	-	-	-	-	-
Critical Hdwy	8.03	7.01	4.11	-	-	-
Critical Hdwy Stg 1	7.03	-	-	-	-	-
Critical Hdwy Stg 2	7.03	-	-	-	-	-
Follow-up Hdwy	3.527	3.309	2.209	-	-	-
Pot Cap-1 Maneuver	753	1047	1318	-	-	-
Stage 1	983	-	-	-	-	-
Stage 2	821	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	742	1047	1318	-	-	-
Mov Cap-2 Maneuver	742	-	-	-	-	-
Stage 1	969	-	-	-	-	-
Stage 2	821	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	2.2	1.1	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1318	-	742	1047	-	-
HCM Lane V/C Ratio	0.015	-	0.349	0.016	-	-
HCM Control Delay (s)	7.8	-	12.4	8.5	-	-
HCM Lane LOS	A	-	B	A	-	-
HCM 95th %tile Q(veh)	0	-	1.6	0	-	-

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

Timing Plan: Mid Peak

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	103	22	25	87	11	206	33	585	71	231	542	71
Future Volume (vph)	103	22	25	87	11	206	33	585	71	231	542	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		7%			-3%			1%			-2%	
Storage Length (ft)	0		0	100		0	80		190	90		90
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (ft)	25			25			101			102		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t		0.921			0.858				0.850			0.850
Fl _t Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1725	1672	0	1814	1593	0	1778	1835	1591	1787	1828	1615
Fl _t Permitted	0.315			0.710			0.261			0.159		
Satd. Flow (perm)	572	1672	0	1356	1593	0	489	1835	1591	299	1828	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		26			264				91			91
Link Speed (mph)		20			30			40			40	
Link Distance (ft)		619			477			833			1404	
Travel Time (s)		16.9			10.8			14.2			23.9	
Peak Hour Factor	0.65	0.65	0.65	0.78	0.78	0.78	0.93	0.93	0.93	0.82	0.82	0.82
Heavy Vehicles (%)	1%	1%	1%	1%	1%	4%	1%	3%	1%	2%	5%	1%
Adj. Flow (vph)	158	34	38	112	14	264	35	629	76	282	661	87
Shared Lane Traffic (%)												
Lane Group Flow (vph)	158	72	0	112	278	0	35	629	76	282	661	87
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2		2	6		6
Detector Phase	7	4		3	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	6.0	8.0		6.0	8.0		6.0	15.0	15.0	6.0	15.0	15.0
Minimum Split (s)	12.0	33.0		12.0	33.0		12.0	28.0	28.0	12.0	35.0	35.0
Total Split (s)	40.0	33.0		40.0	33.0		12.0	90.0	90.0	17.0	95.0	95.0
Total Split (%)	22.2%	18.3%		22.2%	18.3%		6.7%	50.0%	50.0%	9.4%	52.8%	52.8%
Maximum Green (s)	34.0	27.0		34.0	27.0		6.0	84.0	84.0	11.0	89.0	89.0
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	6.0	6.0	3.0	6.0	6.0
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	4.0	4.0	3.0	4.0	4.0
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	20.0	20.0	0.0	20.0	20.0
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	10.0	10.0	0.0	10.0	10.0
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Walk Time (s)		7.0			7.0		0.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)		20.0			20.0		0.0	15.0	15.0		22.0	22.0
Pedestrian Calls (#/hr)		0			0		0	0	0		0	0
Act Effct Green (s)	28.1	14.8		23.4	10.4		51.7	45.4	45.4	62.6	56.6	56.6

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

Timing Plan: Mid Peak

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Actuated g/C Ratio	0.26	0.14		0.22	0.10		0.48	0.42	0.42	0.58	0.52	0.52
v/c Ratio	0.50	0.29		0.31	0.71		0.11	0.82	0.11	0.85	0.69	0.10
Control Delay	37.7	34.9		33.8	18.9		12.1	37.6	3.2	40.0	26.1	3.6
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.7	34.9		33.8	18.9		12.1	37.6	3.2	40.0	26.1	3.6
LOS	D	C		C	B		B	D	A	D	C	A
Approach Delay		36.8			23.1			32.8			28.0	
Approach LOS		D			C			C			C	
Queue Length 50th (ft)	79	27		54	9		9	347	0	82	339	0
Queue Length 95th (ft)	122	55		110	52		30	636	21	#232	546	20
Internal Link Dist (ft)		539			397			753			1324	
Turn Bay Length (ft)				100			80		190	90		90
Base Capacity (vph)	578	455		625	610		307	1478	1299	330	1539	1374
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.16		0.18	0.46		0.11	0.43	0.06	0.85	0.43	0.06

Intersection Summary













Area Type: Other
 Cycle Length: 180
 Actuated Cycle Length: 108.2
 Natural Cycle: 105
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.85
 Intersection Signal Delay: 29.6 Intersection LOS: C
 Intersection Capacity Utilization 82.6% ICU Level of Service E
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 3: Hardin Valley Road & Greenland Way/Performing Arts Way

17 s	90 s	40 s	33 s
12 s	95 s	40 s	33 s

Lanes, Volumes, Timings
 11: Greenland Way & Spring Bluff Way

Timing Plan: Mid Peak

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	273	21	12	27	18	307
Future Volume (vph)	273	21	12	27	18	307
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	13	12	12	13	13	12
Grade (%)	8%			-8%	7%	
Storage Length (ft)	0	100	90			100
Storage Lanes	1	1	1			1
Taper Length (ft)	50		74			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1773	1520	1859	1891	1804	1543
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1773	1520	1859	1891	1804	1543
Link Speed (mph)	20			30	30	
Link Distance (ft)	419			830	477	
Travel Time (s)	14.3			18.9	10.8	
Peak Hour Factor	0.72	0.72	0.70	0.70	0.82	0.82
Heavy Vehicles (%)	1%	2%	1%	8%	5%	1%
Adj. Flow (vph)	379	29	17	39	22	374
Shared Lane Traffic (%)						
Lane Group Flow (vph)	379	29	17	39	22	374
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	29.1% ICU Level of Service A
Analysis Period (min)	15

HCM 6th TWSC
 11: Greenland Way & Spring Bluff Way

Timing Plan: Mid Peak

Intersection						
Int Delay, s/veh	6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↗	↗	↖
Traffic Vol, veh/h	273	21	12	27	18	307
Future Vol, veh/h	273	21	12	27	18	307
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	- None		- None		- None	
Storage Length	0	100	90	-	-	100
Veh in Median Storage#	-	-	0	0	-	-
Grade, %	8	-	-	-8	7	-
Peak Hour Factor	72	72	70	70	82	82
Heavy Vehicles, %	1	2	1	8	5	1
Mvmt Flow	379	29	17	39	22	374

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	95	22	396	0	-	0
Stage 1	22	-	-	-	-	-
Stage 2	73	-	-	-	-	-
Critical Hdwy	8.01	7.02	4.11	-	-	-
Critical Hdwy Stg 1	7.01	-	-	-	-	-
Critical Hdwy Stg 2	7.01	-	-	-	-	-
Follow-up Hdwy	3.509	3.318	2.209	-	-	-
Pot Cap-1 Maneuve	870	1050	1168	-	-	-
Stage 1	993	-	-	-	-	-
Stage 2	922	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuve	857	1050	1168	-	-	-
Mov Cap-2 Maneuve	857	-	-	-	-	-
Stage 1	978	-	-	-	-	-
Stage 2	922	-	-	-	-	-

























Approach	EB	NB	SB
HCM Control Delay, s	12.2	2.5	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1168	-	857	1050	-	-
HCM Lane V/C Ratio	0.015	-	0.442	0.028	-	-
HCM Control Delay (s)	8.1	-	12.5	8.5	-	-
HCM Lane LOS	A	-	B	A	-	-
HCM 95th %tile Q(veh)	0	-	2.3	0.1	-	-

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

08/07/2023

													
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR	
Lane Configurations													
Traffic Volume (vph)	38	14	30	62	8	125	25	932	55	162	1132	23	
Future Volume (vph)	38	14	30	62	8	125	25	932	55	162	1132	23	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Grade (%)		7%			-3%			1%				-2%	
Storage Length (ft)	0		0	100		0	80		190	90		90	
Storage Lanes	1		0	1		0	1		1	1		1	
Taper Length (ft)	25			25			101			102			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Fr _t		0.898			0.859				0.850			0.850	
Fl _t Protected	0.950			0.950			0.950			0.950			
Satd. Flow (prot)	1691	1630	0	1814	1640	0	1778	1835	1591	1805	1900	1553	
Fl _t Permitted	0.580			0.492			0.046			0.105			
Satd. Flow (perm)	1032	1630	0	939	1640	0	86	1835	1591	200	1900	1553	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)		38			152				91			91	
Link Speed (mph)		20			30			40				40	
Link Distance (ft)		619			477			833				1404	
Travel Time (s)		21.1			10.8			14.2				23.9	
Peak Hour Factor	0.78	0.78	0.78	0.82	0.82	0.82	0.96	0.96	0.96	0.95	0.95	0.95	
Heavy Vehicles (%)	3%	1%	1%	1%	1%	1%	1%	3%	1%	1%	1%	5%	
Adj. Flow (vph)	49	18	38	76	10	152	26	971	57	171	1192	24	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	49	56	0	76	162	0	26	971	57	171	1192	24	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6		
Permitted Phases	4			8			2		2	6		6	
Detector Phase	7	4		3	8		5	2	2	1	6	6	
Switch Phase													
Minimum Initial (s)	6.0	8.0		6.0	8.0		6.0	15.0	15.0	6.0	15.0	15.0	
Minimum Split (s)	12.0	33.0		12.0	33.0		12.0	28.0	28.0	12.0	35.0	35.0	
Total Split (s)	40.0	33.0		40.0	33.0		12.0	90.0	90.0	17.0	95.0	95.0	
Total Split (%)	22.2%	18.3%		22.2%	18.3%		6.7%	50.0%	50.0%	9.4%	52.8%	52.8%	
Maximum Green (s)	34.0	27.0		34.0	27.0		6.0	84.0	84.0	11.0	89.0	89.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	6.0	6.0	3.0	6.0	6.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	4.0	4.0	3.0	4.0	4.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	20.0	20.0	0.0	20.0	20.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	10.0	10.0	0.0	10.0	10.0	
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min	
Walk Time (s)		7.0			7.0			0.0	7.0	7.0		7.0	
Flash Dont Walk (s)		20.0			20.0			0.0	15.0	15.0		22.0	
Pedestrian Calls (#/hr)		0			0			0	0	0		0	
Act Effct Green (s)	15.7	8.7		18.8	10.1		90.3	84.3	84.3	100.8	94.4	94.4	

Lanes, Volumes, Timings

3: Hardin Valley Road & Greenland Way/Performing Arts Way

08/07/2023



Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Actuated g/C Ratio	0.12	0.06		0.14	0.07		0.67	0.62	0.62	0.74	0.70	0.70
v/c Ratio	0.30	0.40		0.38	0.62		0.20	0.85	0.06	0.61	0.90	0.02
Control Delay	52.4	36.3		54.0	21.9		10.0	31.0	0.7	20.2	30.9	0.0
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.4	36.3		54.0	21.9		10.0	31.0	0.7	20.2	30.9	0.0
LOS	D	D		D	C		B	C	A	C	C	A
Approach Delay		43.8			32.1			28.9			29.1	
Approach LOS		D			C			C			C	
Queue Length 50th (ft)	37	16		59	9		6	680	0	40	942	0
Queue Length 95th (ft)	65	49		96	61		16	#1108	6	114	#1443	0
Internal Link Dist (ft)		539			397			753			1324	
Turn Bay Length (ft)				100			80		190	90		90
Base Capacity (vph)	425	356		456	449		132	1140	1023	279	1322	1109
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.16		0.17	0.36		0.20	0.85	0.06	0.61	0.90	0.02

Intersection Summary













Area Type:	Other
Cycle Length:	180
Actuated Cycle Length:	135.6
Natural Cycle:	145
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.90
Intersection Signal Delay:	29.8
Intersection LOS:	C
Intersection Capacity Utilization:	97.7%
ICU Level of Service:	F
Analysis Period (min):	15
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.	

Splits and Phases: 3: Hardin Valley Road & Greenland Way/Performing Arts Way

17 s	90 s	40 s	33 s
12 s	95 s	40 s	33 s

Lanes, Volumes, Timings
 11: Greenland Way & Spring Bluff Way

08/07/2023

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	149	8	13	46	68	168
Future Volume (vph)	149	8	13	46	68	168
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	13	12	12	13	13	12
Grade (%)	8%			-8%	7%	
Storage Length (ft)	0	100	90			100
Storage Lanes	1	1	1			1
Taper Length (ft)	25		74			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr _t		0.850				0.850
Fl _t Protected	0.950		0.950			
Satd. Flow (prot)	1773	1535	1859	2002	1876	1543
Fl _t Permitted	0.950		0.950			
Satd. Flow (perm)	1773	1535	1859	2002	1876	1543
Link Speed (mph)	20			30	30	
Link Distance (ft)	419			830	477	
Travel Time (s)	14.3			18.9	10.8	
Peak Hour Factor	0.77	0.77	0.92	0.92	0.87	0.87
Heavy Vehicles (%)	1%	1%	1%	2%	1%	1%
Adj. Flow (vph)	194	10	14	50	78	193
Shared Lane Traffic (%)						
Lane Group Flow (vph)	194	10	14	50	78	193
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	22.3% ICU Level of Service A
Analysis Period (min)	15

Intersection

Int Delay, s/veh 4.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↗	↗	↖
Traffic Vol, veh/h	149	8	13	46	68	168
Future Vol, veh/h	149	8	13	46	68	168
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	- None	- None	- None	- None	- None	- None
Storage Length	0	100	90	-	-	100
Veh in Median Storage#	-	-	0	0	-	-
Grade, %	8	-	-	-8	7	-
Peak Hour Factor	77	77	92	92	87	87
Heavy Vehicles, %	1	1	1	2	1	1
Mvmt Flow	194	10	14	50	78	193

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	156	78	271
Stage 1	78	-	-
Stage 2	78	-	-
Critical Hdwy	8.01	7.01	4.11
Critical Hdwy Stg 1	7.01	-	-
Critical Hdwy Stg 2	7.01	-	-
Follow-up Hdwy	3.509	3.309	2.209
Pot Cap-1 Maneuver	782	969	1298
Stage 1	915	-	-
Stage 2	915	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	773	969	1298
Mov Cap-2 Maneuver	773	-	-
Stage 1	905	-	-
Stage 2	915	-	-

Approach	EB	NB	SB
HCM Control Delay, s	1.1	1.7	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1298	-	773	969	-	-
HCM Lane V/C Ratio	0.011	-	0.25	0.011	-	-
HCM Control Delay (s)	7.8	-	11.2	8.8	-	-
HCM Lane LOS	A	-	B	A	-	-
HCM 95th %tile Q(veh)	0	-	1	0	-	-