

***NORTHSHORE TOWN CENTER  
GI for KIDS MEDICAL OFFICE  
AND RESUBDIVISION  
Knoxville, Tennessee***

***TRAFFIC IMPACT STUDY***

***Prepared For:  
NORTHSHORE MARKET, LLC***

***Prepared By:***



**February 2018**

Revised April 2018

**NORTHSHORE TOWN CENTER  
GI FOR KIDS MEDICAL OFFICE  
AND SUBDISION  
KNOXVILLE, TENNESSEE**

**TRAFFIC IMPACT STUDY**

Prepared for:

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**February 2018  
Revised April 2018**

Prepared by

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**Project No. 226779**

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## INTRODUCTION

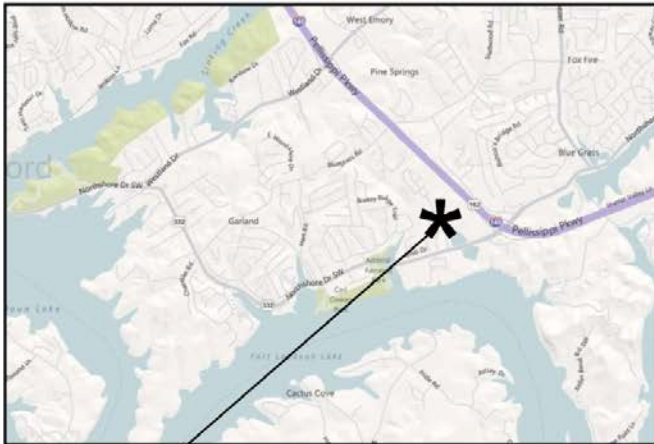
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CDM Smith is pleased to submit this report to update the traffic study of the Northshore Town Center traffic impact assessment prepared in March of 2011 and address the GI for Kids medical office and an associated resubdivision of Lot 8 proposed within the Northshore Town Center site. Northshore Town Center is located in the northwest quadrant of the Northshore Drive (S.R. 332) and Pellissippi Parkway (I-140) interchange in Knox County, Tennessee. The site is within the city limits of Knoxville. **Figure 1** depicts the vicinity map. Pellissippi Parkway accommodated a 2016 average daily traffic of 48,320 northwest of Northshore Drive in Knox County, Tennessee. The study updated the traffic counts within the site vicinity and updated the trip generation for the Northshore Town Center, accounting for the changes in any of the previous identified and/or assumed land uses. The proposed medical office use replaces a general office use and a proposed Chick-fil-A replaces the previously studied gas station with convenience store.

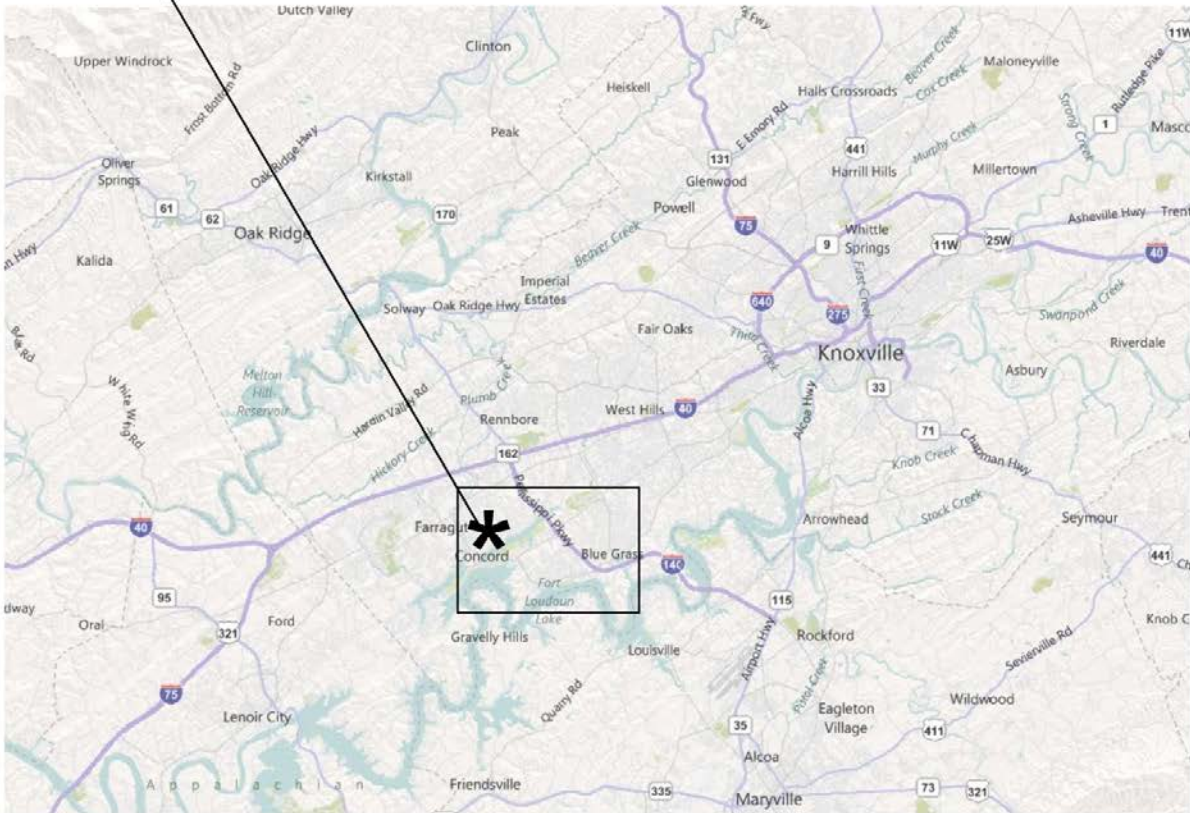
The proposed GI for Kids is a 24,000 square-foot medical office located in the northwest quadrant of the Town Center Boulevard and Boardwalk Boulevard intersection. This intersection is a roundabout that provides access from the Pellissippi Parkway (I-140) southbound off-ramp. The GI for Kids medical office is part of a resubdivision of the previously identified Zone D of the 2011 traffic study. There is not any current development plans of the subdivision other than the GI for Kids medical office. The site plan is illustrated in **Figure 2** of this report.

Northshore Drive is a mixture of 4 lane divided and 5 lanes from Ebenezer Road to just west of Pellissippi Parkway. Northshore Drive is classified as a major arterial adjacent to the Northshore Town Center and a minor arterial west of Concord Road. Northshore Drive was improved in conjunction with the development of Northshore Town Center and interchange improvements. These improvements included widening of Northshore Drive to a 4-lane undivided and divided facility, addition of the required turn lanes for Northshore Town Center, and signalization of Northshore Drive intersections with Town Center Boulevard Thunderhead Road. Northshore Drive becomes divided as the eastbound double left-turn lanes are developed for the intersection with Town Center Boulevard. The westbound approach on Northshore Drive to Thunderhead Road currently has right-lane drop that transitions the 4-lane to the 2-lane facility. **Figure 3** shows existing intersection geometry at the study area intersections.

**VICINITY MAP**  
**Northshore Town Center**  
**Knoxville, TN**

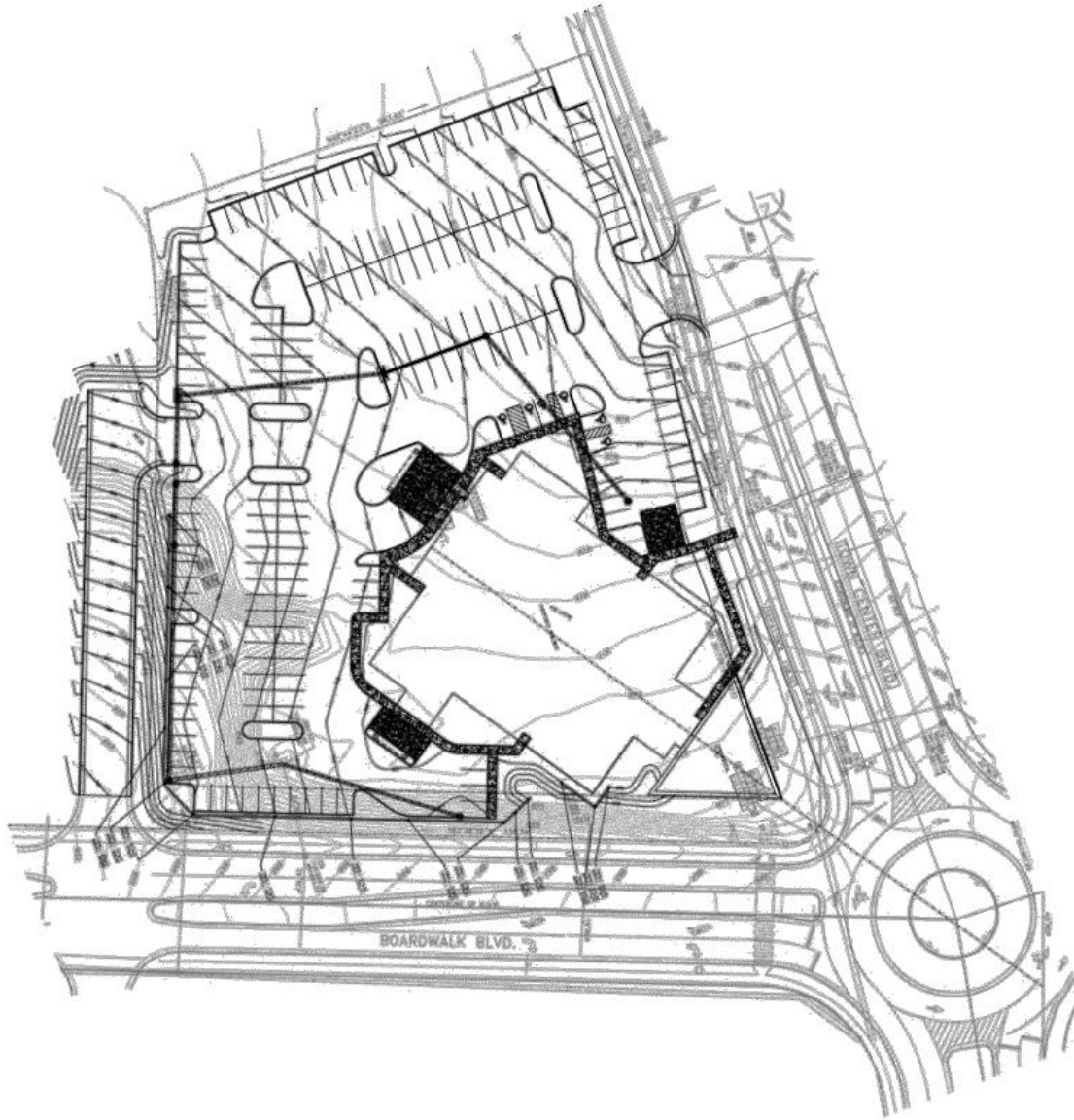


**SITE**



**Figure 1**

**SITE PLAN**  
**GI for KIDS MEDICAL OFFICE**  
**Northshore Town Center**  
**Knoxville, TN**



**Figure 2**

# GEOMETRY AND TRAFFIC CONTROL

## Northshore Town Center Knoxville, TN

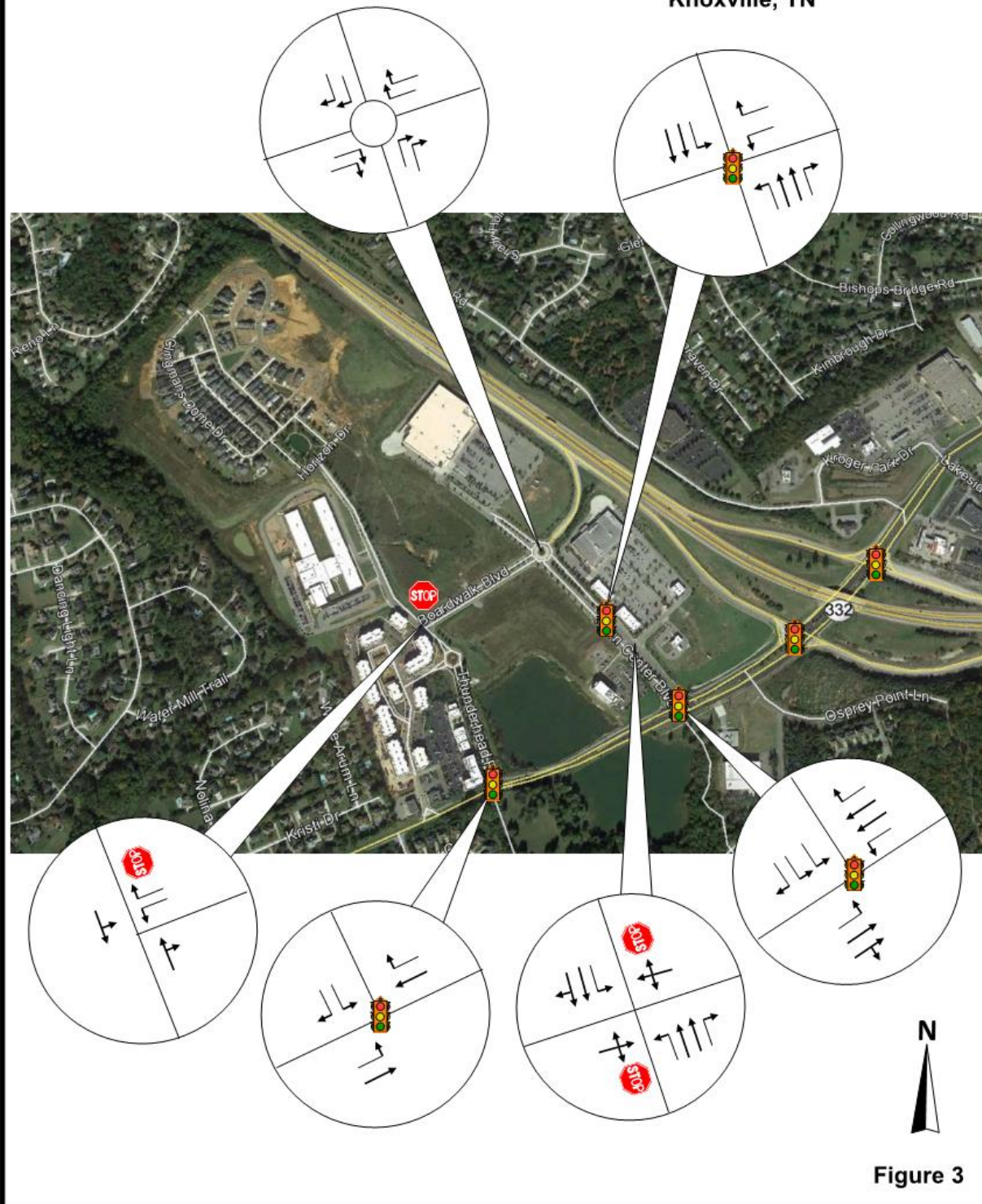


Figure 3

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## EXISTING TRAFFIC

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Existing traffic for the study was collected for the intersections of Thunderhead Road at Northshore Drive and Boardwalk Boulevard in February 2018. Traffic for the Town Center Boulevard intersections with Northshore Drive, Boardwalk Boulevard, and the Publix shopping center driveways were obtained from the traffic study prepared for a proposed Chick-fil-A and were collected in November of 2017. **Figure 4** illustrates the AM and PM peak-hour turning movements for the study intersections. The thru traffic movements on Northshore Drive were increased 2-percent for an adjustment for 2018 traffic.

A left-turn lane analysis of the southbound approach on Thunderhead Road to Boardwalk Boulevard determined that a 125-foot lane is warranted. This lane was a recommended turn lane from the March 2011 traffic study for Northshore Town Center. The provision of this left-turn lane seems precluded with the left-turn lane constructed for the elementary school access.

The northbound approach of the Town Center Boulevard to the Target parking does not currently have signing or markings for the right-lane drop from the roundabout. This signing and marking should be provided in advance of the drop lane for the more efficient flow of traffic into the site.



# 2018 EXISTING TRAFFIC Northshore Town Center Knoxville, TN

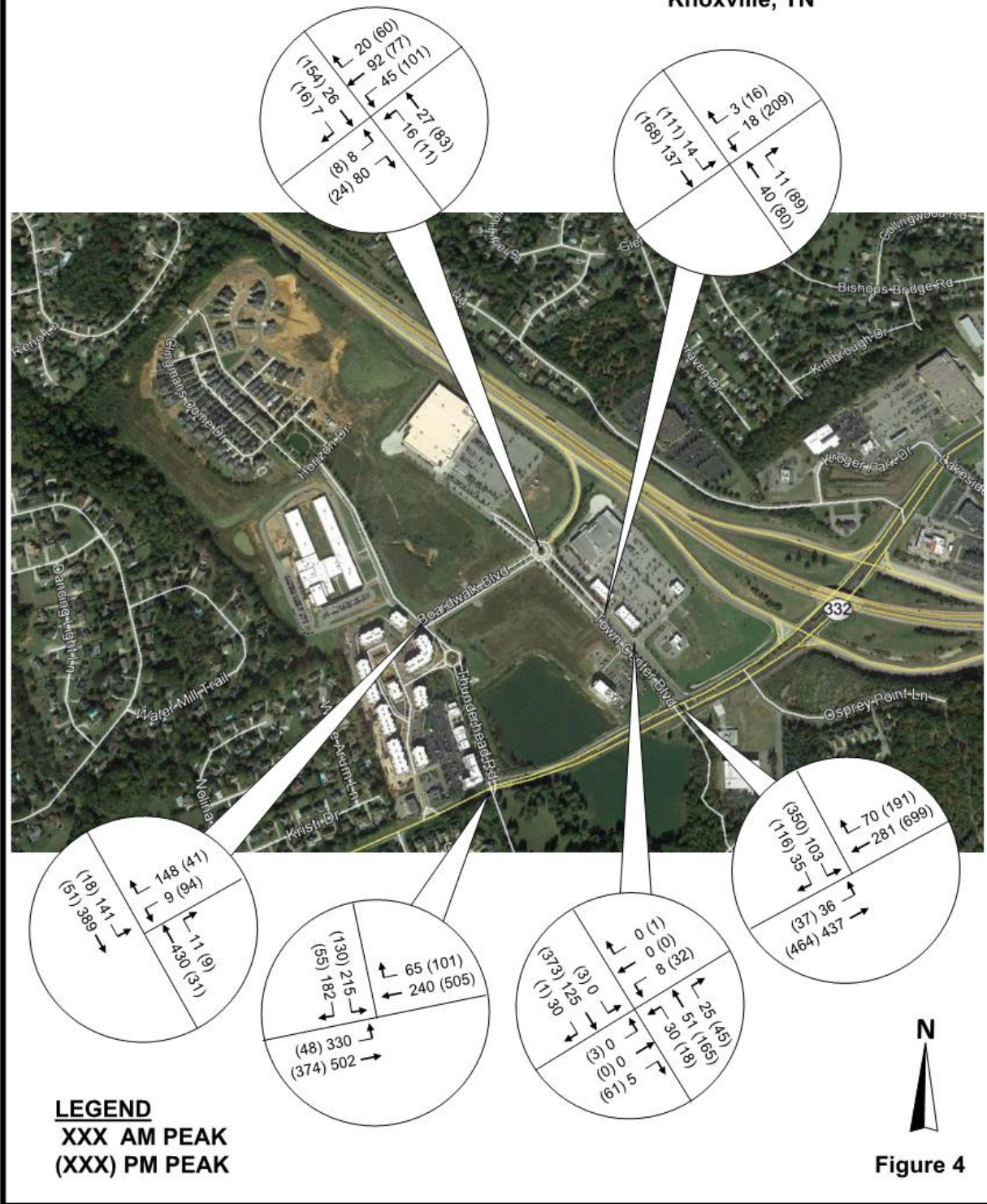


Figure 4

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## PROJECTED TRAFFIC CONDITIONS

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Traffic for this study was projected for the buildout of Northshore Town Center with the proposed changes in the land uses including a proposed Chick-fil-A restaurant and the GI for Kids medical office. A background traffic condition was developed assuming buildout of Northshore Town Center with the proposed Chick-fil-A. Background traffic is traffic that can be anticipated in the site vicinity and is for the purpose of establishing a baseline condition with which to evaluate the traffic impact of the GI for Kids medical office.

In addition to the Northshore Town Center buildout, traffic should grow on Northshore Drive as development occurs along Northshore Drive to the east and west of the site. Therefore, traffic on Northshore Drive was increased 4-percent, reflecting an average annual growth rate of 2-percent for a 2020 horizon year. The 2015 TDOT AADT for Northshore Drive (SR 332) increased approximately 22-percent since 2005, but the 2016 TDOT AADT exhibited an approximate 23-percent decline in the ADT; therefore, the 2-percent growth rate was assumed and is consistent with the rates assumed for the 2011 traffic study, the Chick-fil-A traffic study, and the Aventine Northshore Apartments traffic study.

The buildout of Northshore Town Center adjusted the trip generation previously developed in the 2011 study to reflect the 9<sup>th</sup> edition of **Trip Generation** and the new proposed land uses. **Table 1** presents the trip generation for the Northshore Town Center buildout including any proposed revised land uses. Both the Target and Publix for the Town Center have developed and their respective trips are in the existing traffic counts conducted end of 2017 and beginning of 2018. The ancillary shopping and an outparcel has developed in conjunction with the Publix store. The trip generation for the proposed medical office is removed from the trip generation for the site buildout. The total trip generation for the background traffic is summarized in **Table 2**. With exception of the medical office, the trip generation and trip assignment for Zone D remained consistent with the 2011 traffic study. The trip generation from the 2011 traffic study is available in the appendix for comparison purposes.

Trips for the proposed GI for Kids medical office is generated using the ITE land use code (LUC 720) and is presented in **Table 3**. From the trip generation calculations, the proposed GI for Kids medical office may generate approximately 766 daily weekday trips. The previous study prepared March of 2011 generated trips for a 17,500 square-foot general office land use. The

proposed medical land use will generate additional daily trips but is not significant relative to the buildout of Northshore Town Center.

**TABLE 1 NORTHSORE TOWN CENTER  
TRIP GENERATION FOR BUILDOUT**

ZONE	LAND USE	L.U.C	SIZE	DAILY TRAFFIC	ENTER	AM PEAK EXIT	TOTAL	ENTER	PM PEAK EXIT	TOTAL
A	DISCOUNT STORE (1)	815	135,320			EXISTING TRAFFIC				
	H.T. RESTAURANT	932	6,500	826	39	32	70	38	26	64
	DRIVE-IN BANK	912	4,500	667	31	23	54	55	55	110
	SUB-TOTAL		146,320	1,493	70	55	124	93	81	174
	Internal Trips	10%		149	7	6	12	9	8	17
	Pass-By Trips	20%		299	14	11	25	19	16	35
	Primary Trips			1,045	49	39	87	65	57	122
B	SUPERMARKET (1)	850	54,000			EXISTING TRAFFIC				
	SPECIAL RETAIL (1)	814	25,900			EXISTING TRAFFIC				
	FASTFOOD RESTAURANT (2)	934	4,992	2,477	116	111	227	85	78	163
	DRIVE-IN BANK	912	4,500			EXISTING TRAFFIC				
	SUB-TOTAL		89,392	2,477	116	111	227	85	78	163
	Internal Trips	10%		248	12	11	23	9	8	16
	Pass-By Trips	20%		495	23	22	45	17	16	33
	Primary Trips			1,734	81	78	159	60	55	114
C	OFFICE BLDG.(1)	710	57,500			EXISTING TRAFFIC				
	SHOPPING CENTER	820	87,000	6,203	89	54	143	262	284	546
	H.T. RESTAURANT	932	14,000	1,780	83	68	151	83	55	138
	MULTIPLEX THEATER	445	8		-	-	-	49	60	109
	SUB-TOTAL		158,500	7,983	172	122	294	394	399	793
	Internal Trips	10%		798	17	12	29	39	40	79
	Pass-By Trips	25%		1,996	43	31	74	99	100	198
	Primary Trips			5,189	112	79	191	256	259	516
D	KNOX CO MULTI-FAMILY	225	24	265	3	11	14	14	12	26
	SHOPPING CENTER	820	79,100	5,831	84	51	135	246	266	512
	MEDICAL OFFICE (2)	720	24,000	766	45	12	57	23	58	81
	SUB-TOTAL		103,100	6,862	132	74	206	283	336	619
	Internal Trips	10%		686	13	7	21	28	34	62
	Pass-By Trips	30%		2,058	40	22	62	85	101	186
	Primary Trips			4,117	79	44	124	170	201	371
E	SINGLE FAMILY	210	120	1,242	23	70	94	78	46	124
	KNOX CO MULTI-FAMILY	225	325	2,753	35	124	159	125	102	227
	SUB-TOTAL		445	3,995	58	194	252	203	148	351
	Internal Trips			-	-	-	-	-	-	-
	Pass-By Trips			-	-	-	-	-	-	-
	Primary Trips			3,995	58	194	252	203	148	351
TOTAL TRIP GENERATION				22,810	549	556	1,104	1,059	1,042	2,101
<b>TOTAL PRIMARY TRIP GENERATION</b>				<b>16,080</b>	<b>380</b>	<b>434</b>	<b>813</b>	<b>754</b>	<b>720</b>	<b>1,474</b>

REFERENCE: Trip Generation, 9th Edition, published by the Institute of Transportation Engineers.

**NOTES:**

(1) Developed land use reflected in current traffic.

(2) Revised Land Use from the March 2011 Northshore Town Center traffic study.

**TABLE 2 BACKGROUND TRIP GENERATION  
NORTHSHORE TOWN CENTER BUILDOUT**

	DAILY TRAFFIC	AM PEAK			PM PEAK		
		ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
NORTHSHORE TOWN CENTER	22,044	504	544	1,048	1,036	984	2,020
<b>PRIMARY TRIP GENERATION</b>	<b>15,274</b>	<b>335</b>	<b>422</b>	<b>757</b>	<b>731</b>	<b>661</b>	<b>1,391</b>

REFERENCE: Trip Generation, 9th Edition, published by the Institute of Transportation Engineers.

**TABLE 3 GI FOR KIDS MEDICAL OFFICE  
TRIP GENERATION**

LAND USE	L.U.C	SIZE	DAILY TRAFFIC	AM PEAK ENTER	AM PEAK EXIT	PM PEAK ENTER	PM PEAK EXIT
MEDICAL OFFICE	720	24,000	766	45	12	23	58

REFERENCE: Trip Generation, 9th Edition, published by the Institute of Transportation Engineers.

The daily trips are increased 417, an approximate 2.5-percent of the new daily generated trips for the Northshore Town Center buildout. The peak-hour trips were not significantly affected as differences were less than 10 vehicles during AM peak hour and an 18 vehicle reduction for the PM peak-hour trip generation, the more critical peak hour for Northshore Town Center.

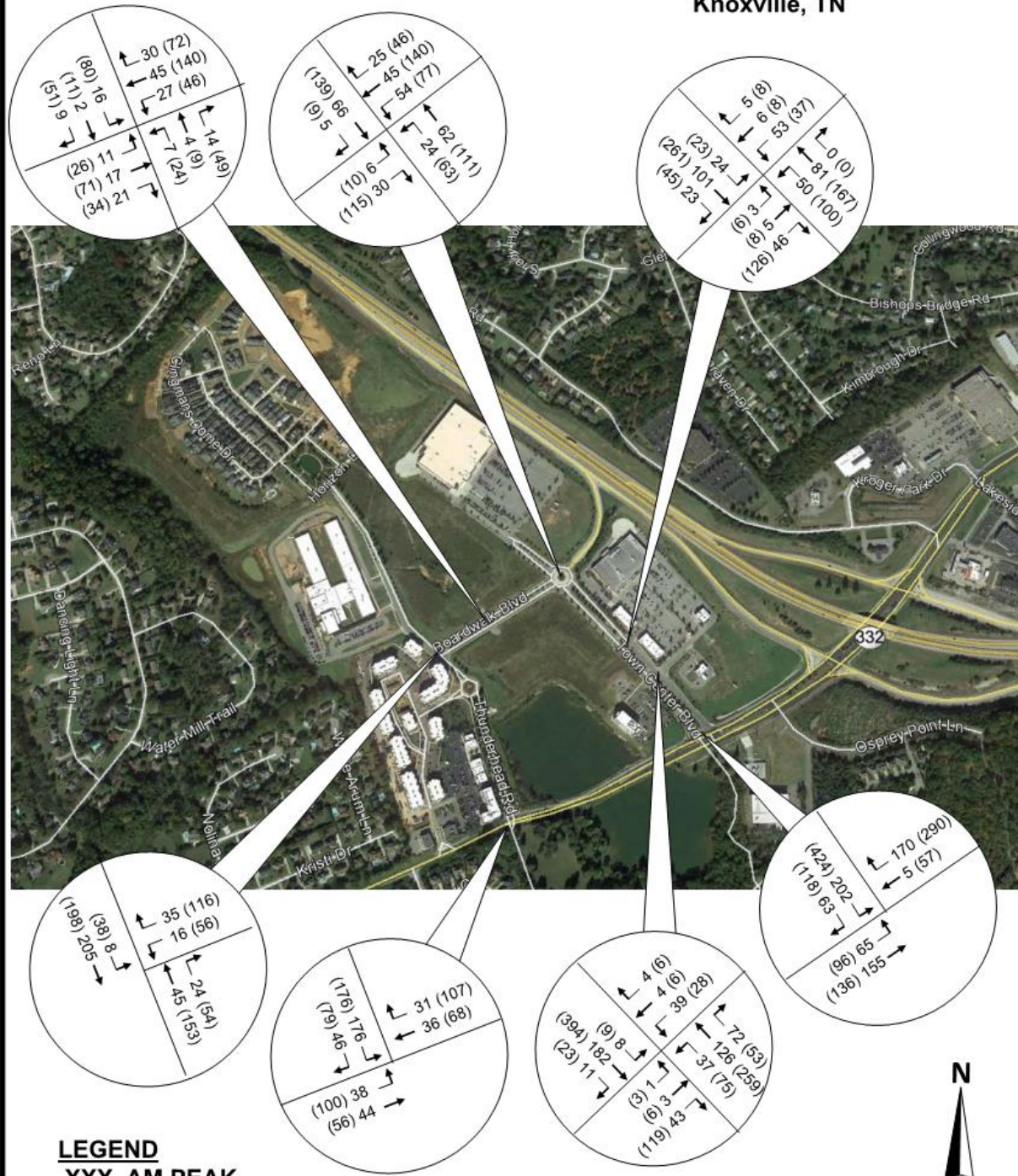
The March 2011 traffic study developed various traffic zones for the distribution of trips for the Northshore Town Center. The updated trip generation for the buildout of the Northshore Town Center was distributed by zone as in the March 2011 traffic study. Some refinements to this distribution were instituted to reflect the more current proposed use, the existing development, and their specific access for which the changed land use would utilize. These refinements are limited to the Chick-fil-A and the proposed medical office uses and their respective driveway accesses. The figures for the traffic zones and their respective distributions are in the Appendix of the report.

The background trip assignment for the Northshore Town Center buildout is reflected in **Figure 5** and total background traffic is illustrated in **Figure 6**. For the proposed GI for Kids medical office, trips were distributed as illustrated in **Figure 7** and the resulting trip assignment is illustrated in **Figure 8**. **Figure 9** illustrates the addition of the GI for Kids medical office trips to the projected background traffic.

**NOTE: Background Trips are the trip assignments for the Northshore Town Center buildout**

## BACKGROUND TRIP ASSIGNMENT

### Northshore Town Center Knoxville, TN



**LEGEND**  
**XXX AM PEAK**  
**(XXX) PM PEAK**



**Figure 5**

# 2020 BACKGROUND TRAFFIC

## Northshore Town Center Knoxville, TN

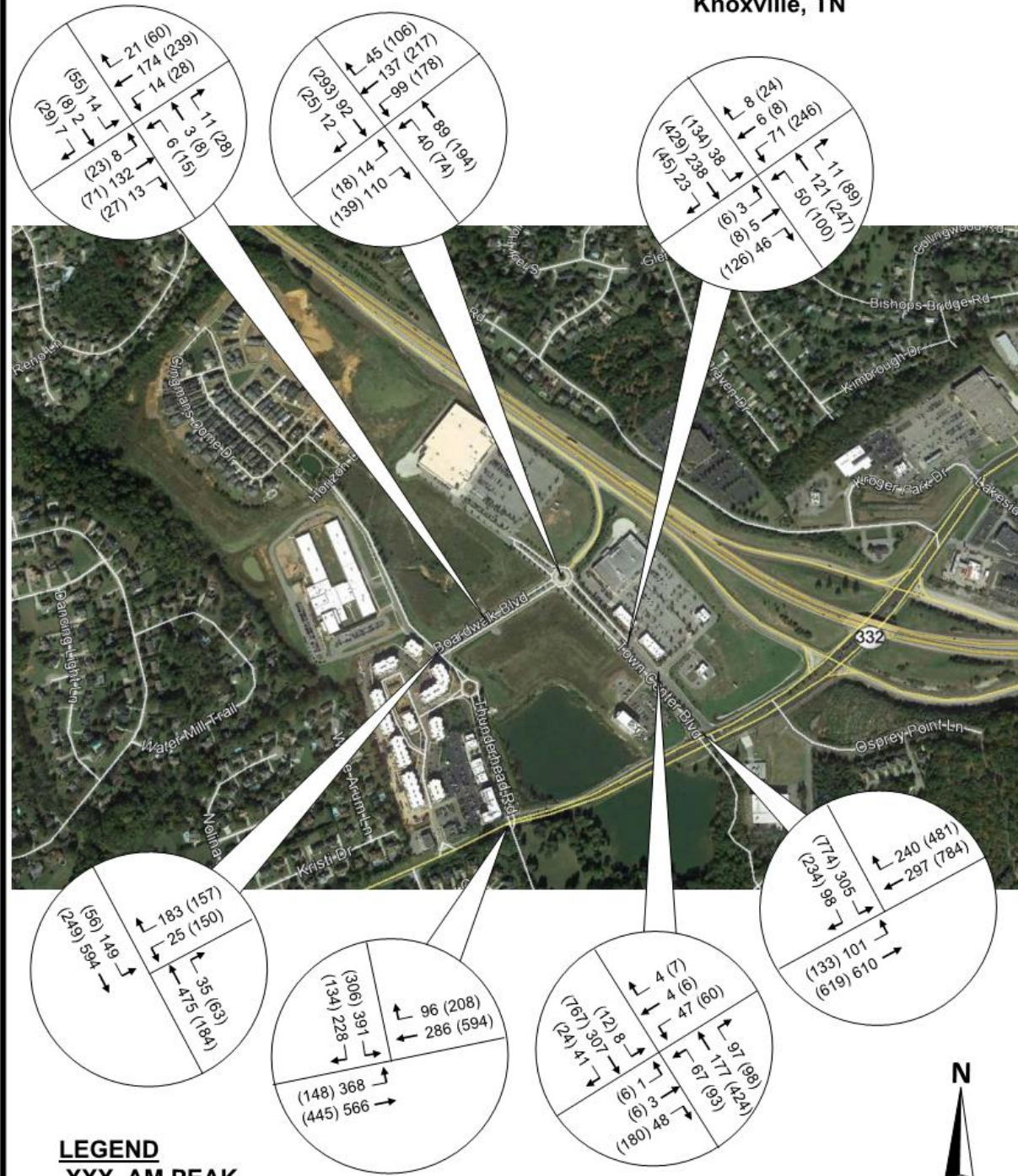


Figure 6

# GI for KIDS MMEICAL OFFICE DISTRIBUTION AND ASSIGNMENT

## Northshore Town Center Knoxville, TN

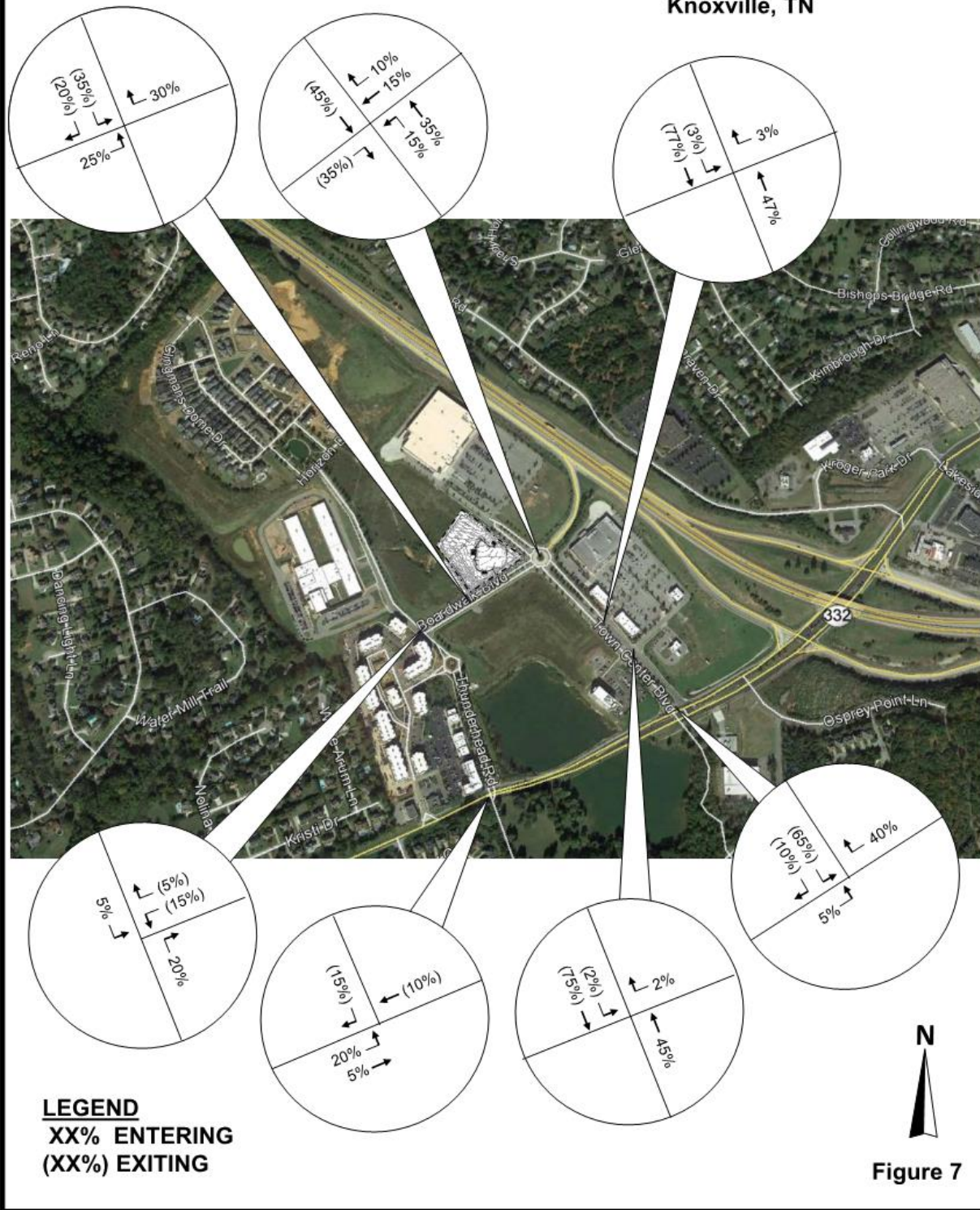


Figure 7

**GI for KIDS MEDICAL OFFICE  
PROJECT TRIPS**  
Northshore Town Center  
Knoxville, TN

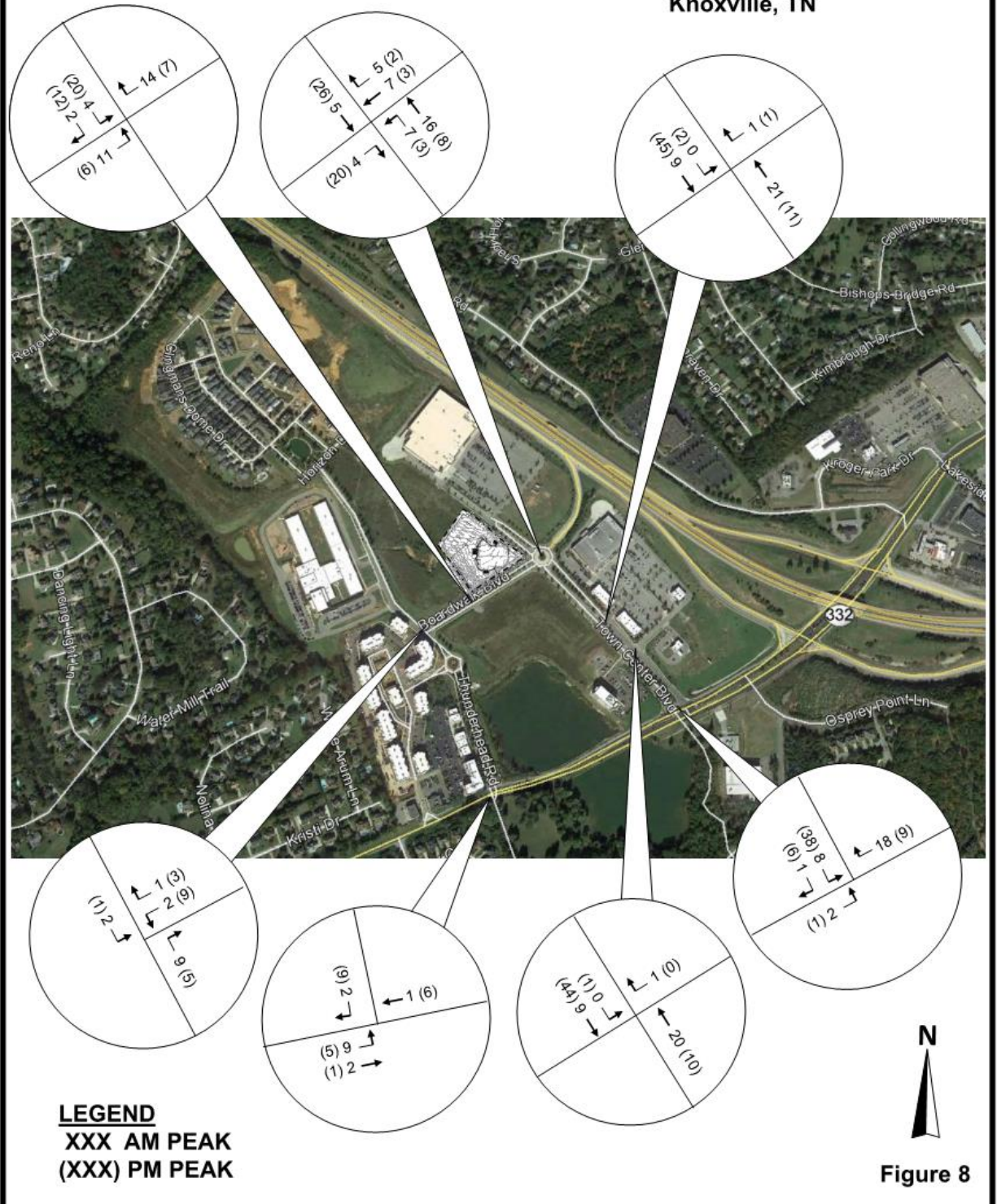
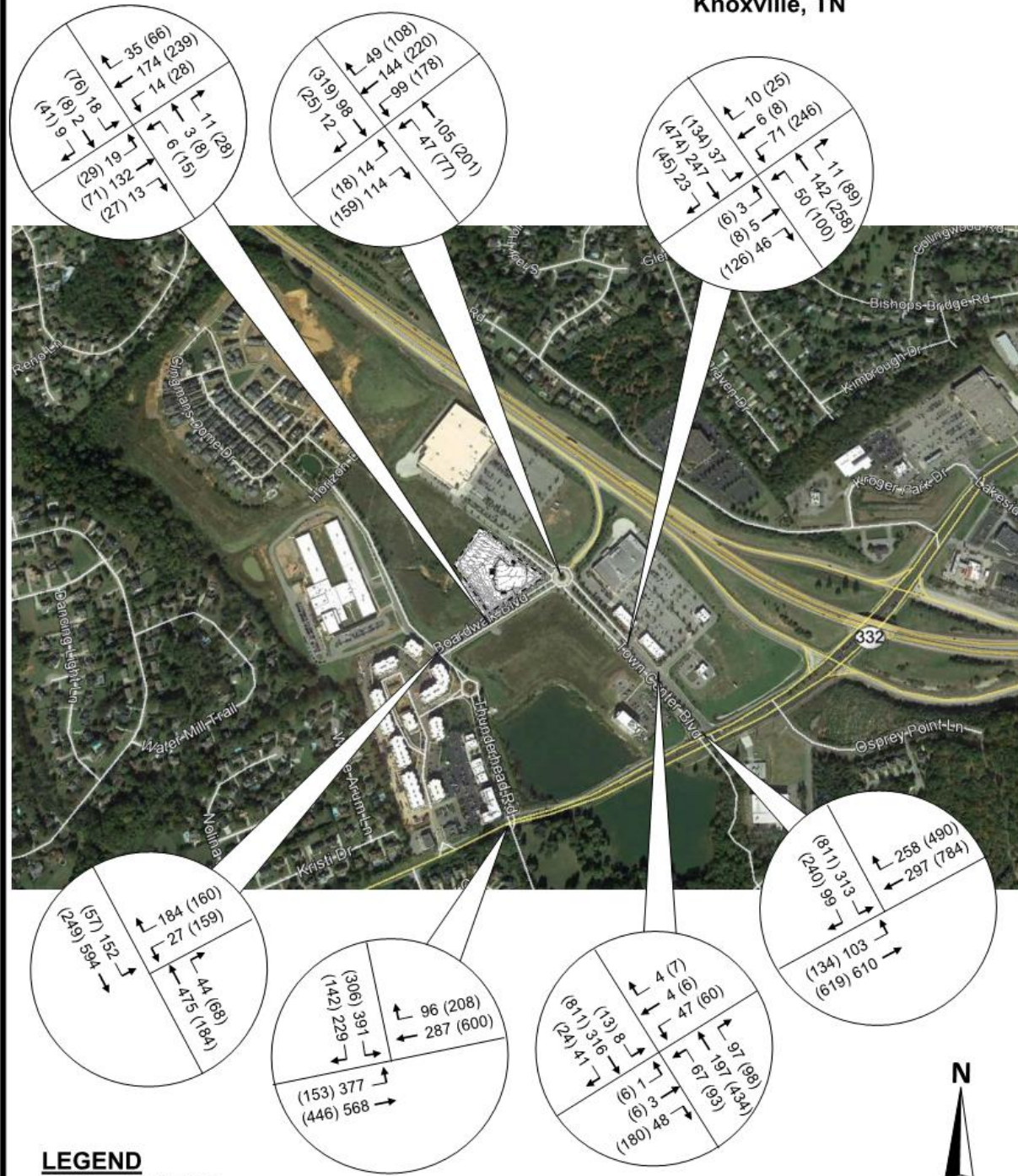


Figure 8



## 2020 PROJECTED TRAFFIC Northshore Town Center Knoxville, TN



**LEGEND**  
 XXX AM PEAK  
 (XXX) PM PEAK

N  
  
 Figure 9

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## TRAFFIC CAPACITY AND LEVELS OF SERVICE ANALYSIS

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In order to evaluate the existing and projected operations of the traffic control devices, capacity and level of service analyses were calculated using methodology from the **Highway Capacity Manual, Special Report 209** published by the Transportation Research Board (TRB). Signalized and unsignalized as well as the roundabout intersections are evaluated based on estimated intersection delays, which may be related to level of service (LOS).

Level of service and capacity are the measurements of an intersection's ability to accommodate traffic volumes. Levels of service for intersections range from A to F. LOS A is the best, and LOS F is failing. For signalized intersections, a LOS of A has an average estimated intersection delay of less than 10 seconds, and LOS F has an estimated delay of greater than 80 seconds. A LOS of C and D are typical design values. Within urban areas, a LOS D, delay between 35 and 55 seconds, is considered acceptable by the Institute of Transportation Engineers (ITE) for signalized intersections.

Unsignalized intersection levels of service have lower thresholds of delays. A LOS of F exceeds estimated delays of 50 seconds. For urban arterials, minor approaches may frequently experience levels of service E. A full level of service description for signalized and unsignalized intersections is presented in **Table 4**.

**TABLE 4  
LEVEL-OF-SERVICE (LOS) CRITERIA DESCRIPTION**

Level of Service	Average Control Delay in seconds per vehicle	
	Signalized Intersections	Stop-controlled Intersections
A	≤ 10	≤ 10
B	> 10 and ≤ 20	> 10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80	> 50

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Analyses were conducted using the Synchro Software, developed by Trafficware. **Table 5** presents the capacity and levels of service for the study intersections. It should be noted that for stop-controlled operations, LOS is reported only for side-street approaches. Analysis of the existing traffic conditions found that the study intersections operated at acceptable levels of service with exception of the stopped approach of Boardwalk Boulevard to Thunderhead Road which left-turn movement fails during the AM peak hour with the school traffic. Analyses conducted for the projected traffic conditions found that the study intersections operate at levels of service consistent with the 2011 traffic study conducted for the Northshore Town Center with optimization of splits. The Thunderhead Road intersection with Northshore Drive would experience a E LOS with the current signal timing but can be improved with the signal timing split optimization. This optimization will provide a LOS C and reduce the otherwise extensive southbound left-turn queue. This optimization can be expected as the Northshore Town Center builds out. The GI for Kids has a very minimal impact on the intersection capacities and delays. With buildout, the eastbound left-turn lane from Northshore Drive to Thunderhead Road requires increased storage, from an existing 100 feet to 350 feet as recommended in the 2011 traffic study.

Further analyses were conducted to evaluate the previous recommendations of the southbound double left-turn lanes and improvements on Northshore Drive. The southbound left-turn movement from Thunderhead Road to Northshore Drive as recommended in the 2011 traffic study was a recommendation for the left-turn traffic volume and mitigation of possible adverse queuing that might occur with the Northshore Town Center, new elementary school, and the Aventine Apartments. Estimated queues from Synchro, presented in **Table 6**, found that the queues should be acceptable for the peak hours; therefore, the existing Thunderhead Road southbound left-turn lane should manage the southbound left-turn queue, and the double left-turn lane should not be necessary.

In the Northshore Town Center 2011 traffic study, four lanes for Northshore Drive with a separate westbound right-turn lane was a recommendation; but the constructed improvements on Northshore Drive were limited to Thunderhead Road within the available right-of-way. Therefore, a right lane drop was provided to transition from the 4-lane facility to the east to the 2-lane facility to the west. Until such time that further improvements are planned for Northshore Drive, the intersection of Northshore Drive and Thunderhead Road can function as currently constructed.

**TABLE 5  
SUMMARY OF CAPACITY AND LEVEL OF SERVICE**

INTERSECTION	TRAFFIC CONTROL	PEAK PERIOD	2018 EXISTING TRAFFIC			2020 BACKGROUND TRAFFIC			2020 PROJECTED TRAFFIC		
			V/C	DELAY	LOS	V/C	DELAY	LOS	V/C	DELAY	LOS
Northshore Dr. at Town Center Blvd.	SIGNAL	AM	0.22	10.1	B	0.38	14.8	B	0.38	14.9	B
		PM	0.44	17.5	B	0.66	39.2	D	0.68	46.0	D
Town Center Blvd. at S. Shopping Ctr. Access	STOP EB/WB	AM	0.01 / 0.01	8.8 / 10.0	A / A	0.07 / 0.15	9.9 / 15.6	A / C	0.07 / 0.15	9.9 / 16.1	A / C
		PM	0.10 / 0.02	10.3 / 15.1	B / C	0.39 / 0.79	15.7 / 113.8	C / F	0.39 / 0.82	16.1 / 124.9	C / F
Town Center Blvd. at N. Shopping Ctr. Access	SIGNAL	AM	0.11	4.5	A	0.19	9.8	A	0.20	9.7	A
		PM	0.33	11.4	B	0.53	15.1	B	0.55	15.1	B
Town Center Blvd. at Boardwalk Blvd.	ROUNDABOUT	AM	---	4.5	A	---	5.0	A	---	5.1	A
		PM	---	4.6	A	---	7.4	A	---	9.1	A
Northshore Dr. at Thunderhead Rd.	SIGNAL	AM	0.72	23.9	C	0.81	70.0	E	0.82	69.7	E
		PM	0.53	14.2	B	0.73	62.8	E	0.73	62.7	E
Mitigation Optimize Splits	SIGNAL	AM				0.83	23.4	C	0.84	23.6	C
		PM				0.73	21.5	C	0.74	22.0	C
Mitigation SB Double Left-Turn	SIGNAL	AM							0.65	20.2	C
		PM							0.61	17.2	B
Mitigation 4-Lane Northshore	SIGNAL	AM							0.77	20.4	C
		PM							0.55	15.8	B
Mitigation 2011 Study Recommended Improvement	SIGNAL	AM							0.77	20.4	C
		PM							0.40	14.3	B
Thunderhead Rd. at Boardwalk Blvd.	STOP WBL/WBR	AM	0.22 / 0.55	73.8 / 22.7	F / C	1.21 / 0.76	409.8 / 38.3	F / E	1.39 / 0.77	485.4 / 39.9	F / E
		PM	0.13 / 0.05	10.0 / 8.7	A / A	0.38 / 0.21	18.6 / 10.7	C / B	0.41 / 0.22	19.3 / 10.7	C / B
Boardwalk Blvd. at Site Access	STOP NB/SB	AM				0.03 / 0.04	10.4 / 11.2	B / B	0.03 / 0.06	10.6 / 11.6	B / B
		PM				0.09 / 0.20	11.3 / 13.9	B / B	0.09 / 0.28	11.6 / 15.1	B / C

Note: Average vehicle delay estimated in seconds. STOP control analyses presented by minor approach.

**TABLE 6  
NORTHSHORE DRIVE & THUNDERHEAD ROAD  
95<sup>TH</sup>-PERCENTILE LEFT-TURN QUEUES**

MITIGATION	EB LT MOVEMENT		SB LT MOVEMENT	
	AM Peak	PM Peak	AM Peak	PM Peak
Optimized Splits	>280	75	>336	>325
SB Double Left-Turn Lanes	177	59	226	>220
Northshore Drive 4-Lane	244	75	304	>325
2011 Recommended Geometry	188	74	196	170

**Note: Queues estimated in feet**

The left-turn movement from Boardwalk Boulevard to Thunderhead Road fails during the AM peak hour, and the Publix shopping center southern driveway access to Town Center Boulevard fails during the PM peak hour. These findings are consistent with the earlier finding of the 2011 traffic study. The improvements constructed in conjunction with the Northshore Town Center continue to mitigate the traffic impact of the development. Left- and right-turn lanes for Thunderhead Road intersection approaches to Boardwalk Boulevard, recommended in the March 2011 Northshore Town Center traffic study will not mitigate failing level of service during the AM peak hour but would improve the efficiency and operation of the intersection. The southbound left-turn lane for Thunderhead Road at Boardwalk Boulevard seems precluded with the left-turn lane constructed for the elementary school. The northbound right-turn lane would improve the efficiency for traffic to turn from Thunderhead Road to Boardwalk Boulevard with buildout of the Northshore Town Center.

The GI for Kids medical office has a minimal impact on the operation and levels of service of the study intersections. The projected trips for GI for Kids medical office at the Thunderhead Road intersection with Boardwalk Boulevard is minimal and does not require any mitigation. Improvements for the Thunderhead Road intersection with Boardwalk Boulevard is associated with the Northshore Town Center buildout as recommended in the March 2011 study.

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## RECOMMENDATIONS & CONCLUSIONS

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This report was commissioned to address traffic impact and access issues related to the development of a proposed GI for Kids medical office and resubdivision of Lot 8 of the Northshore Town Center site in southwest Knox County, Tennessee. This study updated the traffic study prepared for the Northshore Town Center prepared in March 2011, requiring the collection of the existing intersection turning movements, update of the trip generation of the Northshore Town Center, and development of projected traffic with and without the proposed GI for Kids medical office. With the buildout of the Northshore Town Center, including the GI for Kids medical office, it may generate another 16,080 new daily trips with approximately 1,474 occurring in the PM peak hour. The proposed GI for Kids medical office is found to have a minimal impact on the current transportation system and levels of service are not adversely impacted. Daily trips are increased 417 vehicles, an approximate 2.5-percent of the new daily generated trips for the Northshore Town Center buildout. The peak hour trips were not significantly affected as differences were less than 10 vehicles during AM peak hour and a reduction in the PM peak hour trip generation.

Analyses of the resulting traffic projections were conducted to determine the capacity and levels of service for the study area intersections along Northshore Drive, Town Center Boulevard, and Thunderhead Road. The left-turn movement from Boardwalk Boulevard to Thunderhead Road fails during the AM peak hour for the existing and projected traffic condition and is associated with the school peak hour, and the Publix shopping center southern driveway access to Town Center Boulevard fails during the PM peak hour which can be associated with the Chick-fil-A restaurant development. These findings are consistent with earlier finding of the 2011 traffic study. The improvements constructed in conjunction with the Northshore Town Center continue to mitigate the traffic impact of the development. With buildout of the Northshore Town Center, the study identified the following recommendations:

- Provide a minimum 100-foot northbound right-turn lane from Thunderhead Road to the Boardwalk Boulevard as previously recommended in the Northshore Town Center March 2011 traffic study. This lane could be developed from the roundabout. This recommendation is associated with full buildout of Northshore Town Center and is not directly associated with the proposed GI for Kids medical office.
- With buildout of the Northshore Town Center, the eastbound left-turn lane from Northshore Drive to Thunderhead Road should be increased to provide 350 feet of storage as previously recommended in the 2011 traffic study.

- 
- Install RIGHT LANE MUST TURN RIGHT (R3-7/Right) signs and right-turn only markings for the right-lane drop on Town Center Boulevard into the Target store parking mitigating an existing condition and improving the access efficiency.

The southbound left-turn movement from Thunderhead Road to Northshore Drive as recommended was determined unnecessary for the site buildout with projected queues determined acceptable for the peak hours; therefore, the existing Thunderhead Road southbound left-turn lane should manage the southbound left-turn queue, and the double left-turn lane should not be necessary.

Constructed improvements on Northshore Drive were limited to Thunderhead Road within the available right-of-way. therefore, a right lane drop was provided to transition from the 4-lane facility to the east to the 2-lane facility to the west. Until such time that further improvements are planned for Northshore Drive, the intersection of Northshore Drive and Thunderhead Road can function as currently constructed.

The study, therefore, found that there are not any additional improvements necessary with the medical office development as the trips distributed are found to have a minimal impact on the intersections studied. The intersection of Northshore Drive and Thunderhead Road does not currently require improvements as the projected queues and levels of service are acceptable.

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## APPENDIX

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Northshore Town Center 2011 Trip Generation

Traffic Zones and Distributions

Traffic Counts

City of Knoxville Signal Timing

Synchro Analyses

Left-Turn Lane Analysis



# NORTHSHORE TOWN CENTER

## Trip Generation

Northshore Town Center Traffic Study-October 2011

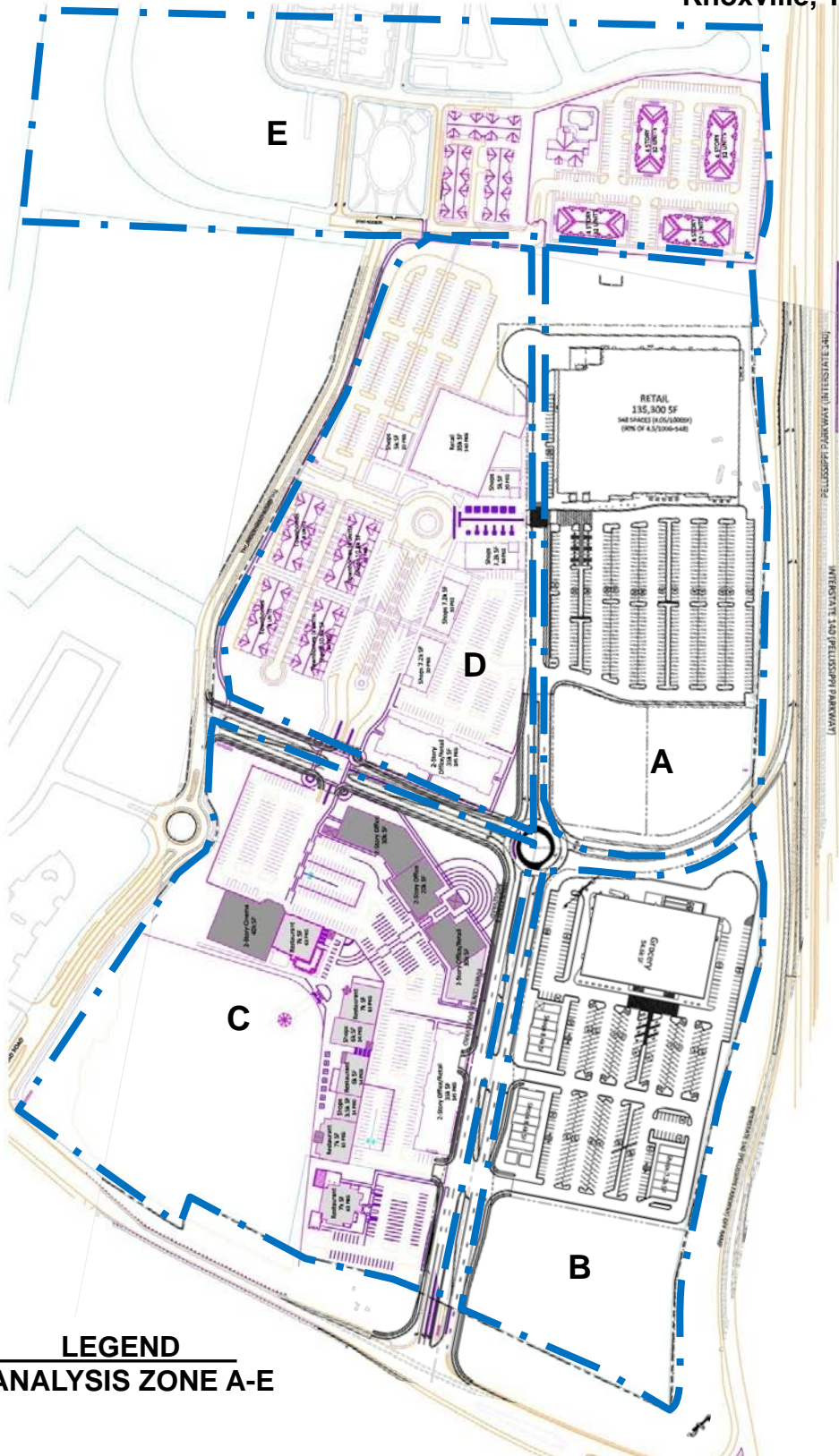
ZONE	LAND USE	L.U.C	SIZE	DAILY		AM PEAK		PM PEAK		TOTAL	
				TRAFFIC	ENTER	ENTER	EXIT	ENTER	EXIT		
<b>A</b>	DISCOUNT STORE	815	135,320	8,347	98	46	143	338	338	677	
	H.T. RESTAURANT	932	6,500	826	39	36	75	43	30	72	
	DRIVE-IN BANK	912	4,500	667	31	24	56	58	58	116	
	SUB-TOTAL		146,320	9,840	168	106	274	439	426	865	
	Internal Trips	10%		984	17	11	27	44	43	87	
	Pass-By Trips	20%		1,968	34	21	55	88	85	173	
	Primary Trips			6,888	117	74	192	307	298	606	
<b>B</b>	SUPERMARKET	850	54,000	5,007	118	76	194	302	290	592	
	SPECIAL RETAIL	814	25,900	1,146	16	10	27	37	47	84	
	SERVICE STA w CONV. MARKET	945	1,000	1,271	40	39	79	49	49	97	
	DRIVE-IN BANK	912	4,500	667	31	24	56	58	58	116	
	SUB-TOTAL		85,400	8,090	206	149	355	445	443	889	
	Internal Trips	10%		809	21	15	36	45	44	89	
	Pass-By Trips	20%		1,618	41	30	71	89	89	178	
	Primary Trips			5,663	144	105	249	312	310	622	
<b>C</b>	OFFICE BLDG.	710	57,500	871	106	14	120	24	119	143	
	SHOPPING CENTER	820	87,000	6,203	87	55	142	278	301	579	
	H.T. RESTAURANT	932	14,000	1,780	84	77	161	92	64	156	
	MULTIPLEX THEATER	445	8		-	-	-	49	60	109	
	SUB-TOTAL		158,500	8,855	276	147	424	444	544	988	
	Internal Trips	10%		885	28	15	42	44	54	99	
	Pass-By Trips	25%		2,214	69	37	106	111	136	247	
	Primary Trips			5,756	180	96	275	288	354	642	
<b>D</b>	KNOX CO MULTI-FAMILY	225	24	265	3	11	14	14	12	26	
	SHOPPING CENTER	820	79,100	5,831	82	52	134	261	283	544	
	OFFICE BLDG.	710	17,500	349	41	6	47	17	82	98	
	SUB-TOTAL		96,600	6,444	126	69	195	292	376	668	
		Internal Trips	10%		644	13	7	19	29	38	67
	Pass-By Trips	30%		1,933	38	21	58	88	113	200	
	Primary Trips			3,867	76	41	117	175	226	401	
<b>E</b>	SINGLE FAMILY	210	120	1,230	23	70	94	78	46	124	
	KNOX CO MULTI-FAMILY	225	325	2,753	35	124	159	125	102	227	
	SUB-TOTAL		445	3,983	58	194	252	203	148	351	
		Internal Trips			-	-	-	-	-	-	-
		Pass-By Trips			-	-	-	-	-	-	-
	Primary Trips			3,983	58	194	252	203	148	351	
TOTAL TRIP GENERATION				37,211	834	666	1,500	1,823	1,938	3,761	
<b>TOTAL PRIMARY TRIP GENERATION</b>				<b>26,155</b>	<b>575</b>	<b>510</b>	<b>1,085</b>	<b>1,286</b>	<b>1,336</b>	<b>2,622</b>	

REFERENCE: Trip Generation, 8th Edition, published by the Institute of Transportation Engineers.

# TRAFFIC ZONES

Northshore Town Center

Knoxville, TN



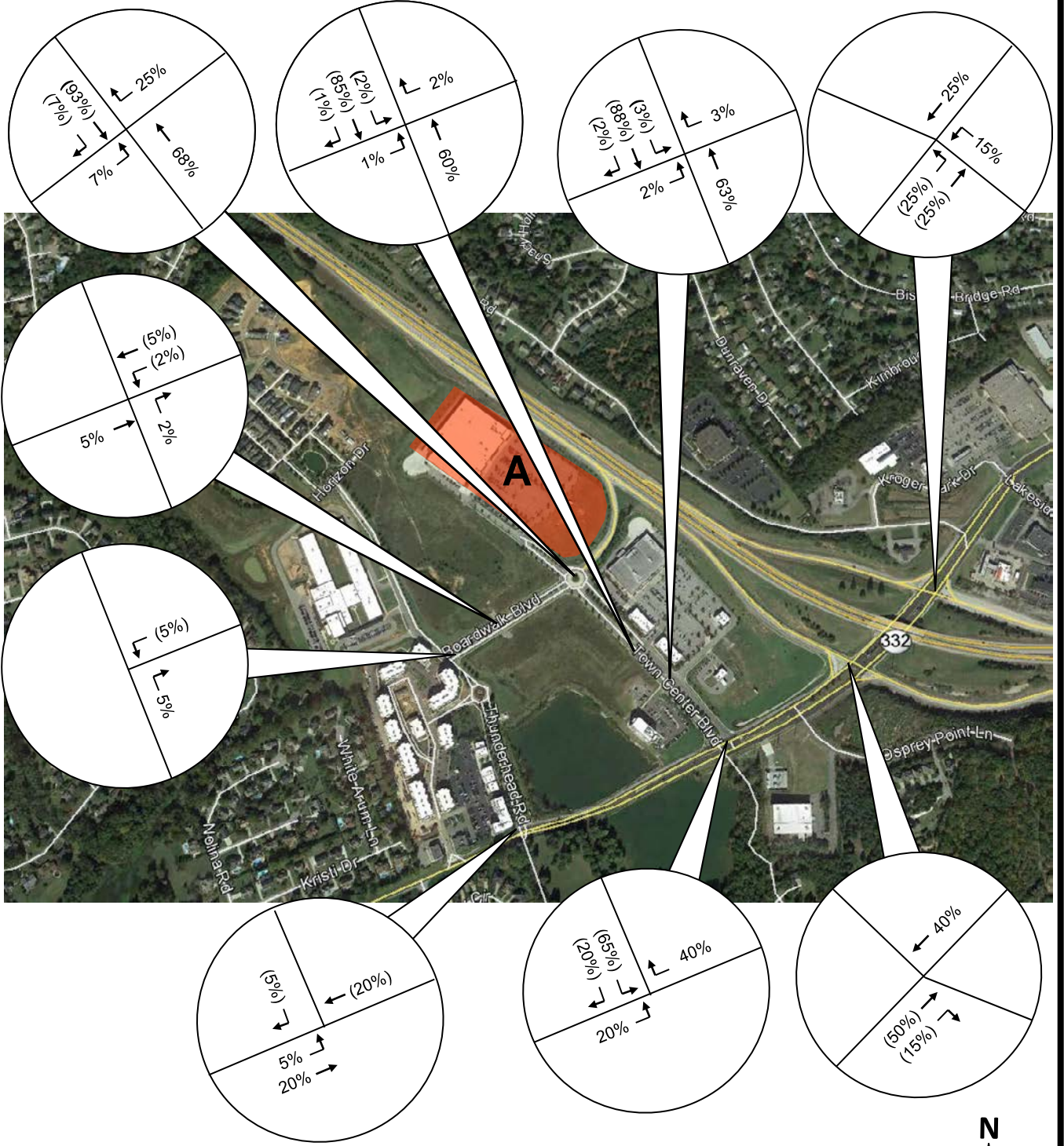
## LEGEND

ANALYSIS ZONE A-E



# PRIMARY DISTRIBUTION AND ASSIGNMENT-ZONE A

## Northshore Town Center Knoxville, TN

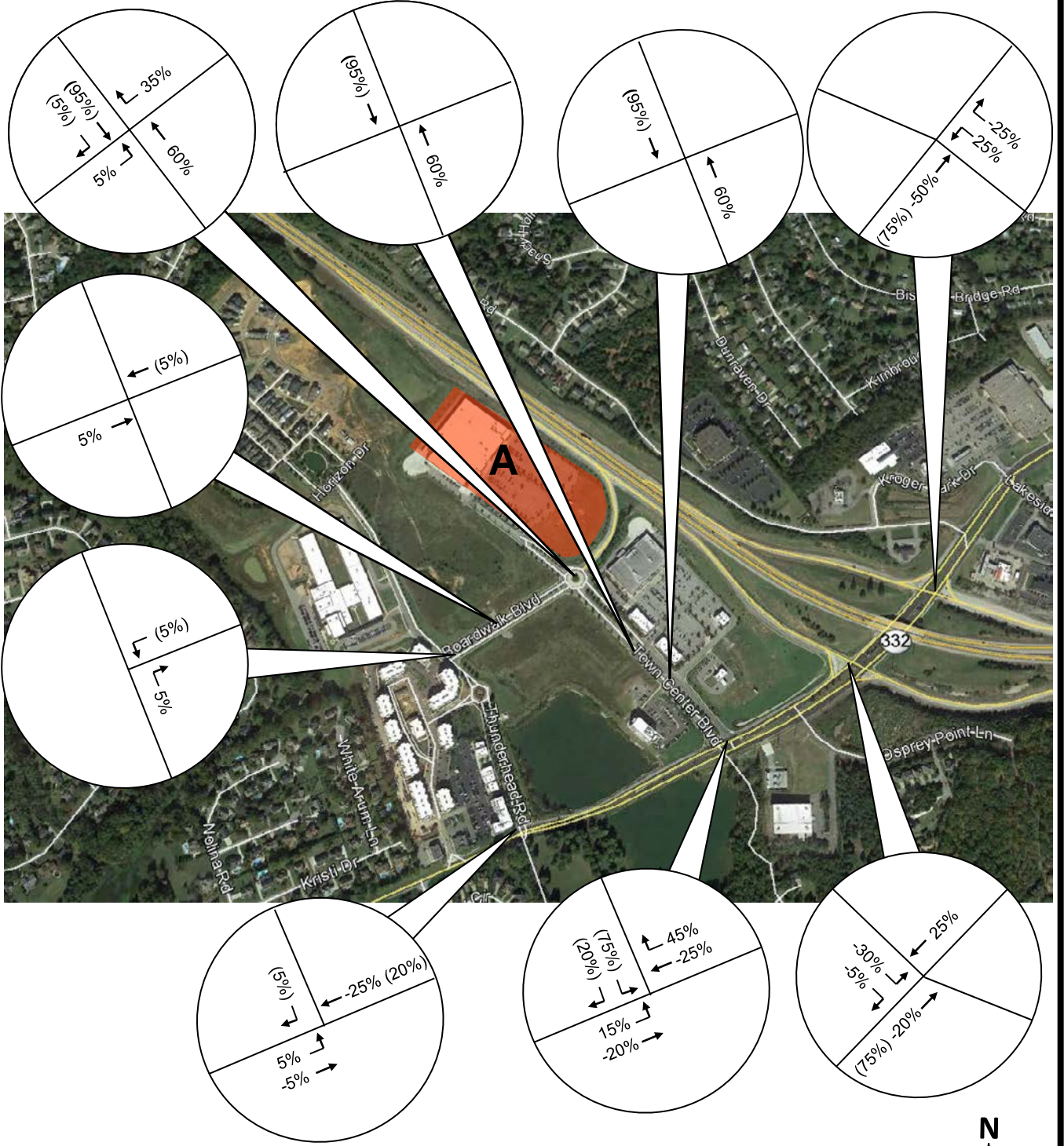


**LEGEND**  
**XX% ENTERING**  
**(XX%) EXITING**



# PASS-BY DISTRIBUTION AND ASSIGNMENT-ZONE A

## Northshore Town Center Knoxville, TN

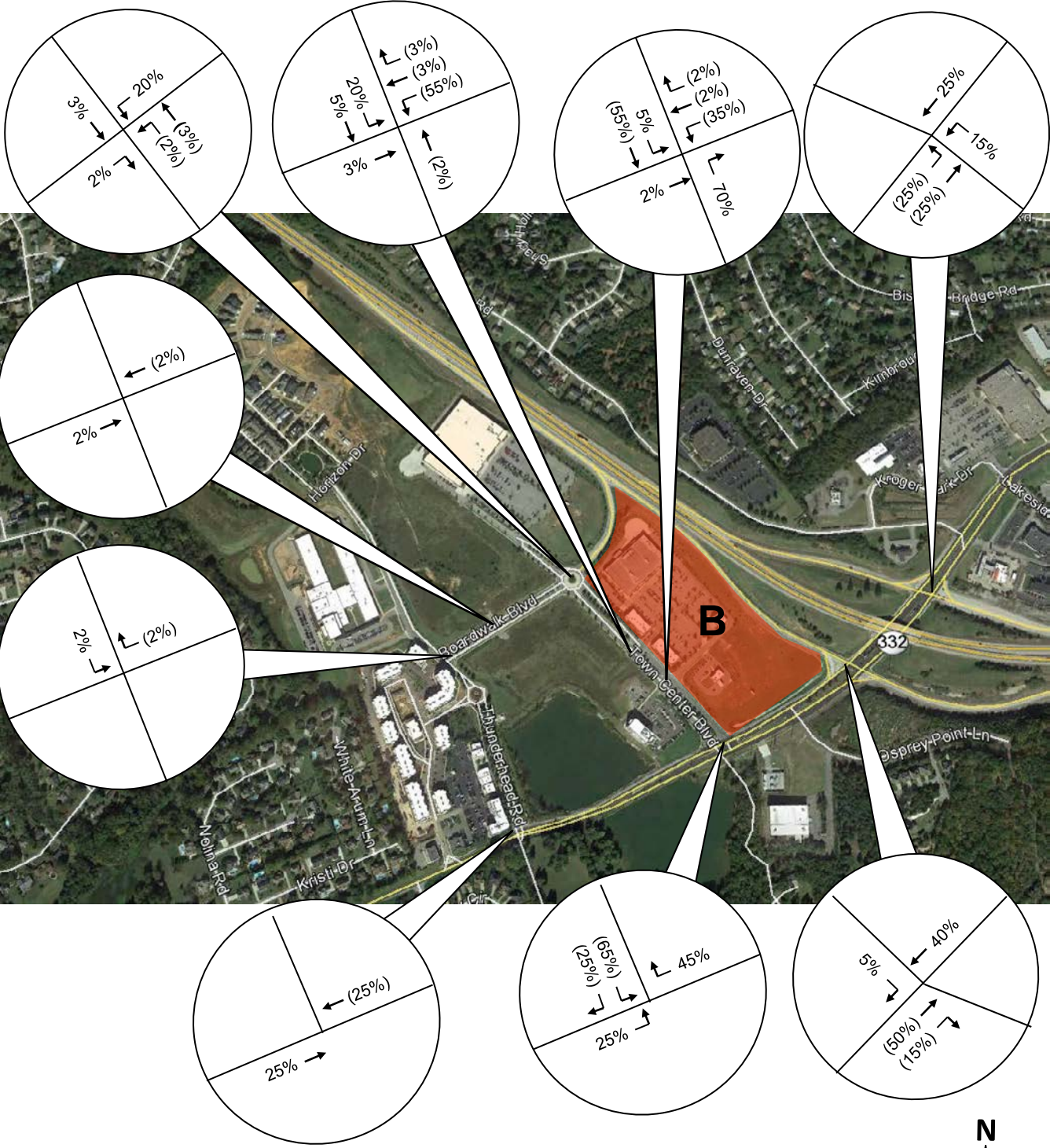


**LEGEND**  
**XX% ENTERING**  
**(XX%) EXITING**



# PRIMARY DISTRIBUTION AND ASSIGNMENT-ZONE B

## Northshore Town Center Knoxville, TN

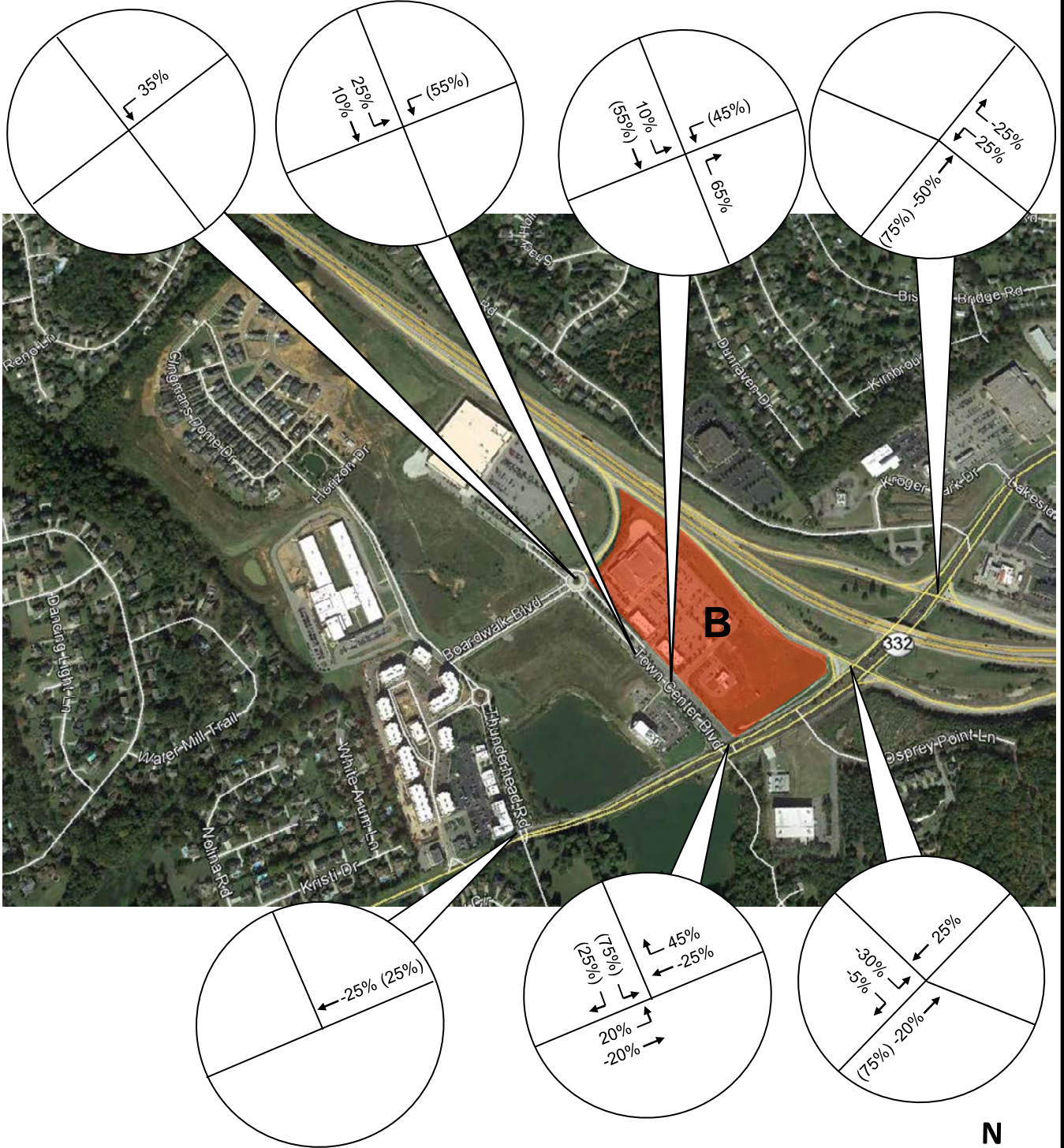


**LEGEND**  
 XX% ENTERING  
 (XX%) EXITING



# PASS-BY DISTRIBUTION AND ASSIGNMENT-ZONE B

Northshore Town Center  
Knoxville, TN

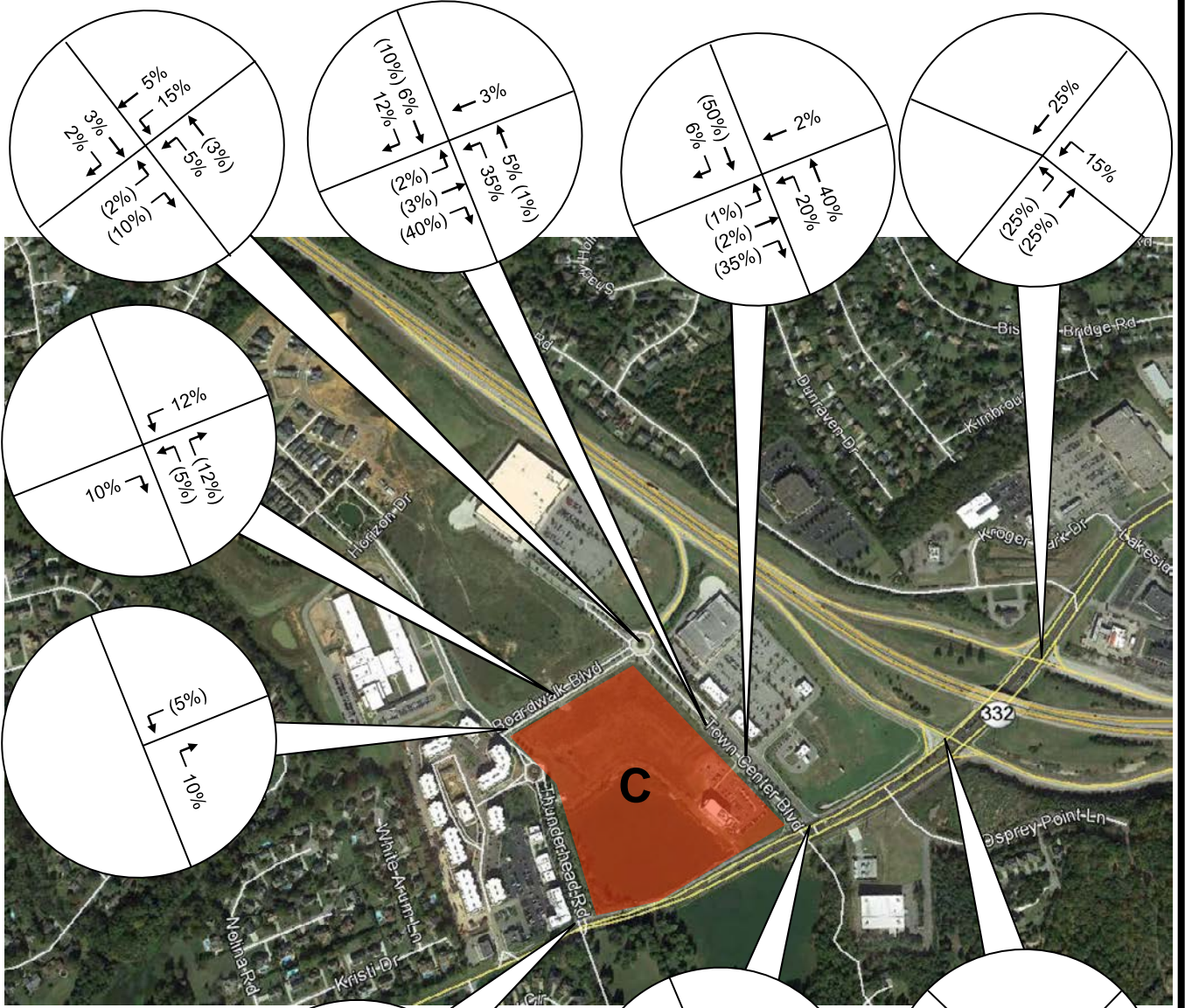


**LEGEND**  
**XX** ENTERING  
**(XX%)** EXITING



# PRIMARY DISTRIBUTION AND ASSIGNMENT-ZONE C

Northshore Town Center  
Knoxville, TN

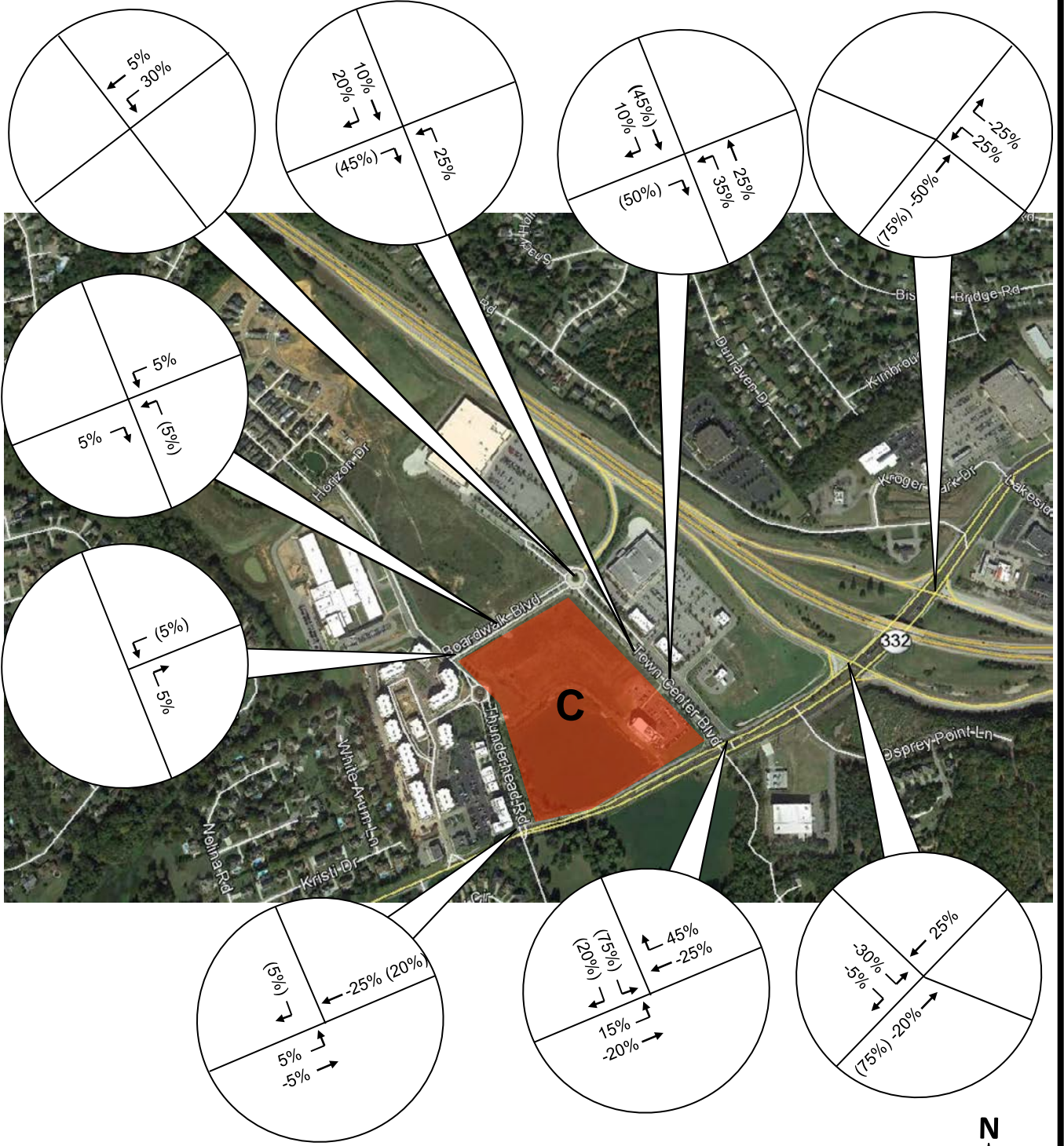


**LEGEND**  
 XX% ENTERING  
 (XX%) EXITING



# PASS-BY DISTRIBUTION AND ASSIGNMENT-ZONE C

Northshore Town Center  
Knoxville, TN



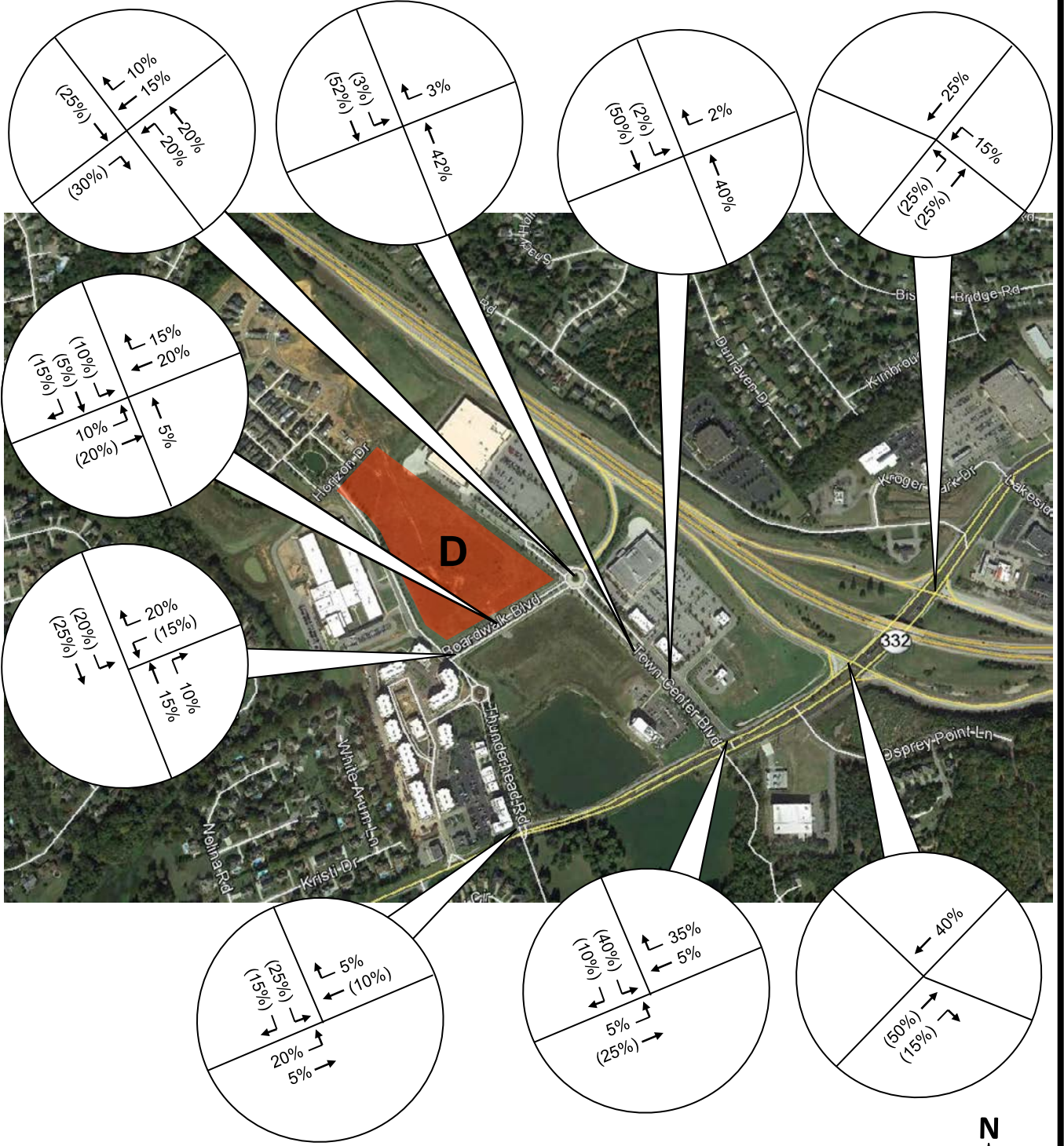
**LEGEND**  
**XX% ENTERING**  
**(XX%) EXITING**





# PRIMARY DISTRIBUTION AND ASSIGNMENT-ZONE D

## Northshore Town Center Knoxville, TN

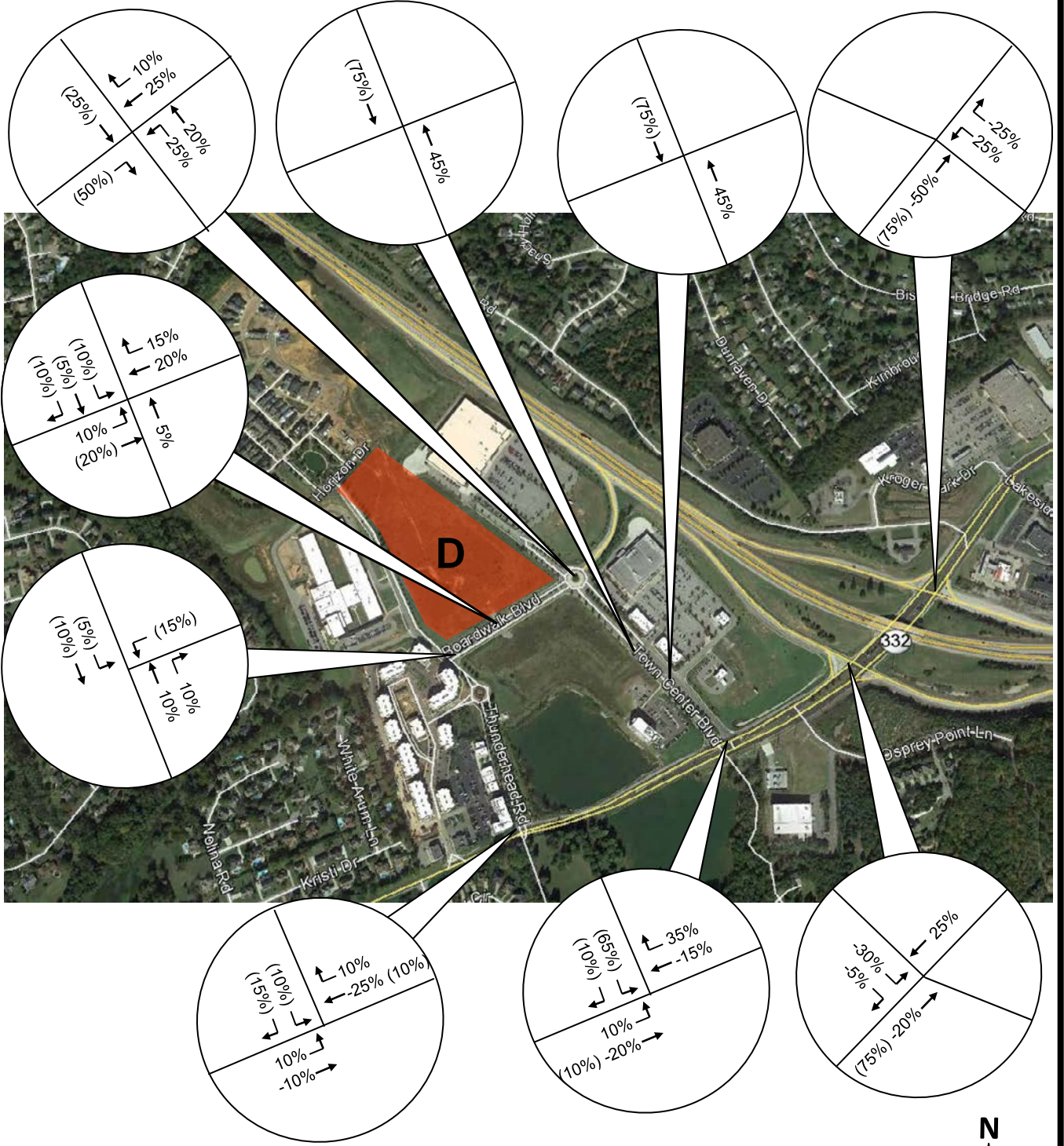


**LEGEND**  
**XX% ENTERING**  
**(XX%) EXITING**



# PASS-BY DISTRIBUTION AND ASSIGNMENT-ZONE D

Northshore Town Center  
Knoxville, TN

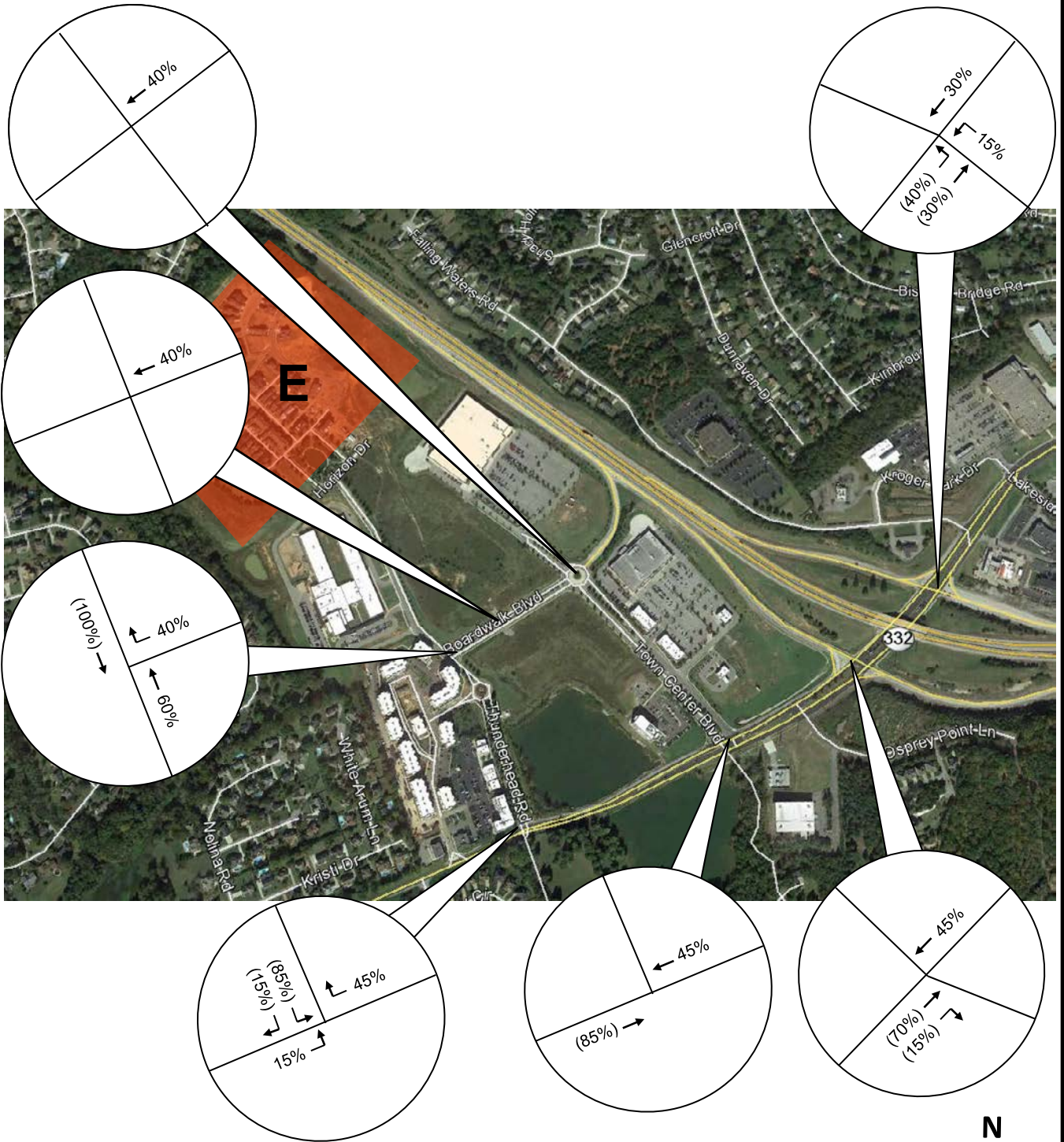


**LEGEND**  
**XX% ENTERING**  
**(XX%) EXITING**



# PRIMARY DISTRIBUTION AND ASSIGNMENT-ZONE E

## Northshore Town Center Knoxville, TN



**LEGEND**  
**XX% ENTERING**  
**(XX%) EXITING**



# CDM Smith, Inc.

1100 Marion Street, Ste 300

Knoxville, TN 37921

865-963-4300

File Name : Thunderhead\_Northshore

Site Code : 00000000

Start Date : 2/15/2018

Page No : 1

Groups Printed- Unshifted

Start Time	THUNDERHEAD RD Southbound				NORTHSHORE DR Westbound				THUNDERHEAD RD Northbound				NORTHSHORE DR Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
07:00 AM	18	0	7	25	0	24	11	35	0	0	0	0	39	95	0	134	194
07:15 AM	64	0	33	97	0	33	22	55	0	0	0	0	137	109	0	246	398
07:30 AM	86	0	75	161	0	44	21	65	0	0	0	0	173	105	0	278	504
07:45 AM	52	0	69	121	0	81	13	94	0	0	0	0	15	119	0	134	349
<b>Total</b>	<b>220</b>	<b>0</b>	<b>184</b>	<b>404</b>	<b>0</b>	<b>182</b>	<b>67</b>	<b>249</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>364</b>	<b>428</b>	<b>0</b>	<b>792</b>	<b>1445</b>
08:00 AM	13	0	5	18	0	82	9	91	0	0	0	0	5	169	0	174	283
08:15 AM	22	0	5	27	0	62	8	70	0	0	0	0	6	126	0	132	229
08:30 AM	15	0	2	17	0	93	6	99	0	0	0	0	4	138	0	142	258
08:45 AM	26	0	3	29	0	69	12	81	0	0	0	0	6	144	0	150	260
<b>Total</b>	<b>76</b>	<b>0</b>	<b>15</b>	<b>91</b>	<b>0</b>	<b>306</b>	<b>35</b>	<b>341</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>21</b>	<b>577</b>	<b>0</b>	<b>598</b>	<b>1030</b>
*** BREAK ***																	
02:00 PM	15	0	8	23	0	72	10	82	0	0	0	0	14	71	0	85	190
02:15 PM	29	0	8	37	0	78	19	97	0	0	0	0	33	76	0	109	243
02:30 PM	16	0	3	19	0	100	15	115	0	0	0	0	29	70	0	99	233
02:45 PM	24	0	27	51	0	96	10	106	0	0	0	0	17	77	0	94	251
<b>Total</b>	<b>84</b>	<b>0</b>	<b>46</b>	<b>130</b>	<b>0</b>	<b>346</b>	<b>54</b>	<b>400</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>93</b>	<b>294</b>	<b>0</b>	<b>387</b>	<b>917</b>
03:00 PM	43	0	60	103	0	75	15	90	0	0	0	0	25	68	0	93	286
03:15 PM	37	0	32	69	0	95	9	104	0	0	0	0	6	80	0	86	259
03:30 PM	26	0	6	32	0	94	9	103	0	0	0	0	13	78	0	91	226
03:45 PM	23	0	12	35	0	108	27	135	0	0	0	0	16	80	0	96	266
<b>Total</b>	<b>129</b>	<b>0</b>	<b>110</b>	<b>239</b>	<b>0</b>	<b>372</b>	<b>60</b>	<b>432</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>60</b>	<b>306</b>	<b>0</b>	<b>366</b>	<b>1037</b>
04:00 PM	32	0	25	57	0	116	17	133	0	0	0	0	22	74	0	96	286
04:15 PM	29	0	17	46	0	112	15	127	0	0	0	0	9	81	0	90	263
04:30 PM	30	0	10	40	2	110	10	122	0	0	0	0	9	93	0	102	264
04:45 PM	32	0	11	43	0	133	17	150	0	0	0	0	11	99	0	110	303
<b>Total</b>	<b>123</b>	<b>0</b>	<b>63</b>	<b>186</b>	<b>2</b>	<b>471</b>	<b>59</b>	<b>532</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>51</b>	<b>347</b>	<b>0</b>	<b>398</b>	<b>1116</b>
05:00 PM	35	0	15	50	0	110	24	134	0	0	0	0	14	84	0	98	282
05:15 PM	39	0	18	57	0	154	32	186	0	0	0	0	11	97	0	108	351
05:30 PM	24	0	11	35	0	108	28	136	0	0	0	0	12	94	0	106	277
05:45 PM	25	0	13	38	0	144	17	161	0	0	0	0	10	86	0	96	295
<b>Total</b>	<b>123</b>	<b>0</b>	<b>57</b>	<b>180</b>	<b>0</b>	<b>516</b>	<b>101</b>	<b>617</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>47</b>	<b>361</b>	<b>0</b>	<b>408</b>	<b>1205</b>
<b>Grand Total</b>	<b>755</b>	<b>0</b>	<b>475</b>	<b>1230</b>	<b>2</b>	<b>2193</b>	<b>376</b>	<b>2571</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>636</b>	<b>2313</b>	<b>0</b>	<b>2949</b>	<b>6750</b>
Apprch %	61.4	0	38.6		0.1	85.3	14.6		0	0	0	0	21.6	78.4	0		
Total %	11.2	0	7	18.2	0	32.5	5.6	38.1	0	0	0	0	9.4	34.3	0	43.7	

# CDM Smith, Inc.

1100 Marion Street, Ste 300

Knoxville, TN 37921

865-963-4300

File Name : Thunderhead\_Northshore

Site Code : 00000000

Start Date : 2/15/2018

Page No : 2

Start Time	THUNDERHEAD RD Southbound				NORTHSORE DR Westbound				THUNDERHEAD RD Northbound				NORTHSORE DR Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	64	0	33	97	0	33	<b>22</b>	55	0	0	0	0	137	109	0	246	398
07:30 AM	<b>86</b>	0	<b>75</b>	<b>161</b>	0	44	21	65	0	0	0	0	<b>173</b>	105	0	<b>278</b>	<b>504</b>
07:45 AM	52	0	69	121	0	81	13	<b>94</b>	0	0	0	0	15	119	0	134	349
08:00 AM	13	0	5	18	0	<b>82</b>	9	91	0	0	0	0	5	<b>169</b>	0	174	283
Total Volume	215	0	182	397	0	240	65	305	0	0	0	0	330	502	0	832	1534
% App. Total	54.2	0	45.8		0	78.7	21.3		0	0	0		39.7	60.3	0		
PHF	.625	.000	.607	.616	.000	.732	.739	.811	.000	.000	.000	.000	.477	.743	.000	.748	.761

Peak Hour Analysis From 02:15 PM to 03:00 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 02:15 PM																	
02:15 PM	29	0	8	37	0	78	<b>19</b>	97	0	0	0	0	<b>33</b>	76	0	<b>109</b>	243
02:30 PM	16	0	3	19	0	<b>100</b>	15	<b>115</b>	0	0	0	0	29	70	0	99	233
02:45 PM	24	0	27	51	0	96	10	106	0	0	0	0	17	<b>77</b>	0	94	251
03:00 PM	<b>43</b>	0	<b>60</b>	<b>103</b>	0	75	15	90	0	0	0	0	25	68	0	93	<b>286</b>
Total Volume	112	0	98	210	0	349	59	408	0	0	0	0	104	291	0	395	1013
% App. Total	53.3	0	46.7		0	85.5	14.5		0	0	0		26.3	73.7	0		
PHF	.651	.000	.408	.510	.000	.873	.776	.887	.000	.000	.000	.000	.788	.945	.000	.906	.885

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	32	0	11	43	0	133	17	150	0	0	0	0	11	<b>99</b>	0	<b>110</b>	303
05:00 PM	35	0	15	50	0	110	24	134	0	0	0	0	<b>14</b>	84	0	98	282
05:15 PM	<b>39</b>	0	<b>18</b>	<b>57</b>	0	<b>154</b>	<b>32</b>	<b>186</b>	0	0	0	0	11	97	0	108	<b>351</b>
05:30 PM	24	0	11	35	0	108	28	136	0	0	0	0	12	94	0	106	277
Total Volume	130	0	55	185	0	505	101	606	0	0	0	0	48	374	0	422	1213
% App. Total	70.3	0	29.7		0	83.3	16.7		0	0	0		11.4	88.6	0		
PHF	.833	.000	.764	.811	.000	.820	.789	.815	.000	.000	.000	.000	.857	.944	.000	.959	.864

# CDM Smith, Inc.

1100 Marion Street, Ste 300

Knoxville, TN 37921

865-963-4300

File Name : Thunderhead\_Boardwalk

Site Code : 00012345

Start Date : 2/20/2018

Page No : 1

Groups Printed- Unshifted

Start Time	THUNDERHEAD RD Southbound				BOARDWALK BLVD Westbound				THUNDERHEAD RD Northbound				BOARDWALK BLVD Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
07:00 AM	13	40	0	53	0	0	32	32	0	69	0	69	0	0	0	0	154
07:15 AM	30	142	0	172	2	0	60	62	0	169	2	171	0	0	0	0	405
07:30 AM	60	157	0	217	1	0	50	51	0	182	4	186	0	0	0	0	454
07:45 AM	38	50	0	88	6	0	6	12	0	10	5	15	0	0	0	0	115
<b>Total</b>	<b>141</b>	<b>389</b>	<b>0</b>	<b>530</b>	<b>9</b>	<b>0</b>	<b>148</b>	<b>157</b>	<b>0</b>	<b>430</b>	<b>11</b>	<b>441</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1128</b>
08:00 AM	10	6	0	16	9	0	3	12	0	5	4	9	0	0	0	0	37
08:15 AM	7	7	0	14	5	0	9	14	0	4	2	6	0	0	0	0	34
08:30 AM	4	5	0	9	3	0	5	8	0	3	4	7	0	0	0	0	24
08:45 AM	4	6	0	10	6	0	6	12	0	3	0	3	0	0	0	0	25
<b>Total</b>	<b>25</b>	<b>24</b>	<b>0</b>	<b>49</b>	<b>23</b>	<b>0</b>	<b>23</b>	<b>46</b>	<b>0</b>	<b>15</b>	<b>10</b>	<b>25</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>120</b>
*** BREAK ***																	
02:00 PM	7	8	0	15	6	0	18	24	0	19	1	20	0	0	0	0	59
02:15 PM	2	8	0	10	9	0	24	33	0	33	4	37	0	0	0	0	80
02:30 PM	3	3	0	6	7	0	28	35	0	24	4	28	0	0	0	0	69
02:45 PM	11	61	0	72	9	0	14	23	0	30	2	32	0	0	0	0	127
<b>Total</b>	<b>23</b>	<b>80</b>	<b>0</b>	<b>103</b>	<b>31</b>	<b>0</b>	<b>84</b>	<b>115</b>	<b>0</b>	<b>106</b>	<b>11</b>	<b>117</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>335</b>
03:00 PM	26	87	0	113	5	0	17	22	0	19	5	24	0	0	0	0	159
03:15 PM	15	36	0	51	10	0	5	15	0	7	3	10	0	0	0	0	76
03:30 PM	9	18	0	27	11	0	9	20	0	7	3	10	0	0	0	0	57
03:45 PM	5	13	0	18	14	0	15	29	0	5	2	7	0	0	0	0	54
<b>Total</b>	<b>55</b>	<b>154</b>	<b>0</b>	<b>209</b>	<b>40</b>	<b>0</b>	<b>46</b>	<b>86</b>	<b>0</b>	<b>38</b>	<b>13</b>	<b>51</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>346</b>
04:00 PM	7	18	0	25	14	0	3	17	0	4	3	7	0	0	0	0	49
04:15 PM	5	16	0	21	16	0	10	26	0	1	2	3	0	0	0	0	50
04:30 PM	7	8	0	15	16	0	4	20	0	6	2	8	0	0	0	0	43
04:45 PM	10	10	0	20	29	0	12	41	0	10	0	10	0	0	0	0	71
<b>Total</b>	<b>29</b>	<b>52</b>	<b>0</b>	<b>81</b>	<b>75</b>	<b>0</b>	<b>29</b>	<b>104</b>	<b>0</b>	<b>21</b>	<b>7</b>	<b>28</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>213</b>
05:00 PM	3	7	0	10	16	0	6	22	0	4	4	8	0	0	0	0	40
05:15 PM	4	21	0	25	27	0	12	39	0	8	0	8	0	0	0	0	72
05:30 PM	1	13	0	14	22	0	11	33	0	9	5	14	0	0	0	0	61
05:45 PM	1	11	0	12	16	0	9	25	0	5	1	6	0	0	0	0	43
<b>Total</b>	<b>9</b>	<b>52</b>	<b>0</b>	<b>61</b>	<b>81</b>	<b>0</b>	<b>38</b>	<b>119</b>	<b>0</b>	<b>26</b>	<b>10</b>	<b>36</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>216</b>
<b>Grand Total</b>	<b>282</b>	<b>751</b>	<b>0</b>	<b>1033</b>	<b>259</b>	<b>0</b>	<b>368</b>	<b>627</b>	<b>0</b>	<b>636</b>	<b>62</b>	<b>698</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2358</b>
<b>Apprch %</b>	<b>27.3</b>	<b>72.7</b>	<b>0</b>		<b>41.3</b>	<b>0</b>	<b>58.7</b>		<b>0</b>	<b>91.1</b>	<b>8.9</b>		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	
<b>Total %</b>	<b>12</b>	<b>31.8</b>	<b>0</b>	<b>43.8</b>	<b>11</b>	<b>0</b>	<b>15.6</b>	<b>26.6</b>	<b>0</b>	<b>27</b>	<b>2.6</b>	<b>29.6</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	

# CDM Smith, Inc.

1100 Marion Street, Ste 300

Knoxville, TN 37921

865-963-4300

File Name : Thunderhead\_Boardwalk

Site Code : 00012345

Start Date : 2/20/2018

Page No : 2

Start Time	THUNDERHEAD RD Southbound				BOARDWALK BLVD Westbound				THUNDERHEAD RD Northbound				BOARDWALK BLVD Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	13	40	0	53	0	0	32	32	0	69	0	69	0	0	0	0	154
07:15 AM	30	142	0	172	2	0	60	62	0	169	2	171	0	0	0	0	405
07:30 AM	60	157	0	217	1	0	50	51	0	182	4	186	0	0	0	0	454
07:45 AM	38	50	0	88	6	0	6	12	0	10	5	15	0	0	0	0	115
Total Volume	141	389	0	530	9	0	148	157	0	430	11	441	0	0	0	0	1128
% App. Total	26.6	73.4	0		5.7	0	94.3		0	97.5	2.5		0	0	0		
PHF	.588	.619	.000	.611	.375	.000	.617	.633	.000	.591	.550	.593	.000	.000	.000	.000	.621

Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 02:15 PM																	
02:15 PM	2	8	0	10	9	0	24	33	0	33	4	37	0	0	0	0	80
02:30 PM	3	3	0	6	7	0	28	35	0	24	4	28	0	0	0	0	69
02:45 PM	11	61	0	72	9	0	14	23	0	30	2	32	0	0	0	0	127
03:00 PM	26	87	0	113	5	0	17	22	0	19	5	24	0	0	0	0	159
Total Volume	42	159	0	201	30	0	83	113	0	106	15	121	0	0	0	0	435
% App. Total	20.9	79.1	0		26.5	0	73.5		0	87.6	12.4		0	0	0		
PHF	.404	.457	.000	.445	.833	.000	.741	.807	.000	.803	.750	.818	.000	.000	.000	.000	.684

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	10	10	0	20	29	0	12	41	0	10	0	10	0	0	0	0	71
05:00 PM	3	7	0	10	16	0	6	22	0	4	4	8	0	0	0	0	40
05:15 PM	4	21	0	25	27	0	12	39	0	8	0	8	0	0	0	0	72
05:30 PM	1	13	0	14	22	0	11	33	0	9	5	14	0	0	0	0	61
Total Volume	18	51	0	69	94	0	41	135	0	31	9	40	0	0	0	0	244
% App. Total	26.1	73.9	0		69.6	0	30.4		0	77.5	22.5		0	0	0		
PHF	.450	.607	.000	.690	.810	.000	.854	.823	.000	.775	.450	.714	.000	.000	.000	.000	.847

# Palmer Engineering Company

400 Shopper Drive  
Winchester, KY 40392

Counted By: AKD

Weather: Rainy/Cloudy

Location: Northshore and Town Center

File Name : North Shore and Town Center

Site Code : 00000000

Start Date : 11/6/2017

Page No : 1

Groups Printed: Unshifted - Bank 1

Start Time	Town Center From North				Northshore From East				From South				Northshore From West				Int. Total				
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds		App. Total	App. Total	App. Total	App. Total
07:00 AM	4	0	22	0	19	42	0	0	61	0	0	0	0	85	8	0	0	0	0	93	180
07:15 AM	4	0	24	0	17	55	0	0	72	0	0	0	0	93	9	0	0	0	0	102	202
07:30 AM	6	0	25	0	19	62	0	0	81	0	0	0	0	100	9	0	0	0	0	109	221
07:45 AM	10	0	24	0	16	67	0	0	83	0	0	0	0	105	8	0	0	0	0	113	230
Total	24	0	95	0	71	226	0	0	297	0	0	0	0	383	34	0	0	0	0	417	833
08:00 AM	8	0	28	0	16	75	0	0	91	0	0	0	0	110	9	0	0	0	0	119	246
08:15 AM	12	0	30	0	42	71	0	0	90	0	0	0	0	113	10	0	0	0	0	123	255
08:30 AM	4	0	25	0	29	64	0	0	84	0	0	0	0	131	6	0	0	0	0	137	250
08:45 AM	4	0	26	0	30	56	0	0	83	0	0	0	0	120	10	0	0	0	0	130	243
Total	28	0	109	0	82	266	0	0	348	0	0	0	0	474	35	0	0	0	0	509	994
*** BREAK ***																					
11:00 AM	3	0	51	0	25	57	0	0	82	0	0	0	0	84	3	0	0	0	0	87	223
11:15 AM	10	0	38	0	48	35	0	0	87	0	0	0	0	82	5	0	0	0	0	87	222
11:30 AM	12	0	63	0	75	35	0	0	103	0	0	0	0	85	9	0	0	0	0	94	272
11:45 AM	13	0	66	0	79	46	0	0	142	0	0	0	0	79	9	0	0	0	0	88	309
Total	38	0	218	0	256	141	0	0	414	0	0	0	0	330	26	0	0	0	0	356	1026
12:00 PM	10	0	46	0	53	88	0	0	141	0	0	0	0	94	10	0	0	0	0	104	301
12:15 PM	13	0	69	0	82	47	0	0	124	0	0	0	0	78	9	0	0	0	0	87	293
12:30 PM	10	0	64	0	74	48	0	0	118	0	0	0	0	92	9	0	0	0	0	102	294
12:45 PM	13	0	59	0	72	39	0	0	127	0	0	0	0	81	10	0	0	0	0	91	290
Total	46	0	238	0	284	187	0	0	510	0	0	0	0	345	38	0	0	0	0	384	1178
*** BREAK ***																					
04:00 PM	22	0	95	0	117	134	0	0	171	0	0	0	0	100	10	0	0	0	0	110	398
04:15 PM	14	0	76	0	90	127	0	0	160	0	0	0	0	117	9	0	0	0	0	126	376
04:30 PM	30	0	76	0	106	138	0	0	184	0	0	0	0	109	14	0	0	0	0	123	413
04:45 PM	26	0	85	0	111	60	0	0	217	0	0	0	0	83	12	0	0	0	0	95	423
Total	92	0	332	0	424	176	0	0	732	0	0	0	0	409	45	0	0	0	0	454	1610
05:00 PM	29	0	102	0	131	179	0	0	217	0	0	0	0	120	5	0	0	0	0	125	473
05:15 PM	31	0	89	0	120	46	0	0	257	0	0	0	0	143	6	0	0	0	0	149	526
05:30 PM	23	0	75	0	98	35	0	0	234	0	0	0	0	95	8	0	0	0	0	103	435
05:45 PM	26	0	51	0	77	32	0	0	188	0	0	0	0	95	11	0	0	0	0	106	371
Total	109	0	317	0	426	151	0	0	896	0	0	0	0	453	30	0	0	0	0	483	1805



# Palmer Engineering Company

400 Shopper Drive  
Winchester, KY 40392

File Name : North Shore and Town Center  
Site Code : 00000000  
Start Date : 11/6/2017  
Page No : 2

Counted By: AKD  
Weather: Rainy/Cloudy  
Location: Northshore and Town Center

Groups Printed: Unshifted - Bank 1

Start Time	Town Center From North						Northshore From East						From South						Northshore From West											
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total
	06:00 PM	17	0	81	0	98	38	155	0	1	194	0	0	0	0	0	0	96	14	0	0	0	110	0	0	0	110	0	0	0
Grand Total	354	0	1390	0	1744	846	2544	0	1	3391	0	0	0	0	0	0	2490	222	0	0	0	2713	0	0	0	2713	0	0	0	2713
Approch %	20.3	0	79.7	0		24.9	75	0	0		0	0	0	0	0	0	91.8	8.2	0	0	0	34.6	0	0	0	34.6	0	0	0	34.6
Total %	4.5	0	17.7	0	22.2	10.8	32.4	0	0	43.2	0	0	0	0	0	0	31.7	2.8	0	0	0	34.6	0	0	0	34.6	0	0	0	34.6
Unshifted	353	0	1375	0	1728	843	2530	0	1	3374	0	0	0	0	0	0	2471	222	0	0	0	2694	0	0	0	2694	0	0	0	2694
% Unshifted	99.7	0	98.9	0	99.1	99.6	99.4	0	100	99.5	0	0	0	0	0	0	99.2	100	0	0	0	99.3	0	0	0	99.3	0	0	0	99.3
Bank 1	1	0	15	0	16	3	14	0	0	17	0	0	0	0	0	0	19	0	0	0	19	0	0	0	19	0	0	0	19	
% Bank 1	0.3	0	1.1	0	0.9	0.4	0.6	0	0	0.5	0	0	0	0	0	0	0.8	0	0	0	0	0.7	0	0	0	0.7	0	0	0	0.7

Start Time	Town Center From North						Northshore From East						From South						Northshore From West											
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total
	07:30 AM	6	0	25	0	31	19	62	0	0	81	0	0	0	0	0	0	100	9	0	0	109	0	0	0	109	0	0	0	109
07:45 AM	10	0	24	0	34	16	67	0	0	83	0	0	0	0	0	0	105	8	0	0	113	0	0	0	113	0	0	0	113	
08:00 AM	8	0	28	0	36	16	75	0	0	91	0	0	0	0	0	0	110	9	0	0	119	0	0	0	119	0	0	0	119	
08:15 AM	12	0	30	0	42	19	71	0	0	90	0	0	0	0	0	0	113	10	0	0	123	0	0	0	123	0	0	0	123	
Total Volume	36	0	107	0	143	70	275	0	0	345	0	0	0	0	0	0	428	36	0	0	464	0	0	0	464	0	0	0	464	
% App. Total	25.2	0	74.8	0		20.3	79.7	0	0		0	0	0	0	0	0	92.2	7.8	0	0		94.3	0	0		94.3	0	0		94.3
PHF	.750	.000	.892	.000	.851	.921	.917	.000	.000	.948	.000	.000	.000	.000	.000	.000	.947	.900	.000	.000	.943	.000	.000	.000	.943	.000	.000	.000	.943	

Start Time	Town Center From North						Northshore From East						From South						Northshore From West											
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total
	04:45 PM	26	0	85	0	111	60	157	0	0	217	0	0	0	0	0	0	83	12	0	0	95	0	0	0	95	0	0	0	95
05:00 PM	29	0	102	0	131	38	179	0	0	217	0	0	0	0	0	0	120	5	0	0	125	0	0	0	125	0	0	0	125	
05:15 PM	31	0	89	0	120	46	211	0	0	257	0	0	0	0	0	0	143	6	0	0	149	0	0	0	149	0	0	0	149	
05:30 PM	23	0	75	0	98	35	199	0	0	234	0	0	0	0	0	0	95	8	0	0	103	0	0	0	103	0	0	0	103	
Total Volume	109	0	351	0	460	179	746	0	0	925	0	0	0	0	0	0	441	31	0	0	472	0	0	0	472	0	0	0	472	
% App. Total	23.7	0	76.3	0		19.4	80.6	0	0		0	0	0	0	0	0	93.4	6.6	0	0		97.2	0	0		97.2	0	0		97.2
PHF	.879	.000	.860	.000	.878	.746	.884	.000	.000	.900	.000	.000	.000	.000	.000	.000	.947	.900	.000	.000	.943	.000	.000	.000	.943	.000	.000	.000	.943	

Peak Hour Analysis From 12:45 PM to 06:00 PM - Peak 1 of 1  
Peak Hour for Entire Intersection Begins at 04:45 PM

# Palmer Engineering Company

400 Shopper Drive  
Winchester, KY 40392

Default Comments

Change These in The Preferences Window

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Then Click the Comments Tab

File Name : Unsignalized  
Site Code : 00000000  
Start Date : 11/6/2017  
Page No : 1

Start Time	Town Center From North						Side Street From East						Town Center From South						Entrance From West					
	Right	Thru	Left	Peds	App. Total		Right	Thru	Left	Peds	App. Total		Right	Thru	Left	Peds	App. Total		Right	Thru	Left	Peds	App. Total	
07:00 AM	1	14	1	0	16		0	0	2	0	15	1	0	0	0	1	0	16	2	0	1	0	3	37
07:15 AM	2	17	0	0	19		0	0	2	0	15	0	0	0	0	0	15	0	0	0	0	0	0	36
07:30 AM	2	42	0	0	44		0	0	1	0	21	2	0	0	0	0	28	0	0	0	0	0	0	73
07:45 AM	3	43	0	0	46		0	0	3	0	10	10	0	0	0	0	24	1	0	0	0	1	1	74
Total	8	116	1	0	125		0	0	8	0	61	13	0	0	0	1	83	3	0	1	0	4	220	
08:00 AM	9	17	0	0	26		0	0	2	0	9	9	0	0	0	0	25	2	0	0	0	2	55	
08:15 AM	16	23	0	0	39		0	0	2	0	11	9	0	0	0	29	2	0	0	0	2	2	72	
08:30 AM	11	30	1	0	42		0	0	3	0	16	5	0	0	1	27	0	0	1	0	1	0	73	
08:45 AM	3	27	0	0	30		0	0	3	0	18	6	0	0	0	32	1	0	0	0	1	1	66	
Total	39	97	1	0	137		0	0	10	0	54	29	0	0	1	113	5	0	1	0	6	6	266	
*** BREAK ***																								
11:00 AM	4	43	1	0	48		1	0	5	0	15	4	0	0	0	28	2	0	0	0	0	2	84	
11:15 AM	3	38	0	0	41		0	0	4	0	31	4	0	0	0	46	8	0	0	0	0	8	99	
11:30 AM	4	57	2	0	63		2	0	11	0	24	4	0	0	0	42	3	0	2	0	0	5	123	
11:45 AM	0	40	2	0	42		1	0	6	0	29	4	0	0	0	48	8	0	1	0	0	9	106	
Total	11	178	5	0	194		4	0	26	0	99	16	0	0	0	164	21	0	3	0	24	24	412	
12:00 PM	0	43	1	0	44		0	0	16	0	36	3	0	0	0	63	6	0	0	0	0	6	129	
12:15 PM	2	57	3	0	62		0	0	10	0	29	3	0	0	0	48	6	0	0	0	6	6	126	
12:30 PM	2	54	0	0	56		0	0	14	0	36	5	0	0	0	61	5	0	3	0	8	8	139	
12:45 PM	10	85	0	0	95		0	0	12	0	26	14	0	0	0	56	8	0	3	0	11	11	174	
Total	14	239	4	0	257		0	0	52	0	127	25	0	0	0	228	25	0	6	0	31	31	568	
*** BREAK ***																								
02:00 PM	4	60	2	0	66		1	0	13	0	30	9	0	0	0	52	8	0	2	0	10	10	142	
02:15 PM	9	62	2	0	73		5	0	12	0	28	6	0	0	0	45	10	0	2	0	12	12	147	
02:30 PM	2	72	2	0	76		0	0	17	0	34	3	0	0	0	53	7	0	1	0	8	8	154	
02:45 PM	5	52	0	0	57		1	0	7	0	36	6	0	0	0	54	6	0	0	0	6	6	125	
Total	20	246	6	0	272		7	0	49	0	128	24	0	0	0	204	31	0	5	0	36	36	568	
03:00 PM	4	84	3	0	91		0	0	20	0	27	3	0	0	0	50	5	0	0	0	5	5	166	
03:15 PM	3	81	1	0	85		0	0	15	0	41	5	0	0	0	57	9	0	0	0	9	9	166	
03:30 PM	3	74	2	0	79		1	0	12	0	33	3	0	0	0	47	6	0	0	0	6	6	145	
03:45 PM	7	53	1	0	61		0	0	14	0	29	4	0	0	0	52	4	0	0	0	4	4	131	
Total	17	292	7	0	316		1	0	61	0	130	15	0	0	0	206	24	0	0	0	24	24	608	

# Palmer Engineering Company

400 Shopper Drive  
Winchester, KY 40392

Default Comments

Change These in The Preferences Window

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Then Click the Comments Tab

File Name : Unsignalized  
Site Code : 00000000  
Start Date : 11/6/2017  
Page No : 2

## Groups Printed- Class 1 - Class 2

Start Time	Town Center From North						Side Street From East						Town Center From South						Entrance From West					
	Right	Thru	Left	Peds	App. Total		Right	Thru	Left	Peds	App. Total		Right	Thru	Left	Peds	App. Total		Right	Thru	Left	Peds	App. Total	
	04:00 PM	5	89	1	0	95	1	0	23	0	24	34	3	0	49	7	0	0	0	7	0	0	0	7
04:15 PM	5	75	0	0	80	0	0	6	0	6	14	26	3	0	43	5	0	0	0	5	0	0	5	134
04:30 PM	0	87	1	0	88	0	0	12	0	12	11	34	8	0	53	10	0	1	0	11	0	0	11	164
04:45 PM	0	84	1	0	85	1	0	8	0	9	10	49	6	0	65	10	0	0	0	10	0	0	10	169
<b>Total</b>	<b>10</b>	<b>335</b>	<b>3</b>	<b>0</b>	<b>348</b>	<b>2</b>	<b>0</b>	<b>49</b>	<b>0</b>	<b>51</b>	<b>47</b>	<b>143</b>	<b>20</b>	<b>0</b>	<b>210</b>	<b>32</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>33</b>	<b>0</b>	<b>0</b>	<b>33</b>	<b>642</b>
05:00 PM	1	105	1	0	107	0	0	7	0	7	12	46	3	0	61	27	0	2	0	29	0	0	29	204
05:15 PM	0	97	0	0	97	0	0	5	0	5	12	36	1	0	49	14	0	0	0	14	0	0	14	165
05:30 PM	1	75	0	0	76	0	0	8	0	8	8	37	2	0	47	7	0	0	0	7	0	0	7	138
05:45 PM	2	80	0	0	82	0	0	13	0	13	10	32	2	0	44	7	0	1	0	8	0	0	8	147
<b>Total</b>	<b>4</b>	<b>357</b>	<b>1</b>	<b>0</b>	<b>362</b>	<b>0</b>	<b>0</b>	<b>33</b>	<b>0</b>	<b>33</b>	<b>42</b>	<b>151</b>	<b>8</b>	<b>0</b>	<b>201</b>	<b>55</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>58</b>	<b>0</b>	<b>0</b>	<b>58</b>	<b>654</b>

\*\*\* BREAK \*\*\*

Grand Total	123	1860	28	0	2011	14	0	288	0	302	366	893	150	0	1409	196	0	20	0	216	0	0	216	3938
Approch %	6.1	92.5	1.4	0		4.6	0	95.4	0		26	63.4	10.6	0		90.7	0	9.3	0		0	0	5.5	
Total %	3.1	47.2	0.7	0	51.1	0.4	0	7.3	0	7.7	9.3	22.7	3.8	0	35.8	5	0	0.5	0		0	0	5.5	
Class 1	123	1841	28	0	1992	13	0	288	0	301	366	883	150	0	1399	196	0	20	0	216	0	0	216	3908
% Class 1	100	99	100	0	99.1	92.9	0	100	0	99.7	100	98.9	100	0	99.3	100	0	100	0	100	0	0	100	99.2
Class 2	0	19	0	0	19	1	0	0	0	1	0	10	0	0	10	0	0	0	0	0	0	0	0	30
% Class 2	0	1	0	0	0.9	7.1	0	0	0	0.3	0	1.1	0	0	0.7	0	0	0	0	0	0	0	0	0.8

Start Time	Town Center From North						Side Street From East						Town Center From South						Entrance From West					
	Right	Thru	Left	Peds	App. Total		Right	Thru	Left	Peds	App. Total		Right	Thru	Left	Peds	App. Total		Right	Thru	Left	Peds	App. Total	
	07:30 AM	2	42	0	0	44	0	0	1	0	1	5	21	2	0	28	0	0	0	0	0	0	0	0
07:45 AM	3	43	0	0	46	0	0	3	0	3	4	10	10	0	24	1	0	0	0	1	0	0	1	74
08:00 AM	9	17	0	0	26	0	0	2	0	2	7	9	9	0	25	2	0	0	0	2	0	0	2	55
08:15 AM	16	23	0	0	39	0	0	2	0	2	9	11	9	0	29	2	0	0	0	2	0	0	2	72
Total Volume	30	125	0	0	155	0	0	8	0	8	25	51	30	0	106	5	0	0	0	5	0	0	5	274
% App. Total	19.4	80.6	0	0		0	0	100	0		23.6	48.1	28.3	0		100	0	0	0		0	0		
PHF	.469	.727	.000	.000	.842	.000	.000	.667	.000	.667	.694	.607	.750	.000	.914	.625	.000	.000	.000	.625	.000	.000	.625	.926

Peak Hour Analysis From 07:00 AM to 08:15 AM - Peak 1 of 1  
Peak Hour for Entire Intersection Begins at 07:30 AM

# Palmer Engineering Company

400 Shopper Drive  
Winchester, KY 40392

Default Comments

Change These in The Preferences Window

Select File/Preference in the Main Screenshot

Then Click the Comments Tab

File Name : Unsignalized  
Site Code : 00000000  
Start Date : 11/6/2017  
Page No : 3

Start Time	Town Center From North				Side Street From East				Town Center From South				Entrance From West								
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 06:30 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	0	87	1	0	88	0	0	12	0	12	11	34	8	0	53	10	0	1	0	11	164
04:45 PM	0	84	1	0	85	1	0	8	0	9	10	49	6	0	65	10	0	0	0	10	169
05:00 PM	1	105	1	0	107	0	0	7	0	7	12	46	3	0	61	27	0	2	0	29	204
05:15 PM	0	97	0	0	97	0	0	5	0	5	12	36	1	0	49	14	0	0	0	14	165
Total Volume	1	373	3	0	377	1	0	32	0	33	45	165	18	0	228	61	0	3	0	64	702
% App. Total	0.3	98.9	0.8	0	99.9	3	0	97	0	99.9	19.7	72.4	7.9	0	95.3	95.3	0	4.7	0	17.8	100.0
PHF	.250	.888	.750	.000	.881	.250	.000	.667	.000	.688	.938	.842	.563	.000	.877	.565	.000	.375	.000	.552	.860

# Palmer Engineering Company

400 Shopper Drive  
Winchester, KY 40392

Counted By: JJLC

Weather: Rain/ Cloudy

Location: Town Center & Signal Side St  
Location

File Name : Town Center and Side St  
Site Code : 00000000  
Start Date : 11/6/2017  
Page No : 1

Start Time	Town Center From North				SIDE ST From East				Town Center From South				Int. Total
	Thru	Left	App. Total	Right	Right	Left	App. Total	Right	Thru	Left	App. Total	Int. Total	
07:00 AM	14	4	18	2	4	4	6	4	9	0	13	37	
07:15 AM	22	4	26	1	1	2	2	3	12	0	15	43	
07:30 AM	63	4	67	1	3	4	4	4	13	0	17	88	
07:45 AM	13	3	16	1	4	5	5	3	10	0	13	34	
Total	112	15	127	5	12	17	17	14	44	0	58	202	
08:00 AM	21	6	27	0	3	3	3	2	7	0	9	39	
08:15 AM	40	1	41	1	8	9	9	2	10	0	12	62	
08:30 AM	27	4	31	0	6	6	6	4	7	0	11	48	
08:45 AM	14	3	17	0	9	9	9	11	8	1	20	46	
Total	102	14	116	1	26	27	27	19	32	1	52	195	
*** BREAK ***													
11:00 AM	26	18	44	2	12	14	14	10	17	0	27	85	
11:15 AM	23	11	34	1	20	21	21	8	17	0	25	80	
11:30 AM	40	18	58	1	30	31	31	14	12	1	27	116	
11:45 AM	28	12	40	1	27	28	28	14	16	0	30	98	
Total	117	59	176	5	89	94	94	46	62	1	109	379	
12:00 PM	24	19	43	2	17	19	19	19	19	0	38	100	
12:15 PM	37	23	60	4	46	50	50	13	20	0	33	143	
12:30 PM	25	14	39	5	35	40	40	12	16	0	28	107	
12:45 PM	44	14	58	6	28	34	34	11	19	0	30	122	
Total	130	70	200	17	126	143	143	55	74	0	129	472	
*** BREAK ***													
01:00 PM	1	0	1	0	0	0	0	0	1	0	1	2	
Total	1	0	1	0	0	0	0	0	1	0	1	2	
*** BREAK ***													
04:00 PM	43	37	80	7	50	57	57	26	17	0	43	180	
04:15 PM	34	18	52	2	43	45	45	7	7	0	14	111	
04:30 PM	44	26	70	3	44	52	52	25	18	1	44	166	
04:45 PM	42	36	78	6	51	57	57	29	27	0	56	191	
Total	163	117	280	18	193	211	211	87	69	1	157	648	
05:00 PM	44	18	62	5	48	53	53	21	16	0	37	152	

# Palmer Engineering Company

400 Shopper Drive  
Winchester, KY 40392

Counted By: JJLC

Weather: Rain/ Cloudy

Location: Town Center & Signal Side St  
Location

File Name : Town Center and Side St  
Site Code : 00000000  
Start Date : 11/6/2017  
Page No : 2

Groups Printed: Unshifted - Bank 1

Start Time	Town Center From North				SIDE ST From East				Town Center From South						
	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
05:15 PM	38	31	69	2	61	63	14	19	0	33	14	19	0	33	165
05:30 PM	37	16	53	1	49	50	16	17	0	33	16	17	0	33	136
05:45 PM	32	24	56	5	35	40	15	18	0	33	15	18	0	33	129
Total	151	89	240	13	193	206	66	70	0	136	66	70	0	136	582
06:00 PM	36	21	57	0	42	42	23	22	0	45	23	22	0	45	144
Grand Total	812	385	1197	59	681	740	310	374	3	687	310	374	3	687	2624
Approch %	67.8	32.2		8	92		45.1	54.4	0.4		45.1	54.4	0.4		
Total %	30.9	14.7	45.6	2.2	26	28.2	11.8	14.3	0.1	26.2	11.8	14.3	0.1	26.2	
Unshifted	801	383	1184	58	674	732	308	372	3	683	308	372	3	683	2599
% Unshifted	98.6	99.5	98.9	98.3	99	98.9	99.4	99.5	100	99.4	99.4	99.5	100	99.4	99
Bank 1	11	2	13	1	7	8	2	2	0	4	2	2	0	4	25
% Bank 1	1.4	0.5	1.1	1.7	1	1.1	0.6	0.5	0	0.6	0.6	0.5	0	0.6	1

\*\*\* BREAK \*\*\*

Start Time	Town Center From North				SIDE ST From East				Town Center From South						
	Thru	Left	App. Total	Right	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
07:00 AM	63	4	67	1	3	4	4	13	0	17	4	13	0	17	88
07:30 AM	13	3	16	1	4	5	3	10	0	13	3	10	0	13	34
08:00 AM	21	6	27	0	3	3	2	7	0	9	2	7	0	9	39
08:15 AM	40	1	41	1	8	9	2	10	0	12	2	10	0	12	62
Total Volume	137	14	151	3	18	21	11	40	0	51	11	40	0	51	223
% App. Total	90.7	9.3		14.3	85.7		21.6	78.4	0		21.6	78.4	0		
PHF	.544	.583	.563	.750	.563	.583	.688	.769	.000	.750	.688	.769	.000	.750	.634

Peak Hour Analysis From 07:00 AM to 10:00 AM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 07:30 AM

# Palmer Engineering Company

400 Shopper Drive  
Winchester, KY 40392

Counted By: JJLC

Weather: Rain/ Cloudy

Location: Town Center & Signal Side St  
Location

File Name : Town Center and Side St  
Site Code : 00000000  
Start Date : 11/6/2017  
Page No : 3

Start Time	Town Center From North			SIDE ST From East			Town Center From South			
	Thru	Left	App. Total	Right	Left	App. Total	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 01:00 PM to 06:15 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:30 PM										
04:30 PM	44	26	70	3	49	52	18	1	44	166
04:45 PM	42	36	78	6	51	57	27	0	56	191
05:00 PM	44	18	62	5	48	53	16	0	37	152
05:15 PM	38	31	69	2	61	63	19	0	33	165
Total Volume	168	111	279	16	209	225	80	1	170	674
% App. Total	60.2	39.8	.894	7.1	92.9	.893	47.1	0.6	.759	.882
PHF	.955	.771	.894	.667	.857	.893	.741	.250	.759	.882

# Palmer Engineering Company

400 Shopper Drive  
Winchester, KY 40392

Counted By: JJLC  
Weather: Cloudy/Rainy  
Location: Roundabout along Town Center

File Name : Roundabout  
Site Code : 00000000  
Start Date : 11/6/2017  
Page No : 1

Groups Printed: Unshifted - Bank 1																					
Start Time	Town Center From North				Off Ramp From East				Town Center From South				Boardwalk From West								
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	1	1	0	0	2	4	28	3	0	35	0	4	7	1	12	11	0	1	0	12	61
07:15 AM	1	0	0	0	1	2	43	7	0	52	0	4	10	0	14	14	0	1	0	15	82
07:30 AM	1	5	0	0	6	3	56	3	0	62	0	5	9	0	14	35	0	3	0	38	120
07:45 AM	2	3	0	0	5	2	12	7	0	21	0	10	3	0	13	37	0	4	0	41	80
Total	5	9	0	0	14	11	139	20	0	170	0	23	29	1	53	97	0	9	0	106	343
08:00 AM	1	6	0	0	7	6	14	16	0	36	0	5	2	0	7	5	0	1	0	6	56
08:15 AM	3	12	0	0	15	9	10	19	0	38	0	7	2	0	9	3	0	0	0	3	65
08:30 AM	1	10	0	0	11	11	7	15	0	33	0	7	0	0	7	7	0	2	0	9	60
08:45 AM	1	11	0	0	12	4	10	9	0	23	0	9	0	1	10	4	0	0	0	4	49
Total	6	39	0	0	45	30	41	59	0	130	0	28	4	1	33	19	0	3	0	22	230
*** BREAK ***																					
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2
11:30 AM	1	21	0	0	22	10	9	11	0	30	0	10	3	0	13	3	0	1	0	4	69
11:45 AM	1	25	0	0	26	7	9	17	0	33	0	18	2	0	20	3	0	3	0	6	85
Total	2	46	0	0	48	17	18	28	0	63	0	28	5	0	33	6	0	6	0	12	156
12:00 PM	3	23	0	0	26	14	10	18	0	42	0	12	2	0	14	7	0	3	0	10	92
12:15 PM	0	24	0	0	24	8	12	13	0	33	0	15	3	0	18	4	0	2	0	6	81
12:30 PM	1	25	0	0	26	9	15	13	0	37	0	19	0	0	19	5	0	1	0	6	88
12:45 PM	2	26	0	0	28	15	8	18	0	41	0	22	1	0	23	5	0	4	0	9	101
Total	6	98	0	0	104	46	45	62	0	153	0	68	6	0	74	21	0	10	0	31	362
01:00 PM	1	27	0	0	28	6	8	10	0	24	0	25	3	0	28	6	0	2	0	8	88
01:15 PM	2	29	0	0	31	11	6	14	0	31	0	14	8	0	22	5	0	4	0	9	93
*** BREAK ***																					
Total	3	56	0	0	59	17	14	24	0	55	0	39	11	0	50	11	0	6	0	17	181
02:00 PM	5	24	0	0	29	8	16	14	0	38	0	22	8	0	30	10	0	2	0	12	109
02:15 PM	2	32	0	0	34	16	10	19	0	45	0	23	7	0	30	6	0	3	0	9	118
02:30 PM	7	41	0	0	48	9	13	18	0	40	0	19	7	0	26	6	0	2	0	8	122
02:45 PM	4	20	0	0	24	7	16	27	0	50	0	20	13	0	33	12	0	2	0	14	121
Total	18	117	0	0	135	40	55	78	0	173	0	84	35	0	119	34	0	9	0	43	470
03:00 PM	1	27	0	0	28	17	15	25	0	57	0	12	4	0	16	27	0	4	0	31	132
03:15 PM	3	35	0	0	38	11	10	11	0	32	0	20	5	0	25	12	0	7	0	19	114
03:30 PM	4	32	0	0	36	16	12	25	0	53	0	18	4	0	22	8	0	4	0	12	123



# Palmer Engineering Company

400 Shopper Drive  
Winchester, KY 40392

Counted By: JJLC  
Weather: Cloudy/Rainy  
Location: Roundabout along Town Center

File Name : Roundabout  
Site Code : 00000000  
Start Date : 11/6/2017  
Page No : 2

Groups Printed: Unshifted - Bank 1

Start Time	Town Center From North				Off Ramp From East				Town Center From South				Boardwalk From West					
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds		
	App. Total				App. Total				App. Total				App. Total					
03:45 PM	2	27	0	0	21	18	38	0	77	0	25	2	2	0	3	0	5	138
Total	10	121	0	0	65	55	99	0	219	0	75	15	0	49	18	0	67	507
04:00 PM	7	41	0	0	13	9	25	0	47	0	22	3	0	3	0	4	0	7
04:15 PM	1	26	0	0	7	16	24	0	47	0	14	1	0	6	0	3	0	9
04:30 PM	5	43	0	0	15	15	23	0	53	0	18	3	0	6	0	2	0	8
04:45 PM	4	37	0	0	18	23	27	0	68	0	21	3	0	7	0	1	0	8
Total	17	147	0	0	53	63	99	0	215	0	75	10	0	22	0	10	0	32
05:00 PM	6	35	0	0	15	22	19	0	56	0	23	3	0	7	0	1	0	8
05:15 PM	1	39	0	0	12	17	32	0	61	0	21	2	0	4	0	4	0	8
05:30 PM	5	29	0	0	16	26	14	0	56	0	15	3	0	7	0	0	0	7
05:45 PM	7	33	0	0	12	23	18	0	53	0	24	2	0	5	0	3	0	8
Total	19	136	0	0	55	88	83	0	226	0	83	10	0	23	0	8	0	31
06:00 PM	1	31	0	0	16	13	22	0	51	0	13	3	0	1	0	1	0	2
06:15 PM	0	3	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	4
Grand Total	87	803	0	0	351	531	574	0	1456	0	516	128	2	283	0	80	0	363
Approch %	9.8	90.2	0	0	24.1	36.5	39.4	0	79.9	0	19.8	0.3	0	78	0	22	0	10.8
Total %	2.6	23.9	0	0	10.5	15.8	17.1	0	43.4	0	15.4	3.8	0.1	8.4	0	2.4	0	10.8
Unshifted	86	794	0	0	349	526	573	0	1448	0	512	128	2	281	0	77	0	358
% Unshifted	98.9	98.9	0	0	99.4	99.1	99.8	0	99.5	0	99.2	100	100	99.3	0	96.2	0	98.6
Bank 1	1	9	0	0	2	5	1	0	8	0	4	0	0	2	0	3	0	5
% Bank 1	1.1	1.1	0	0	0.6	0.9	0.2	0	0.5	0	0.8	0	0	0.7	0	3.8	0	1.4

# Palmer Engineering Company

400 Shopper Drive  
Winchester, KY 40392

Counted By: JJLC  
Weather: Cloudy/Rainy  
Location: Roundabout along Town Center

File Name : Roundabout  
Site Code : 00000000  
Start Date : 11/6/2017  
Page No : 3

Start Time	Town Center From North				Off Ramp From East				Town Center From South				Boardwalk From West								
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:30 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	1	5	0	0	6	3	56	3	0	62	0	5	9	0	14	35	0	3	0	38	120
07:45 AM	2	3	0	0	5	2	12	7	0	21	0	10	3	0	13	37	0	4	0	41	80
08:00 AM	1	6	0	0	7	6	14	16	0	36	0	5	2	0	7	5	0	1	0	6	56
08:15 AM	3	12	0	0	15	9	10	19	0	38	0	7	2	0	9	3	0	0	0	3	65
Total Volume	7	26	0	0	33	20	92	45	0	157	0	27	16	0	43	80	0	8	0	88	321
% App. Total	21.2	78.8	0	0	55.0	12.7	58.6	28.7	0	63.3	0	62.8	37.2	0	76.8	90.9	0	9.1	0	53.7	66.9
PHF	.583	.542	.000	.000	.550	.556	.411	.592	.000	.633	.000	.675	.444	.000	.768	.541	.000	.500	.000	.537	.669
Peak Hour Analysis From 01:00 PM to 06:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	5	43	0	0	48	15	15	23	0	53	0	18	3	0	21	6	0	2	0	8	130
04:45 PM	4	37	0	0	41	18	23	27	0	68	0	21	3	0	24	7	0	1	0	8	141
05:00 PM	6	35	0	0	41	15	22	19	0	56	0	23	3	0	26	7	0	1	0	8	131
05:15 PM	1	39	0	0	40	12	17	32	0	61	0	21	2	0	23	4	0	4	0	8	132
Total Volume	16	154	0	0	170	60	77	101	0	238	0	83	11	0	94	24	0	8	0	32	534
% App. Total	9.4	90.6	0	0	88.5	25.2	32.4	42.4	0	87.5	0	88.3	11.7	0	90.4	75	0	25	0	32	534
PHF	.667	.895	.000	.000	.885	.833	.837	.789	.000	.875	.000	.902	.917	.000	.904	.857	.000	.500	.000	1.00	.947

## Traffic History

Traffic History reflects the Annual Average Daily Traffic (AADT) count along specific locations on Tennessee's road network

View stations on map:

Non-Map Record Search:

Station Number:

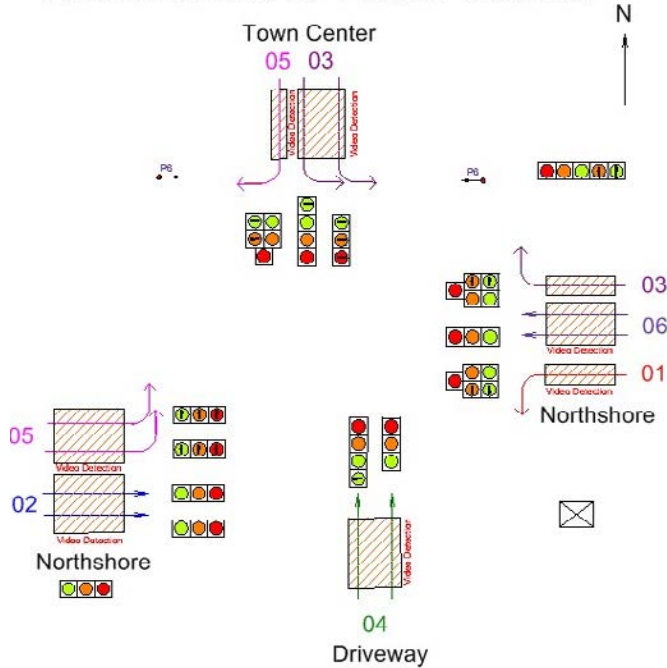
**Station Informa**

Station	000130
Route	SR332
Location	NEAR BLUE GRAS
County	Knox
2016	11116
2015	14465
2014	14184
2013	13852
2012	12328
2011	11352
2010	11255
2009	11031
2008	10929
2007	11985
2006	11744
2005	11818
2004	11544
2003	11081
2002	10558
2001	8860
2000	10456
1999	8610
1998	8051

(https://maps.google.com/maps?ll=35.85819,-84.077811&z=16&t=m&hl=en-  
<https://maps.google.com/maps?ll=35.85819,-84.077811,16z/data=!10m1!1e1!12b1?solMap data @ 2018 - Google>

Download	KML	ESRI Geodatabase	ESRI Shapefile	Database
File:	(/Applications/Files/TrfcHist.kmz)	(/Applications/Files/TrfcHistFGDB.zip)	(/Applications/Files/TrfcHistSHP.zip)	(/Applications/Files/1
Open	Google Earth	ArcGIS Explorer		MS Access o
With:	(https://earth.google.com/)	(http://www.esri.com/software/arcgis/explorer/index.html)		

# Northshore & Town Center



MAX 1: (0-255)								TIMING PLAN: 1	
PH	1	2	3	4	5	6	7	8	
	10	60	30	10	20	60	10	10	
MAX 2: (0-255)									
PH	1	2	3	4	5	6	7	8	
	15	65	35	15	25	65	20	20	
SHIFT-RT.-> TO VIEW OR ENTER PHASES 9-16									

YELLOW: (0-25.5)								TIMING PLAN: 2	
PH	1	2	3	4	5	6	7	8	
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RED: (0-25.5)									
PH	1	2	3	4	5	6	7	8	
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SHIFT-RT.-> TO VIEW OR ENTER PHASES 9-16									

CYCLE/MIN TIMES							VALUE (0-255 SECS)	
# OF CYCLES TO OUT-OF-STEP: 0 (0= DIS)								
	CYCLE	1	2	3	4	5	6	
	LENGTH	80	90	100	90	100	100	
	MIN LENGTH	0	0	0	0	0	0	
(0= DISABLED)								

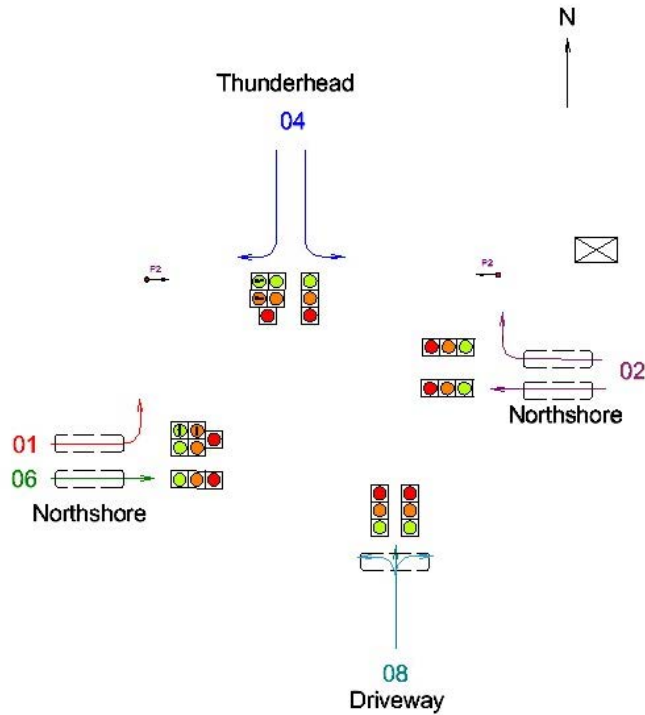
OFFSETS							VALUE (%:0-100)	
	CYCLE	1	2	3	4	5	6	
	OFFSET 1	45	0	97	0	0	0	
	OFFSET 2	0	0	0	0	0	0	
	OFFSET 3	0	0	0	0	0	0	
	OFFSET 4	0	0	0	0	0	0	
	OFFSET 5	0	0	0	0	0	0	

SPLIT 1 ALL CYCLES								VALUE (%:0-100)	
PHASE ALLOCATIONS 4 SPLITS/CYCLE: N									
PHASE	1	2	3	4	5	6	7	8	
SPLIT 1	15	37	35	13	20	37	20	23	
PHASE	1	2	3	4	5	6	7	8	
SPLIT 2	15	37	25	13	20	37	20	23	
SHIFT-RT.-> TO VIEW OR ENTER PHASES 9-16									

SPLIT 1 ALL CYCLES								VALUE (%:0-100)	
PHASE ALLOCATIONS 4 SPLITS/CYCLE: N									
PHASE	9	10	11	12	13	14	15	16	
SPLIT 1	0	0	0	0	0	0	0	0	
PHASE	9	10	11	12	13	14	15	16	
SPLIT 2	0	0	0	0	0	0	0	0	
SHIFT-LT.<- TO VIEW OR ENTER PHASES 1-8									

SPLIT 3 ALL CYCLES								VALUE (%:0-100)	
PHASE ALLOCATIONS 4 SPLITS/CYCLE: N									
PHASE	1	2	3	4	5	6	7	8	
SPLIT 3	0	0	0	0	0	0	0	0	
PHASE	1	2	3	4	5	6	7	8	
SPLIT 4	15	37	25	13	20	37	20	23	
SHIFT-RT.-> TO VIEW OR ENTER PHASES 9-16									

# Northshore & Thunderhead



MAX 1: (0-255)								TIMING PLAN: 1	
PH	1	2	3	4	5	6	7	8	
	15	45	10	25	10	60	10	25	
MAX 2: (0-255)									
PH	1	2	3	4	5	6	7	8	
	20	20	20	20	20	20	20	20	
SHIFT-RT.-> TO VIEW OR ENTER PHASES 9-16									

YELLOW: (0-25.5)								TIMING PLAN: 2	
PH	1	2	3	4	5	6	7	8	
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RED: (0-25.5)									
PH	1	2	3	4	5	6	7	8	
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SHIFT-RT.-> TO VIEW OR ENTER PHASES 9-16									

CYCLE/DWELL TIMES							VALUE (0-255 SECS)		
# OF CYCLES TO OUT-OF-STEP: 0 (0= DIS)									
	CYCLE	1	2	3	4	5	6		
	LENGTH	80	90	100	90	90	100		
	MAX DWELL	0	0	0	0	0	0		

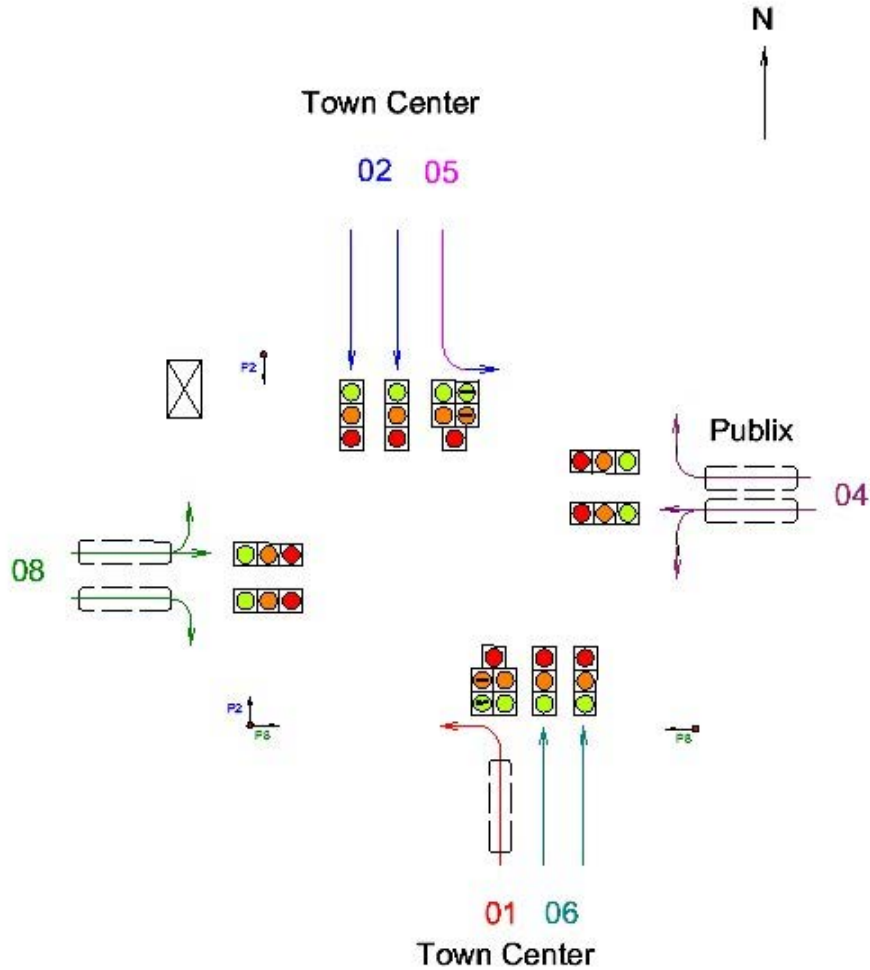
OFFSETS							VALUE (%:0-100)		
	CYCLE	1	2	3	4	5	6		
	OFFSET 1	38	93	8	0	0	0		
	OFFSET 2	0	93	0	0	0	0		
	OFFSET 3	0	0	0	0	0	0		
	OFFSET 4	0	0	0	0	0	0		
	OFFSET 5	0	0	0	0	0	0		

SPLIT 1 ALL CYCLES								VALUE (%:0-100)	
PHASE ALLOCATIONS 4 SPLITS/CYCLE: N									
PHASE	1	2	3	4	5	6	7	8	
SPLIT 1	25	50	0	25	0	75	0	25	
PHASE	1	2	3	4	5	6	7	8	
SPLIT 2	30	45	0	25	0	75	0	25	
SHIFT-RT.-> TO VIEW OR ENTER PHASES 9-16									

SPLIT 1 ALL CYCLES								VALUE (%:0-100)	
PHASE ALLOCATIONS 4 SPLITS/CYCLE: N									
PHASE	9	10	11	12	13	14	15	16	
SPLIT 1	0	0	0	0	0	0	0	0	
PHASE	9	10	11	12	13	14	15	16	
SPLIT 2	0	0	0	0	0	0	0	0	
SHIFT-LT.<- TO VIEW OR ENTER PHASES 1-8									

SPLIT 3 ALL CYCLES								VALUE (%:0-100)	
PHASE ALLOCATIONS 4 SPLITS/CYCLE: N									
PHASE	1	2	3	4	5	6	7	8	
SPLIT 3	30	45	0	25	0	75	0	25	
PHASE	1	2	3	4	5	6	7	8	
SPLIT 4	20	60	0	20	0	80	0	20	
SHIFT-RT.-> TO VIEW OR ENTER PHASES 9-16									

# Town Center & Publix



Local: 0000025, TC & Publix, Page: 10

MAX 1: (0-255)		TIMING PLAN: 1							
PH	1	2	3	4	5	6	7	8	
	20	60	20	20	20	60	20	20	

MAX 2: (0-255)		TIMING PLAN: 1							
PH	1	2	3	4	5	6	7	8	
	30	70	30	30	30	70	30	30	

SHIFT-RT.-> TO VIEW OR ENTER PHASES 9-16

YELLOW: (0-25.5)		TIMING PLAN: 1							
PH	1	2	3	4	5	6	7	8	
	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	

RED: (0-25.5)		TIMING PLAN: 1							
PH	1	2	3	4	5	6	7	8	
	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	

SHIFT-RT.-> TO VIEW OR ENTER PHASES 9-16

Queues  
101: Northshore Dr & Town Center Blvd.

Existing 2018 AM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	39	471	1	302	75	2	55	57	38
v/c Ratio	0.05	0.17	0.00	0.12	0.06	0.01	0.32	0.33	0.10
Control Delay	2.7	3.7	5.0	7.0	0.9	0.0	42.3	42.6	0.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	2.7	3.7	5.0	7.0	0.9	0.0	42.3	42.6	0.9
Queue Length 50th (ft)	2	16	0	28	0	0	31	32	0
Queue Length 95th (ft)	m8	m83	2	69	10	0	67	69	2
Internal Link Dist (ft)		1108		332		58		381	
Turn Bay Length (ft)	350				350				
Base Capacity (vph)	895	2762	798	2489	1471	282	373	374	476
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.17	0.00	0.12	0.05	0.01	0.15	0.15	0.08

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis  
101: Northshore Dr & Town Center Blvd.

Existing 2018 AM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	437	1	1	281	70	1	0	1	103	1	35
Future Volume (vph)	36	437	1	1	281	70	1	0	1	103	1	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (prot)	1770	3538		1770	3539	1583		1695		1681	1687	1583
Flt Permitted	0.53	1.00		0.48	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (perm)	987	3538		898	3539	1583		1695		1681	1687	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	39	470	1	1	302	75	1	0	1	111	1	38
RTOR Reduction (vph)	0	0	0	0	0	22	0	2	0	0	0	33
Lane Group Flow (vph)	39	471	0	1	302	53	0	0	0	55	57	5
Turn Type	pm+pt	NA		pm+pt	NA	pm+ov	Split	NA		Split	NA	pm+ov
Protected Phases	5	2		1	6	3	4	4		3	3	5
Permitted Phases	2			6		6						3
Actuated Green, G (s)	65.4	60.3		57.4	56.3	63.8		1.1		7.5	7.5	12.6
Effective Green, g (s)	65.4	60.3		57.4	56.3	63.8		1.1		7.5	7.5	12.6
Actuated g/C Ratio	0.73	0.67		0.64	0.63	0.71		0.01		0.08	0.08	0.14
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	761	2370		583	2213	1210		20		140	140	221
v/s Ratio Prot	c0.00	c0.13		0.00	0.09	0.00		c0.00		0.03	c0.03	0.00
v/s Ratio Perm	0.03			0.00		0.03						0.00
v/c Ratio	0.05	0.20		0.00	0.14	0.04		0.00		0.39	0.41	0.02
Uniform Delay, d1	3.5	5.7		5.9	6.9	3.9		43.9		39.1	39.1	33.4
Progression Factor	0.69	0.75		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Incremental Delay, d2	0.0	0.1		0.0	0.1	0.0		0.0		1.8	1.9	0.0
Delay (s)	2.5	4.4		5.9	7.0	4.0		43.9		40.9	41.1	33.4
Level of Service	A	A		A	A	A		D		D	D	C
Approach Delay (s)		4.2			6.4			43.9			39.1	
Approach LOS		A			A			D			D	

Intersection Summary





















HCM 2000 Control Delay	10.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.22		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	36.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



HCM Unsignalized Intersection Capacity Analysis  
 102: Town Center Blvd. & S. Shopping Cnt

Existing 2018 AM Peak  
 Northshore Town Center GI Kids TIS

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (veh/h)	0	0	5	8	0	0	30	51	25	0	125	30	
Future Volume (Veh/h)	0	0	5	8	0	0	30	51	25	0	125	30	
Sign Control		Stop			Stop			Free			Free		
Grade		0%			0%			0%			0%		
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	
Hourly flow rate (vph)	0	0	5	9	0	0	32	55	27	0	134	32	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type													
Median storage veh													
Upstream signal (ft)													
pX, platoon unblocked													
vC, conflicting volume	242	296	83	191	285	28	166			82			
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	242	296	83	191	285	28	166			82			
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1			
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2			
p0 queue free %	100	100	99	99	100	100	98			100			
cM capacity (veh/h)	680	600	960	735	609	1041	1410			1513			
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3				
Volume Total	5	9	32	28	28	27	0	89	77				
Volume Left	0	9	32	0	0	0	0	0	0				
Volume Right	5	0	0	0	0	27	0	0	32				
cSH	960	735	1410	1700	1700	1700	1700	1700	1700				
Volume to Capacity	0.01	0.01	0.02	0.02	0.02	0.02	0.00	0.05	0.05				
Queue Length 95th (ft)	0	1	2	0	0	0	0	0	0				
Control Delay (s)	8.8	10.0	7.6	0.0	0.0	0.0	0.0	0.0	0.0				
Lane LOS	A	A	A										
Approach Delay (s)	8.8	10.0	2.1										
Approach LOS	A	A											
Intersection Summary													
Average Delay			1.3										
Intersection Capacity Utilization			24.4%	ICU Level of Service					A				
Analysis Period (min)			15										

Queues  
103: Town Center Blvd. & N. Shopping Cnt

Existing 2018 AM Peak  
Northshore Town Center GI Kids TIS



Lane Group	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	29	5	63	17	22	217
v/c Ratio	0.13	0.01	0.02	0.01	0.02	0.07
Control Delay	22.3	0.0	4.5	0.0	2.6	2.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.3	0.0	4.5	0.0	2.6	2.0
Queue Length 50th (ft)	9	0	0	0	1	0
Queue Length 95th (ft)	19	0	9	0	5	13
Internal Link Dist (ft)		236	207			432
Turn Bay Length (ft)				50	150	
Base Capacity (vph)	514	1107	2931	1335	1012	3076
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.00	0.02	0.01	0.02	0.07

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
 103: Town Center Blvd. & N. Shopping Cnt

Existing 2018 AM Peak  
 Northshore Town Center GI Kids TIS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	18	0	3	0	40	11	14	137	0
Future Volume (vph)	0	0	0	18	0	3	0	40	11	14	137	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0			5.0	5.0	5.0	5.0	
Lane Util. Factor				1.00	1.00			0.95	1.00	1.00	0.95	
Fr <sub>t</sub>				1.00	0.85			1.00	0.85	1.00	1.00	
Fl <sub>t</sub> Protected				0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1770	1583			3539	1583	1770	3539	
Fl <sub>t</sub> Permitted				0.95	1.00			1.00	1.00	0.63	1.00	
Satd. Flow (perm)				1770	1583			3539	1583	1166	3539	
Peak-hour factor, PHF	0.93	0.93	0.93	0.63	0.93	0.63	0.93	0.63	0.63	0.63	0.63	0.93
Adj. Flow (vph)	0	0	0	29	0	5	0	63	17	22	217	0
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	6	0	0	0
Lane Group Flow (vph)	0	0	0	29	0	0	0	63	11	22	217	0
Turn Type	Perm			Perm	NA		pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4			8		1	6		5	2	
Permitted Phases	4			8			6		6	2		
Actuated Green, G (s)				3.2	3.2			35.6	35.6	41.8	41.8	
Effective Green, g (s)				3.2	3.2			35.6	35.6	41.8	41.8	
Actuated g/C Ratio				0.06	0.06			0.65	0.65	0.76	0.76	
Clearance Time (s)				5.0	5.0			5.0	5.0	5.0	5.0	
Vehicle Extension (s)				3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)				102	92			2290	1024	899	2689	
v/s Ratio Prot					0.00			0.02		0.00	c0.06	
v/s Ratio Perm				c0.02					0.01	0.02		
v/c Ratio				0.28	0.00			0.03	0.01	0.02	0.08	
Uniform Delay, d <sub>1</sub>				24.8	24.4			3.5	3.4	1.8	1.7	
Progression Factor				1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d <sub>2</sub>				1.5	0.0			0.0	0.0	0.0	0.1	
Delay (s)				26.3	24.4			3.5	3.5	1.8	1.7	
Level of Service				C	C			A	A	A	A	
Approach Delay (s)		0.0			26.1			3.5			1.8	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	4.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.11		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	24.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Intersection									
Intersection Delay, s/veh	4.5								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	131		234		64		49		
Demand Flow Rate, veh/h	133		239		65		50		
Vehicles Circulating, veh/h	108		77		12		232		
Vehicles Exiting, veh/h	174		0		229		84		
Follow-Up Headway, s	3.186		3.186		3.186		3.186		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	4.1		5.0		3.5		4.1		
Approach LOS	A		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LTR	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LTR	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.474	0.526	0.870	0.130	0.477	0.523	0.480	0.520	
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113	4.293	4.113	
Entry Flow, veh/h	63	70	208	31	31	34	24	26	
Cap Entry Lane, veh/h	1042	1048	1067	1071	1120	1120	949	961	
Entry HV Adj Factor	0.977	0.992	0.982	0.968	0.973	1.001	0.964	1.003	
Flow Entry, veh/h	62	69	204	30	30	34	23	26	
Cap Entry, veh/h	1018	1039	1047	1036	1090	1121	915	964	
V/C Ratio	0.060	0.067	0.195	0.029	0.028	0.030	0.025	0.027	
Control Delay, s/veh	4.1	4.0	5.2	3.7	3.5	3.5	4.2	4.0	
LOS	A	A	A	A	A	A	A	A	
95th %tile Queue, veh	0	0	1	0	0	0	0	0	

Queues  
105: Northshore Dr & Thunderhead Rd

Existing 2018 AM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBT	WBR	NBT	SBT	SBR
Lane Group Flow (vph)	434	662	317	86	3	283	239
v/c Ratio	0.59	0.51	0.36	0.11	0.02	1.04	0.48
Control Delay	9.3	8.2	12.1	1.3	30.0	102.3	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.3	8.2	12.1	1.3	30.0	102.3	7.9
Queue Length 50th (ft)	86	153	109	0	1	~175	0
Queue Length 95th (ft)	103	171	63	3	7	#252	31
Internal Link Dist (ft)		320	870		122	759	
Turn Bay Length (ft)	100			150			200
Base Capacity (vph)	808	1293	885	798	318	273	500
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.51	0.36	0.11	0.01	1.04	0.48

Intersection Summary

~ 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.

HCM Signalized Intersection Capacity Analysis  
105: Northshore Dr & Thunderhead Rd

Existing 2018 AM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	330	502	1	1	240	65	1	1	1	215	0	182
Future Volume (vph)	330	502	1	1	240	65	1	1	1	215	0	182
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00			1.00	0.85		0.95			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00		0.98			0.95	1.00
Satd. Flow (prot)	1770	1862			1862	1583		1750			1770	1583
Flt Permitted	0.45	1.00			1.00	1.00		0.92			0.76	1.00
Satd. Flow (perm)	835	1862			1861	1583		1635			1408	1583
Peak-hour factor, PHF	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Adj. Flow (vph)	434	661	1	1	316	86	1	1	1	283	0	239
RTOR Reduction (vph)	0	0	0	0	0	45	0	1	0	0	0	193
Lane Group Flow (vph)	434	662	0	0	317	41	0	2	0	0	283	46
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	1	6			2			8			4	
Permitted Phases	6			2		2	8			4		4
Actuated Green, G (s)	62.5	62.5			42.8	42.8		17.5			17.5	17.5
Effective Green, g (s)	62.5	62.5			42.8	42.8		17.5			17.5	17.5
Actuated g/C Ratio	0.69	0.69			0.48	0.48		0.19			0.19	0.19
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)	732	1293			885	752		317			273	307
v/s Ratio Prot	c0.10	0.36										
v/s Ratio Perm	c0.31				0.17	0.03		0.00			c0.20	0.03
v/c Ratio	0.59	0.51			0.36	0.05		0.01			1.04	0.15
Uniform Delay, d1	6.5	6.5			14.9	12.7		29.2			36.2	30.1
Progression Factor	1.00	1.00			0.68	0.28		1.00			1.00	1.00
Incremental Delay, d2	1.3	1.5			1.1	0.1		0.0			64.3	0.2
Delay (s)	7.8	8.0			11.3	3.7		29.2			100.6	30.3
Level of Service	A	A			B	A		C			F	C
Approach Delay (s)		7.9			9.7			29.2			68.4	
Approach LOS		A			A			C			E	

Intersection Summary

HCM 2000 Control Delay	23.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	70.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis  
 106: Thunderhead Rd & Boardwalk Blvd

Existing 2018 AM Peak  
 Northshore Town Center GI Kids TIS



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↶	↷	↶			↷
Traffic Volume (veh/h)	9	148	430	11	141	389
Future Volume (Veh/h)	9	148	430	11	141	389
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.62	0.62	0.62	0.62	0.62	0.62
Hourly flow rate (vph)	15	239	694	18	227	627
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (ft)			1106			
pX, platoon unblocked	0.94	0.94			0.94	
vC, conflicting volume	1784	703			712	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1801	656			665	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	76	46			74	
cM capacity (veh/h)	61	440			872	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	15	239	712	854
Volume Left	15	0	0	227
Volume Right	0	239	18	0
cSH	61	440	1700	872
Volume to Capacity	0.24	0.54	0.42	0.26
Queue Length 95th (ft)	21	79	0	26
Control Delay (s)	81.9	22.5	0.0	6.0
Lane LOS	F	C		A
Approach Delay (s)	26.0		0.0	6.0
Approach LOS	D			

Intersection Summary			
Average Delay	6.5		
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		

Queues  
101: Northshore Dr & Town Center Blvd.

Existing 2018 PM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	42	528	1	794	217	2	199	200	132
v/c Ratio	0.09	0.22	0.00	0.36	0.15	0.01	0.65	0.66	0.34
Control Delay	5.9	6.4	9.0	12.7	0.8	0.0	47.8	47.8	8.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	5.9	6.4	9.0	12.7	0.8	0.0	47.8	47.8	8.2
Queue Length 50th (ft)	5	36	0	127	0	0	124	125	0
Queue Length 95th (ft)	m18	102	3	248	19	0	187	189	44
Internal Link Dist (ft)		1108		332		65		381	
Turn Bay Length (ft)	350				350				
Base Capacity (vph)	552	2376	694	2199	1419	277	383	384	462
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.22	0.00	0.36	0.15	0.01	0.52	0.52	0.29

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.



HCM Signalized Intersection Capacity Analysis  
 101: Northshore Dr & Town Center Blvd.

Existing 2018 PM Peak  
 Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	37	464	1	1	699	191	1	0	1	350	1	116
Future Volume (vph)	37	464	1	1	699	191	1	0	1	350	1	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (prot)	1770	3538		1770	3539	1583		1695		1681	1686	1583
Flt Permitted	0.28	1.00		0.46	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (perm)	529	3538		849	3539	1583		1695		1681	1686	1583
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	42	527	1	1	794	217	1	0	1	398	1	132
RTOR Reduction (vph)	0	0	0	0	0	56	0	2	0	0	0	108
Lane Group Flow (vph)	42	528	0	1	794	161	0	0	0	199	200	24
Turn Type	pm+pt	NA		pm+pt	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6	3	4	4		3	3	
Permitted Phases	2			6		6						3
Actuated Green, G (s)	63.4	59.2		57.2	56.1	74.2		1.6		18.1	18.1	18.1
Effective Green, g (s)	63.4	59.2		57.2	56.1	74.2		1.6		18.1	18.1	18.1
Actuated g/C Ratio	0.63	0.59		0.57	0.56	0.74		0.02		0.18	0.18	0.18
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	387	2094		495	1985	1253		27		304	305	286
v/s Ratio Prot	c0.00	c0.15		0.00	c0.22	0.02		c0.00		0.12	c0.12	
v/s Ratio Perm	0.06			0.00		0.08						0.02
v/c Ratio	0.11	0.25		0.00	0.40	0.13		0.00		0.65	0.66	0.08
Uniform Delay, d1	7.6	9.8		9.2	12.4	3.7		48.4		38.0	38.1	34.1
Progression Factor	0.74	0.71		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Incremental Delay, d2	0.1	0.3		0.0	0.6	0.0		0.0		5.0	5.0	0.1
Delay (s)	5.7	7.2		9.2	13.0	3.7		48.4		43.0	43.1	34.2
Level of Service	A	A		A	B	A		D		D	D	C
Approach Delay (s)		7.1			11.0			48.4			40.8	
Approach LOS		A			B			D			D	

Intersection Summary		
HCM 2000 Control Delay	17.5	HCM 2000 Level of Service
HCM 2000 Volume to Capacity ratio	0.44	B
Actuated Cycle Length (s)	100.0	Sum of lost time (s)
Intersection Capacity Utilization	53.2%	20.0
Analysis Period (min)	15	ICU Level of Service
		A

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis  
 102: Town Center Blvd. & S. Shopping Cnt

Existing 2018 PM Peak  
 Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↗	↕	↗	↗	↕	↕
Traffic Volume (veh/h)	3	0	61	32	0	1	18	165	45	3	373	1
Future Volume (Veh/h)	3	0	61	32	0	1	18	165	45	3	373	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	3	0	71	37	0	1	21	192	52	3	434	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	580	726	218	528	675	96	435			244		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	580	726	218	528	675	96	435			244		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	91	90	100	100	98			100		
cM capacity (veh/h)	391	342	787	388	366	942	1121			1319		
Direction, Lane #												
	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3			
Volume Total	74	38	21	96	96	52	3	289	146			
Volume Left	3	37	21	0	0	0	3	0	0			
Volume Right	71	1	0	0	0	52	0	0	1			
cSH	756	394	1121	1700	1700	1700	1319	1700	1700			
Volume to Capacity	0.10	0.10	0.02	0.06	0.06	0.03	0.00	0.17	0.09			
Queue Length 95th (ft)	8	8	1	0	0	0	0	0	0			
Control Delay (s)	10.3	15.1	8.3	0.0	0.0	0.0	7.7	0.0	0.0			
Lane LOS	B	C	A				A					
Approach Delay (s)	10.3	15.1	0.7				0.1					
Approach LOS	B	C										
Intersection Summary												
Average Delay			1.9									
Intersection Capacity Utilization			30.1%		ICU Level of Service				A			
Analysis Period (min)			15									

Queues  
103: Town Center Blvd. & N. Shopping Cnt

Existing 2018 PM Peak  
Northshore Town Center GI Kids TIS



Lane Group	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	238	18	91	101	126	191
v/c Ratio	0.53	0.02	0.07	0.14	0.19	0.10
Control Delay	21.5	0.1	13.8	2.4	7.5	6.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.5	0.1	13.8	2.4	7.5	6.6
Queue Length 50th (ft)	66	0	10	0	17	13
Queue Length 95th (ft)	108	0	24	16	43	29
Internal Link Dist (ft)		236	207			432
Turn Bay Length (ft)				50	150	
Base Capacity (vph)	579	1058	1396	708	676	2001
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.02	0.07	0.14	0.19	0.10
<b>Intersection Summary</b>						

HCM Signalized Intersection Capacity Analysis  
103: Town Center Blvd. & N. Shopping Cnt

Existing 2018 PM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↑↑	↗	↖	↗	
Traffic Volume (vph)	0	0	0	209	0	16	0	80	89	111	168	0
Future Volume (vph)	0	0	0	209	0	16	0	80	89	111	168	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				5.0	5.0			5.0	5.0	5.0	5.0	
Lane Util. Factor				1.00	1.00			0.95	1.00	1.00	0.95	
Frt				1.00	0.85			1.00	0.85	1.00	1.00	
Flt Protected				0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1770	1583			3539	1583	1770	3539	
Flt Permitted				0.95	1.00			1.00	1.00	0.56	1.00	
Satd. Flow (perm)				1770	1583			3539	1583	1043	3539	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	0	0	238	0	18	0	91	101	126	191	0
RTOR Reduction (vph)	0	0	0	0	13	0	0	0	63	0	0	0
Lane Group Flow (vph)	0	0	0	238	5	0	0	91	38	126	191	0
Turn Type	Perm			Perm	NA		pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4			8		1	6		5	2	
Permitted Phases	4			8			6		6	2		
Actuated Green, G (s)				13.9	13.9			20.7	20.7	31.1	31.1	
Effective Green, g (s)				13.9	13.9			20.7	20.7	31.1	31.1	
Actuated g/C Ratio				0.25	0.25			0.38	0.38	0.57	0.57	
Clearance Time (s)				5.0	5.0			5.0	5.0	5.0	5.0	
Vehicle Extension (s)				3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)				447	400			1331	595	661	2001	
v/s Ratio Prot					0.00			0.03		c0.02	0.05	
v/s Ratio Perm				c0.13					0.02	c0.09		
v/c Ratio				0.53	0.01			0.07	0.06	0.19	0.10	
Uniform Delay, d1				17.7	15.4			11.0	11.0	5.8	5.5	
Progression Factor				1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2				1.2	0.0			0.1	0.2	0.1	0.1	
Delay (s)				19.0	15.4			11.1	11.2	6.0	5.6	
Level of Service				B	B			B	B	A	A	
Approach Delay (s)		0.0			18.7			11.1			5.7	
Approach LOS		A			B			B			A	

Intersection Summary

HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	32.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Intersection									
Intersection Delay, s/veh	4.6								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	33		250		99		179		
Demand Flow Rate, veh/h	34		255		101		182		
Vehicles Circulating, veh/h	273		109		8		203		
Vehicles Exiting, veh/h	112		0		298		161		
Follow-Up Headway, s	3.186		3.186		3.186		3.186		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	4.2		4.9		3.6		4.6		
Approach LOS	A		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LTR	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LTR	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.471	0.529	0.749	0.251	0.465	0.535	0.473	0.527	
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113	4.293	4.113	
Entry Flow, veh/h	16	18	191	64	47	54	86	96	
Cap Entry Lane, veh/h	921	933	1041	1047	1123	1124	970	980	
Entry HV Adj Factor	0.969	0.972	0.981	0.984	0.993	0.974	0.977	0.987	
Flow Entry, veh/h	16	17	187	63	47	53	84	95	
Cap Entry, veh/h	893	907	1021	1031	1115	1095	948	967	
V/C Ratio	0.017	0.019	0.183	0.061	0.042	0.048	0.089	0.098	
Control Delay, s/veh	4.2	4.1	5.2	4.0	3.6	3.7	4.6	4.6	
LOS	A	A	A	A	A	A	A	A	
95th %tile Queue, veh	0	0	1	0	0	0	0	0	

Queues  
105: Northshore Dr & Thunderhead Rd

Existing 2018 PM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBT	WBR	NBT	SBT	SBR
Lane Group Flow (vph)	56	436	588	117	2	151	64
v/c Ratio	0.10	0.31	0.47	0.11	0.01	0.78	0.23
Control Delay	3.6	4.5	10.1	2.1	0.0	68.7	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.6	4.5	10.1	2.1	0.0	68.7	9.2
Queue Length 50th (ft)	8	75	277	28	0	93	0
Queue Length 95th (ft)	16	104	49	0	0	#171	27
Internal Link Dist (ft)		320	870		78	759	
Turn Bay Length (ft)	100			150			200
Base Capacity (vph)	653	1420	1248	1099	297	211	302
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.31	0.47	0.11	0.01	0.72	0.21

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
105: Northshore Dr & Thunderhead Rd

Existing 2018 PM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	48	374	1	1	505	101	1	0	1	130	0	55
Future Volume (vph)	48	374	1	1	505	101	1	0	1	130	0	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00			1.00	0.85		0.93			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00		0.98			0.95	1.00
Satd. Flow (prot)	1770	1862			1863	1583		1695			1770	1583
Flt Permitted	0.34	1.00			1.00	1.00		0.89			0.76	1.00
Satd. Flow (perm)	634	1862			1862	1583		1553			1409	1583
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	56	435	1	1	587	117	1	0	1	151	0	64
RTOR Reduction (vph)	0	0	0	0	0	40	0	2	0	0	0	55
Lane Group Flow (vph)	56	436	0	0	588	77	0	0	0	0	151	9
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	1	6			2			8			4	
Permitted Phases	6			2		2	8			4		4
Actuated Green, G (s)	76.3	76.3			66.1	66.1		13.7			13.7	13.7
Effective Green, g (s)	76.3	76.3			66.1	66.1		13.7			13.7	13.7
Actuated g/C Ratio	0.76	0.76			0.66	0.66		0.14			0.14	0.14
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)	542	1420			1230	1046		212			193	216
v/s Ratio Prot	0.01	c0.23										
v/s Ratio Perm	0.07				c0.32	0.05		0.00			c0.11	0.01
v/c Ratio	0.10	0.31			0.48	0.07		0.00			0.78	0.04
Uniform Delay, d1	4.4	3.7			8.4	6.0		37.2			41.7	37.4
Progression Factor	1.00	1.00			0.97	1.33		1.00			1.00	1.00
Incremental Delay, d2	0.1	0.6			1.3	0.1		0.0			18.4	0.1
Delay (s)	4.4	4.2			9.4	8.2		37.2			60.1	37.5
Level of Service	A	A			A	A		D			E	D
Approach Delay (s)		4.3			9.2			37.2			53.4	
Approach LOS		A			A			D			D	

Intersection Summary

HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	60.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis  
 106: Thunderhead Rd & Boardwalk Blvd

Existing 2018 PM Peak  
 Northshore Town Center GI Kids TIS



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	94	41	31	9	18	51
Future Volume (Veh/h)	94	41	31	9	18	51
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	111	48	36	11	21	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (ft)			1106			
pX, platoon unblocked						
vC, conflicting volume	144	42			47	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	144	42			47	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	87	95			99	
cM capacity (veh/h)	838	1029			1560	
Direction, Lane #	WB 1	WB 2	NB 1	SB 1		
Volume Total	111	48	47	81		
Volume Left	111	0	0	21		
Volume Right	0	48	11	0		
cSH	838	1029	1700	1560		
Volume to Capacity	0.13	0.05	0.03	0.01		
Queue Length 95th (ft)	11	4	0	1		
Control Delay (s)	10.0	8.7	0.0	2.0		
Lane LOS	A	A		A		
Approach Delay (s)	9.6		0.0	2.0		
Approach LOS	A					
Intersection Summary						
Average Delay			5.9			
Intersection Capacity Utilization			22.2%		ICU Level of Service	A
Analysis Period (min)			15			



Queues  
101: Northshore Dr & Town Center Blvd.

Background 2020 AM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	110	664	1	323	261	2	166	167	107
v/c Ratio	0.15	0.28	0.00	0.16	0.20	0.01	0.60	0.61	0.20
Control Delay	4.7	6.9	8.0	11.8	1.0	0.0	43.5	43.5	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.7	6.9	8.0	11.8	1.0	0.0	43.5	43.5	4.1
Queue Length 50th (ft)	8	26	0	40	0	0	92	93	0
Queue Length 95th (ft)	m42	m155	2	96	24	0	150	151	24
Internal Link Dist (ft)		1108		332		136		381	
Turn Bay Length (ft)	350				350				
Base Capacity (vph)	776	2399	614	1988	1370	282	373	374	627
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.28	0.00	0.16	0.19	0.01	0.45	0.45	0.17

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis  
101: Northshore Dr & Town Center Blvd.

Background 2020 AM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	101	610	1	1	297	240	1	0	1	305	1	98
Future Volume (vph)	101	610	1	1	297	240	1	0	1	305	1	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (prot)	1770	3538		1770	3539	1583		1695		1681	1686	1583
Flt Permitted	0.50	1.00		0.40	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (perm)	936	3538		744	3539	1583		1695		1681	1686	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	110	663	1	1	323	261	1	0	1	332	1	107
RTOR Reduction (vph)	0	0	0	0	0	83	0	2	0	0	0	80
Lane Group Flow (vph)	110	664	0	1	323	178	0	0	0	166	167	27
Turn Type	pm+pt	NA		pm+pt	NA	pm+ov	Split	NA		Split	NA	pm+ov
Protected Phases	5	2		1	6	3	4	4		3	3	5
Permitted Phases	2			6		6						3
Actuated Green, G (s)	59.2	53.1		47.7	46.6	61.3		1.1		14.7	14.7	22.3
Effective Green, g (s)	59.2	53.1		47.7	46.6	61.3		1.1		14.7	14.7	22.3
Actuated g/C Ratio	0.66	0.59		0.53	0.52	0.68		0.01		0.16	0.16	0.25
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	686	2087		406	1832	1166		20		274	275	392
v/s Ratio Prot	c0.01	c0.19		0.00	0.09	0.02		c0.00		0.10	c0.10	0.01
v/s Ratio Perm	0.09			0.00		0.09						0.01
v/c Ratio	0.16	0.32		0.00	0.18	0.15		0.00		0.61	0.61	0.07
Uniform Delay, d1	5.8	9.3		9.9	11.5	5.1		43.9		35.0	35.0	25.9
Progression Factor	0.74	0.84		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Incremental Delay, d2	0.0	0.2		0.0	0.2	0.1		0.0		3.8	3.8	0.1
Delay (s)	4.3	8.0		9.9	11.7	5.2		43.9		38.7	38.7	26.0
Level of Service	A	A		A	B	A		D		D	D	C
Approach Delay (s)		7.5			8.8			43.9			35.6	
Approach LOS		A			A			D			D	

Intersection Summary

HCM 2000 Control Delay	14.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	47.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis  
 102: Town Center Blvd. & S. Shopping Cnt

Background 2020 AM Peak  
 Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↗	↕↕	↗	↗	↗	↕↕
Traffic Volume (veh/h)	1	3	48	47	4	4	67	177	97	8	307	41
Future Volume (Veh/h)	1	3	48	47	4	4	67	177	97	8	307	41
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	3	52	51	4	4	73	192	105	9	334	45
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)								461			287	
pX, platoon unblocked	1.00	1.00	1.00	1.00	1.00		1.00					
vC, conflicting volume	622	818	190	576	735	96	379			297		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	622	817	189	576	735	96	379			297		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	99	94	86	99	100	94			99		
cM capacity (veh/h)	347	288	820	352	322	942	1176			1261		
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>NB 2</b>	<b>NB 3</b>	<b>NB 4</b>	<b>SB 1</b>	<b>SB 2</b>	<b>SB 3</b>			
Volume Total	56	59	73	96	96	105	9	223	156			
Volume Left	1	51	73	0	0	0	9	0	0			
Volume Right	52	4	0	0	0	105	0	0	45			
cSH	730	365	1176	1700	1700	1700	1261	1700	1700			
Volume to Capacity	0.08	0.16	0.06	0.06	0.06	0.06	0.01	0.13	0.09			
Queue Length 95th (ft)	6	14	5	0	0	0	1	0	0			
Control Delay (s)	10.3	16.7	8.3	0.0	0.0	0.0	7.9	0.0	0.0			
Lane LOS	B	C	A				A					
Approach Delay (s)	10.3	16.7	1.6				0.2					
Approach LOS	B	C										
<b>Intersection Summary</b>												
Average Delay			2.6									
Intersection Capacity Utilization			33.2%		ICU Level of Service				A			
Analysis Period (min)			15									

Queues  
103: Town Center Blvd. & N. Shopping Cnt

Background 2020 AM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	3	55	77	16	54	132	12	41	284
v/c Ratio	0.01	0.19	0.37	0.06	0.07	0.05	0.01	0.05	0.12
Control Delay	17.7	9.0	24.9	13.7	4.2	7.5	0.0	4.2	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.7	9.0	24.9	13.7	4.2	7.5	0.0	4.2	7.8
Queue Length 50th (ft)	1	1	23	2	5	6	0	4	24
Queue Length 95th (ft)	6	24	52	14	17	28	0	14	51
Internal Link Dist (ft)		180		236		207			432
Turn Bay Length (ft)					100		50	150	
Base Capacity (vph)	429	531	415	533	814	2463	1144	911	2291
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.10	0.19	0.03	0.07	0.05	0.01	0.05	0.12

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
 103: Town Center Blvd. & N. Shopping Cnt

Background 2020 AM Peak  
 Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↑↑	↗	↖	↗	
Traffic Volume (vph)	3	5	46	71	6	8	50	121	11	38	238	23
Future Volume (vph)	3	5	46	71	6	8	50	121	11	38	238	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95	
Frt	1.00	0.86		1.00	0.92		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1609		1770	1706		1770	3539	1583	1770	3492	
Flt Permitted	0.75	1.00		0.72	1.00		0.55	1.00	1.00	0.67	1.00	
Satd. Flow (perm)	1392	1609		1343	1706		1031	3539	1583	1245	3492	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	5	50	77	7	9	54	132	12	41	259	25
RTOR Reduction (vph)	0	44	0	0	8	0	0	0	5	0	9	0
Lane Group Flow (vph)	3	11	0	77	8	0	54	132	7	41	275	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4			8		1	6		5	2	
Permitted Phases	4			8			6		6	2		
Actuated Green, G (s)	6.1	6.1		6.1	6.1		35.2	31.3	31.3	32.6	30.0	
Effective Green, g (s)	6.1	6.1		6.1	6.1		35.2	31.3	31.3	32.6	30.0	
Actuated g/C Ratio	0.11	0.11		0.11	0.11		0.64	0.57	0.57	0.59	0.55	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	154	178		148	189		712	2014	900	762	1904	
v/s Ratio Prot		0.01			0.00		c0.01	0.04		0.00	c0.08	
v/s Ratio Perm	0.00			c0.06			0.04		0.00	0.03		
v/c Ratio	0.02	0.06		0.52	0.04		0.08	0.07	0.01	0.05	0.14	
Uniform Delay, d1	21.8	21.9		23.1	21.8		3.7	5.3	5.1	4.7	6.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.1		3.3	0.1		0.0	0.1	0.0	0.0	0.2	
Delay (s)	21.8	22.0		26.3	21.9		3.7	5.4	5.1	4.7	6.3	
Level of Service	C	C		C	C		A	A	A	A	A	
Approach Delay (s)		22.0			25.6			4.9			6.1	
Approach LOS		C			C			A			A	

Intersection Summary

HCM 2000 Control Delay	9.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.19		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	38.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Intersection									
Intersection Delay, s/veh	5.0								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	135		306		140		113		
Demand Flow Rate, veh/h	137		312		143		115		
Vehicles Circulating, veh/h	212		158		15		306		
Vehicles Exiting, veh/h	209		0		334		164		
Follow-Up Headway, s	3.186		3.186		3.186		3.186		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	4.4		5.9		3.8		4.6		
Approach LOS	A		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LTR	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LTR	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.467	0.533	0.840	0.160	0.469	0.531	0.470	0.530	
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113	4.293	4.113	
Entry Flow, veh/h	64	73	262	50	67	76	54	61	
Cap Entry Lane, veh/h	964	974	1004	1012	1117	1118	898	912	
Entry HV Adj Factor	0.991	0.980	0.981	0.980	0.983	0.977	0.984	0.982	
Flow Entry, veh/h	63	72	257	49	66	74	53	60	
Cap Entry, veh/h	956	955	985	991	1098	1092	883	895	
V/C Ratio	0.066	0.075	0.261	0.049	0.060	0.068	0.060	0.067	
Control Delay, s/veh	4.4	4.5	6.2	4.1	3.8	3.9	4.6	4.6	
LOS	A	A	A	A	A	A	A	A	
95th %tile Queue, veh	0	0	1	0	0	0	0	0	

Queues  
105: Northshore Dr & Thunderhead Rd



Lane Group	EBL	EBT	WBT	WBR	NBT	SBT	SBR
Lane Group Flow (vph)	400	616	312	104	3	425	248
v/c Ratio	0.55	0.48	0.34	0.13	0.01	1.56	0.49
Control Delay	8.5	7.8	10.3	1.0	26.7	296.6	8.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.5	7.8	10.3	1.0	26.7	296.6	8.0
Queue Length 50th (ft)	77	138	47	0	1	~344	0
Queue Length 95th (ft)	118	204	77	4	9	#524	62
Internal Link Dist (ft)		320	870		120	759	
Turn Bay Length (ft)	100			150			200
Base Capacity (vph)	815	1293	905	823	221	273	507
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.48	0.34	0.13	0.01	1.56	0.49

Intersection Summary

~ 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.

HCM Signalized Intersection Capacity Analysis  
 105: Northshore Dr & Thunderhead Rd

Background 2020 AM Peak  
 Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	368	566	1	1	286	96	1	1	1	391	0	228
Future Volume (vph)	368	566	1	1	286	96	1	1	1	391	0	228
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00			1.00	0.85		0.95			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00		0.98			0.95	1.00
Satd. Flow (prot)	1770	1862			1862	1583		1750			1770	1583
Flt Permitted	0.46	1.00			1.00	1.00		0.64			0.76	1.00
Satd. Flow (perm)	852	1862			1861	1583		1133			1408	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	400	615	1	1	311	104	1	1	1	425	0	248
RTOR Reduction (vph)	0	0	0	0	0	53	0	1	0	0	0	200
Lane Group Flow (vph)	400	616	0	0	312	51	0	2	0	0	425	48
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	1	6			2			8			4	
Permitted Phases	6			2		2	8			4		4
Actuated Green, G (s)	62.5	62.5			43.8	43.8		17.5			17.5	17.5
Effective Green, g (s)	62.5	62.5			43.8	43.8		17.5			17.5	17.5
Actuated g/C Ratio	0.69	0.69			0.49	0.49		0.19			0.19	0.19
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)	731	1293			905	770		220			273	307
v/s Ratio Prot	c0.08	0.33										
v/s Ratio Perm	c0.30				0.17	0.03		0.00			c0.30	0.03
v/c Ratio	0.55	0.48			0.34	0.07		0.01			1.56	0.16
Uniform Delay, d1	6.3	6.3			14.2	12.2		29.3			36.2	30.1
Progression Factor	1.00	1.00			0.61	0.20		1.00			1.00	1.00
Incremental Delay, d2	0.8	1.3			1.0	0.2		0.0			267.8	0.2
Delay (s)	7.1	7.5			9.7	2.6		29.3			304.0	30.4
Level of Service	A	A			A	A		C			F	C
Approach Delay (s)		7.4			7.9			29.3			203.2	
Approach LOS		A			A			C			F	

Intersection Summary

HCM 2000 Control Delay	70.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	85.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



HCM Unsignalized Intersection Capacity Analysis  
 106: Thunderhead Rd & Boardwalk Blvd

Background 2020 AM Peak  
 Northshore Town Center GI Kids TIS



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	25	183	475	35	149	594
Future Volume (Veh/h)	25	183	475	35	149	594
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.62	0.62	0.62	0.62	0.62	0.62
Hourly flow rate (vph)	40	295	766	56	240	958
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (ft)			1106			
pX, platoon unblocked	0.96	0.96			0.96	
vC, conflicting volume	2232	794			822	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2260	767			796	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	24			70	
cM capacity (veh/h)	30	387			795	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	40	295	822	1198
Volume Left	40	0	0	240
Volume Right	0	295	56	0
cSH	30	387	1700	795
Volume to Capacity	1.32	0.76	0.48	0.30
Queue Length 95th (ft)	113	156	0	32
Control Delay (s)	470.1	38.5	0.0	8.6
Lane LOS	F	E		A
Approach Delay (s)	90.1		0.0	8.6
Approach LOS	F			

Intersection Summary			
Average Delay		17.2	
Intersection Capacity Utilization		80.0%	ICU Level of Service D
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis  
107: Boardwalk Blvd & Access

Background 2020 AM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	132	13	14	174	21	6	3	11	14	2	7
Future Volume (Veh/h)	8	132	13	14	174	21	6	3	11	14	2	7
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	143	14	15	189	23	7	3	12	15	2	8
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None					None						
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	212		157		396		410	150	405	406	200	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	212		157		396		410	150	405	406	200	
tC, single (s)	4.1		4.1		7.1		6.5	6.2	7.1	6.5	6.2	
tC, 2 stage (s)												
tF (s)	2.2		2.2		3.5		4.0	3.3	3.5	4.0	3.3	
p0 queue free %	99		99		99		99	99	97	100	99	
cM capacity (veh/h)	1358		1423		550		522	896	539	525	840	
Direction, Lane #												
	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	9	157	15	212	22	25						
Volume Left	9	0	15	0	7	15						
Volume Right	0	14	0	23	12	8						
cSH	1358	1700	1423	1700	690	608						
Volume to Capacity	0.01	0.09	0.01	0.12	0.03	0.04						
Queue Length 95th (ft)	1	0	1	0	2	3						
Control Delay (s)	7.7	0.0	7.6	0.0	10.4	11.2						
Lane LOS	A		A		B	B						
Approach Delay (s)	0.4		0.5		10.4	11.2						
Approach LOS					B	B						
Intersection Summary												
Average Delay			1.6									
Intersection Capacity Utilization			21.6%		ICU Level of Service				A			
Analysis Period (min)			15									

Queues  
105: Northshore Dr & Thunderhead Rd

Background 2020 AM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBT	WBR	NBT	SBT	SBR
Lane Group Flow (vph)	400	616	312	104	3	425	248
v/c Ratio	0.75	0.62	0.53	0.18	0.01	0.86	0.35
Control Delay	25.0	19.0	26.0	2.5	14.7	44.4	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.0	19.0	26.0	2.5	14.7	44.4	3.9
Queue Length 50th (ft)	137	244	153	0	1	211	0
Queue Length 95th (ft)	#261	379	153	9	6	#336	44
Internal Link Dist (ft)		320	870		120	759	
Turn Bay Length (ft)	100			150			200
Base Capacity (vph)	537	1000	594	576	665	563	782
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.74	0.62	0.53	0.18	0.00	0.75	0.32

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
105: Northshore Dr & Thunderhead Rd

Background 2020 AM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	368	566	1	1	286	96	1	1	1	391	0	228
Future Volume (vph)	368	566	1	1	286	96	1	1	1	391	0	228
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00			1.00	0.85		0.95			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00		0.98			0.95	1.00
Satd. Flow (prot)	1770	1862			1862	1583		1750			1770	1583
Flt Permitted	0.35	1.00			1.00	1.00		0.93			0.76	1.00
Satd. Flow (perm)	658	1862			1860	1583		1662			1408	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	400	615	1	1	311	104	1	1	1	425	0	248
RTOR Reduction (vph)	0	0	0	0	0	71	0	1	0	0	0	161
Lane Group Flow (vph)	400	616	0	0	312	33	0	2	0	0	425	87
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	1	6			2			8			4	
Permitted Phases	6			2		2	8			4		4
Actuated Green, G (s)	48.3	48.3			28.7	28.7		31.7			31.7	31.7
Effective Green, g (s)	48.3	48.3			28.7	28.7		31.7			31.7	31.7
Actuated g/C Ratio	0.54	0.54			0.32	0.32		0.35			0.35	0.35
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)	533	999			593	504		585			495	557
v/s Ratio Prot	c0.12	0.33										
v/s Ratio Perm	c0.28				0.17	0.02		0.00			c0.30	0.06
v/c Ratio	0.75	0.62			0.53	0.07		0.00			0.86	0.16
Uniform Delay, d1	14.0	14.4			25.1	21.3		18.9			27.1	20.0
Progression Factor	1.00	1.00			0.83	0.33		1.00			1.00	1.00
Incremental Delay, d2	5.9	2.9			3.3	0.2		0.0			13.8	0.1
Delay (s)	19.8	17.3			24.2	7.3		18.9			40.9	20.1
Level of Service	B	B			C	A		B			D	C
Approach Delay (s)		18.3			20.0			18.9			33.2	
Approach LOS		B			B			B			C	

Intersection Summary

HCM 2000 Control Delay	23.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	85.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Queues  
101: Northshore Dr & Town Center Blvd.

Background 2020 PM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	145	674	1	852	523	2	420	422	254
v/c Ratio	0.37	0.30	0.00	0.47	0.38	0.01	1.10	1.10	0.46
Control Delay	6.7	5.7	9.0	17.7	1.3	0.0	112.3	113.0	7.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.7	5.7	9.0	17.7	1.3	0.0	112.3	113.0	7.1
Queue Length 50th (ft)	17	44	0	164	0	0	~321	~323	0
Queue Length 95th (ft)	m29	m74	3	288	31	0	#516	#521	62
Internal Link Dist (ft)		1108		332		76		381	
Turn Bay Length (ft)	350		50		350				
Base Capacity (vph)	471	2228	584	1816	1361	277	383	384	557
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.30	0.00	0.47	0.38	0.01	1.10	1.10	0.46

Intersection Summary

- ~ 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.
- m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis  
101: Northshore Dr & Town Center Blvd.

Background 2020 PM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	133	619	1	1	784	481	1	0	1	774	1	234
Future Volume (vph)	133	619	1	1	784	481	1	0	1	774	1	234
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (prot)	1770	3538		1770	3539	1583		1695		1681	1686	1583
Flt Permitted	0.22	1.00		0.40	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (perm)	412	3538		737	3539	1583		1695		1681	1686	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	145	673	1	1	852	523	1	0	1	841	1	254
RTOR Reduction (vph)	0	0	0	0	0	156	0	2	0	0	0	196
Lane Group Flow (vph)	145	674	0	1	852	367	0	0	0	420	422	58
Turn Type	pm+pt	NA		pm+pt	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6	3	4	4		3	3	
Permitted Phases	2			6		6						3
Actuated Green, G (s)	61.1	55.0		48.4	47.3	70.1		1.1		22.8	22.8	22.8
Effective Green, g (s)	61.1	55.0		48.4	47.3	70.1		1.1		22.8	22.8	22.8
Actuated g/C Ratio	0.61	0.55		0.48	0.47	0.70		0.01		0.23	0.23	0.23
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	371	1945		368	1673	1188		18		383	384	360
v/s Ratio Prot	c0.03	0.19		0.00	c0.24	0.07		c0.00		0.25	c0.25	
v/s Ratio Perm	0.20			0.00		0.16						0.04
v/c Ratio	0.39	0.35		0.00	0.51	0.31		0.00		1.10	1.10	0.16
Uniform Delay, d1	10.2	12.5		13.3	18.3	5.7		48.9		38.6	38.6	30.9
Progression Factor	0.70	0.56		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Incremental Delay, d2	0.3	0.2		0.0	1.1	0.1		0.0		74.6	75.3	0.2
Delay (s)	7.6	7.2		13.3	19.4	5.9		48.9		113.2	113.9	31.1
Level of Service	A	A		B	B	A		D		F	F	C
Approach Delay (s)		7.3			14.2			48.9			94.4	
Approach LOS		A			B			D			F	





















Intersection Summary

HCM 2000 Control Delay	39.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis  
 102: Town Center Blvd. & S. Shopping Cnt

Background 2020 PM Peak  
 Northshore Town Center GI Kids TIS

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	6	180	60	6	7	93	424	98	12	767	24
Future Volume (Veh/h)	6	6	180	60	6	7	93	424	98	12	767	24
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	7	196	65	7	8	101	461	107	13	834	26
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)								461			287	
pX, platoon unblocked	0.91	0.91	0.91	0.91	0.91		0.91					
vC, conflicting volume	1317	1643	430	1306	1549	230	860			568		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1155	1512	182	1142	1409	230	654			568		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	94	93	74	27	94	99	88			99		
cM capacity (veh/h)	118	94	756	89	109	772	847			1000		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3			
Volume Total	210	80	101	230	230	107	13	556	304			
Volume Left	7	65	101	0	0	0	13	0	0			
Volume Right	196	8	0	0	0	107	0	0	26			
cSH	534	100	847	1700	1700	1700	1000	1700	1700			
Volume to Capacity	0.39	0.80	0.12	0.14	0.14	0.06	0.01	0.33	0.18			
Queue Length 95th (ft)	46	110	10	0	0	0	1	0	0			
Control Delay (s)	16.0	119.5	9.8	0.0	0.0	0.0	8.6	0.0	0.0			
Lane LOS	C	F	A				A					
Approach Delay (s)	16.0	119.5	1.5				0.1					
Approach LOS	C	F										
Intersection Summary												
Average Delay			7.7									
Intersection Capacity Utilization			56.3%		ICU Level of Service				B			
Analysis Period (min)			15									

Queues  
103: Town Center Blvd. & N. Shopping Cnt

Background 2020 PM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	7	146	267	35	109	268	97	146	515
v/c Ratio	0.02	0.27	0.76	0.07	0.24	0.20	0.14	0.26	0.38
Control Delay	12.2	4.8	32.1	7.2	9.6	14.5	2.1	9.3	14.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.2	4.8	32.1	7.2	9.6	14.5	2.1	9.3	14.5
Queue Length 50th (ft)	2	2	76	2	17	34	0	23	67
Queue Length 95th (ft)	8	32	#148	17	41	60	15	52	105
Internal Link Dist (ft)		236		236		207			432
Turn Bay Length (ft)					75		50	150	
Base Capacity (vph)	472	642	422	583	459	1311	676	570	1349
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.23	0.63	0.06	0.24	0.20	0.14	0.26	0.38

Intersection Summary

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



HCM Signalized Intersection Capacity Analysis  
103: Town Center Blvd. & N. Shopping Cnt

Background 2020 PM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↑↑	↗	↖	↗↖	
Traffic Volume (vph)	6	8	126	246	8	24	100	247	89	134	429	45
Future Volume (vph)	6	8	126	246	8	24	100	247	89	134	429	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.2	5.2		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95	
Frt	1.00	0.86		1.00	0.89		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1601		1770	1655		1770	3539	1583	1770	3489	
Flt Permitted	0.73	1.00		0.66	1.00		0.45	1.00	1.00	0.57	1.00	
Satd. Flow (perm)	1368	1601		1237	1655		839	3539	1583	1055	3489	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	7	9	137	267	9	26	109	268	97	146	466	49
RTOR Reduction (vph)	0	97	0	0	19	0	0	0	63	0	13	0
Lane Group Flow (vph)	7	49	0	267	16	0	109	268	34	146	502	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4			8		1	6		5	2	
Permitted Phases	4			8			6		6	2		
Actuated Green, G (s)	15.9	15.9		15.7	15.7		23.4	19.4	19.4	24.8	20.1	
Effective Green, g (s)	15.9	15.9		15.7	15.7		23.4	19.4	19.4	24.8	20.1	
Actuated g/C Ratio	0.29	0.29		0.29	0.29		0.43	0.35	0.35	0.45	0.37	
Clearance Time (s)	5.0	5.0		5.2	5.2		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	395	462		353	472		424	1248	558	536	1275	
v/s Ratio Prot		0.03			0.01		0.02	0.08		c0.02	c0.14	
v/s Ratio Perm	0.01			c0.22			0.09		0.02	0.10		
v/c Ratio	0.02	0.11		0.76	0.03		0.26	0.21	0.06	0.27	0.39	
Uniform Delay, d1	14.0	14.3		17.9	14.2		9.7	12.5	11.8	9.0	12.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.1		8.9	0.0		0.3	0.4	0.2	0.3	0.9	
Delay (s)	14.0	14.4		26.8	14.2		10.0	12.9	12.0	9.3	13.8	
Level of Service	B	B		C	B		A	B	B	A	B	
Approach Delay (s)		14.4			25.4			12.0			12.8	
Approach LOS		B			C			B			B	

Intersection Summary

HCM 2000 Control Delay	15.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	15.2
Intersection Capacity Utilization	57.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Intersection									
Intersection Delay, s/veh	7.4								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	171		544		291		345		
Demand Flow Rate, veh/h	174		555		297		352		
Vehicles Circulating, veh/h	521		317		20		520		
Vehicles Exiting, veh/h	351		0		675		352		
Follow-Up Headway, s	3.186		3.186		3.186		3.186		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	5.9		9.4		4.5		7.3		
Approach LOS	A		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LTR	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LTR	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.471	0.529	0.789	0.211	0.471	0.529	0.469	0.531	
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113	4.293	4.113	
Entry Flow, veh/h	82	92	438	117	140	157	165	187	
Cap Entry Lane, veh/h	764	785	891	905	1113	1114	765	785	
Entry HV Adj Factor	0.980	0.985	0.980	0.983	0.976	0.982	0.982	0.977	
Flow Entry, veh/h	80	91	429	115	137	154	162	183	
Cap Entry, veh/h	749	773	873	890	1087	1094	751	767	
V/C Ratio	0.107	0.117	0.492	0.129	0.126	0.141	0.216	0.238	
Control Delay, s/veh	5.9	5.9	10.5	5.3	4.4	4.5	7.2	7.3	
LOS	A	A	B	A	A	A	A	A	
95th %tile Queue, veh	0	0	3	0	0	0	1	1	

Queues  
105: Northshore Dr & Thunderhead Rd

Background 2020 PM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBT	WBR	NBT	SBT	SBR
Lane Group Flow (vph)	161	485	647	226	3	333	146
v/c Ratio	0.32	0.35	0.56	0.21	0.04	1.58	0.40
Control Delay	5.2	5.0	10.5	1.9	36.0	312.7	10.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	5.2	5.0	10.5	1.9	36.0	312.7	10.2
Queue Length 50th (ft)	23	86	320	27	1	~303	0
Queue Length 95th (ft)	40	126	36	0	10	#475	54
Internal Link Dist (ft)		320	870		71	759	
Turn Bay Length (ft)	100			150			200
Base Capacity (vph)	585	1397	1154	1067	165	211	361
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.28	0.35	0.56	0.21	0.02	1.58	0.40

Intersection Summary

~ 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.

HCM Signalized Intersection Capacity Analysis  
105: Northshore Dr & Thunderhead Rd

Background 2020 PM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	148	445	1	1	594	208	1	1	1	306	0	134
Future Volume (vph)	148	445	1	1	594	208	1	1	1	306	0	134
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00			1.00	0.85		0.95			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00		0.98			0.95	1.00
Satd. Flow (prot)	1770	1862			1863	1583		1750			1770	1583
Flt Permitted	0.29	1.00			1.00	1.00		0.62			0.76	1.00
Satd. Flow (perm)	532	1862			1862	1583		1096			1408	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	161	484	1	1	646	226	1	1	1	333	0	146
RTOR Reduction (vph)	0	0	0	0	0	86	0	1	0	0	0	124
Lane Group Flow (vph)	161	485	0	0	647	140	0	2	0	0	333	22
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	1	6			2			8			4	
Permitted Phases	6			2		2	8			4		4
Actuated Green, G (s)	75.0	75.0			62.0	62.0		15.0			15.0	15.0
Effective Green, g (s)	75.0	75.0			62.0	62.0		15.0			15.0	15.0
Actuated g/C Ratio	0.75	0.75			0.62	0.62		0.15			0.15	0.15
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)	498	1396			1154	981		164			211	237
v/s Ratio Prot	0.03	c0.26										
v/s Ratio Perm	0.22				c0.35	0.09		0.00			c0.24	0.01
v/c Ratio	0.32	0.35			0.56	0.14		0.01			1.58	0.09
Uniform Delay, d1	6.3	4.2			11.1	7.9		36.2			42.5	36.6
Progression Factor	1.00	1.00			0.75	1.23		1.00			1.00	1.00
Incremental Delay, d2	0.4	0.7			1.8	0.3		0.0			281.7	0.2
Delay (s)	6.7	4.9			10.0	10.0		36.2			324.2	36.8
Level of Service	A	A			B	B		D			F	D
Approach Delay (s)		5.4			10.0			36.2			236.6	
Approach LOS		A			B			D			F	

Intersection Summary

HCM 2000 Control Delay	62.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	90.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis  
 106: Thunderhead Rd & Boardwalk Blvd

Background 2020 PM Peak  
 Northshore Town Center GI Kids TIS



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	150	157	184	63	56	249
Future Volume (Veh/h)	150	157	184	63	56	249
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	163	171	200	68	61	271
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (ft)			1106			
pX, platoon unblocked						
vC, conflicting volume	627	234			268	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	627	234			268	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	62	79			95	
cM capacity (veh/h)	426	805			1296	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	163	171	268	332
Volume Left	163	0	0	61
Volume Right	0	171	68	0
cSH	426	805	1700	1296
Volume to Capacity	0.38	0.21	0.16	0.05
Queue Length 95th (ft)	44	20	0	4
Control Delay (s)	18.6	10.7	0.0	1.8
Lane LOS	C	B		A
Approach Delay (s)	14.5		0.0	1.8
Approach LOS	B			

Intersection Summary			
Average Delay			5.8
Intersection Capacity Utilization	48.0%	ICU Level of Service	A
Analysis Period (min)			15

HCM Unsignalized Intersection Capacity Analysis  
107: Access & Boardwalk Blvd

Background 2020 PM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	23	71	27	28	239	60	15	8	28	55	8	29
Future Volume (Veh/h)	23	71	27	28	239	60	15	8	28	55	8	29
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	25	77	29	30	260	65	16	9	30	60	9	32
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
	None					None						
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	325		106		498		526		92		292	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	325		106		498		526		92		292	
tC, single (s)	4.1		4.1		7.1		6.5		6.2		6.2	
tC, 2 stage (s)												
tF (s)	2.2		2.2		3.5		4.0		3.3		3.3	
p0 queue free %	98		98		96		98		97		96	
cM capacity (veh/h)	1235		1485		441		438		966		747	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	25	106	30	325	55	101						
Volume Left	25	0	30	0	16	60						
Volume Right	0	29	0	65	30	32						
cSH	1235	1700	1485	1700	626	503						
Volume to Capacity	0.02	0.06	0.02	0.19	0.09	0.20						
Queue Length 95th (ft)	2	0	2	0	7	19						
Control Delay (s)	8.0	0.0	7.5	0.0	11.3	13.9						
Lane LOS	A		A		B		B					
Approach Delay (s)	1.5		0.6		11.3		13.9					
Approach LOS					B		B					
Intersection Summary												
Average Delay			3.8									
Intersection Capacity Utilization			35.7%		ICU Level of Service				A			
Analysis Period (min)			15									

Queues  
105: Northshore Dr & Thunderhead Rd

Background 2020 PM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBT	WBR	NBT	SBT	SBR
Lane Group Flow (vph)	161	485	647	226	3	333	146
v/c Ratio	0.48	0.42	0.69	0.25	0.02	0.85	0.27
Control Delay	13.8	11.8	18.1	3.3	28.0	54.6	5.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.8	11.8	18.1	3.3	28.0	54.6	5.6
Queue Length 50th (ft)	42	154	381	56	1	195	0
Queue Length 95th (ft)	75	239	512	0	7	#316	43
Internal Link Dist (ft)		320	870		71	759	
Turn Bay Length (ft)	100			150			200
Base Capacity (vph)	338	1160	937	908	533	450	605
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.42	0.69	0.25	0.01	0.74	0.24

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
105: Northshore Dr & Thunderhead Rd

Background 2020 PM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	148	445	1	1	594	208	1	1	1	306	0	134
Future Volume (vph)	148	445	1	1	594	208	1	1	1	306	0	134
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00			1.00	0.85		0.95			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00		0.98			0.95	1.00
Satd. Flow (prot)	1770	1862			1863	1583		1750			1770	1583
Flt Permitted	0.21	1.00			1.00	1.00		0.94			0.76	1.00
Satd. Flow (perm)	388	1862			1862	1583		1665			1408	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	161	484	1	1	646	226	1	1	1	333	0	146
RTOR Reduction (vph)	0	0	0	0	0	112	0	1	0	0	0	106
Lane Group Flow (vph)	161	485	0	0	647	114	0	2	0	0	333	40
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	1	6			2			8			4	
Permitted Phases	6			2		2	8			4		4
Actuated Green, G (s)	62.3	62.3			50.4	50.4		27.7			27.7	27.7
Effective Green, g (s)	62.3	62.3			50.4	50.4		27.7			27.7	27.7
Actuated g/C Ratio	0.62	0.62			0.50	0.50		0.28			0.28	0.28
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)	337	1160			938	797		461			390	438
v/s Ratio Prot	0.03	c0.26										
v/s Ratio Perm	0.26				c0.35	0.07		0.00			c0.24	0.03
v/c Ratio	0.48	0.42			0.69	0.14		0.00			0.85	0.09
Uniform Delay, d1	12.7	9.6			18.9	13.3		26.2			34.2	26.8
Progression Factor	1.00	1.00			0.69	1.25		1.00			1.00	1.00
Incremental Delay, d2	1.1	1.1			3.7	0.3		0.0			16.4	0.1
Delay (s)	13.8	10.7			16.8	16.9		26.2			50.6	26.9
Level of Service	B	B			B	B		C			D	C
Approach Delay (s)		11.5			16.9			26.2			43.4	
Approach LOS		B			B			C			D	

Intersection Summary

HCM 2000 Control Delay	21.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	90.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Queues  
101: Northshore Dr & Town Center Blvd.

Buildout 2020 AM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	112	664	1	323	280	2	170	171	108
v/c Ratio	0.15	0.28	0.00	0.16	0.22	0.01	0.60	0.61	0.20
Control Delay	4.7	7.0	8.0	12.0	1.0	0.0	43.2	43.3	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.7	7.0	8.0	12.0	1.0	0.0	43.2	43.3	4.1
Queue Length 50th (ft)	8	26	0	41	0	0	94	95	0
Queue Length 95th (ft)	m43	m156	2	96	25	0	153	154	24
Internal Link Dist (ft)		1108		332		68		381	
Turn Bay Length (ft)	350				350				
Base Capacity (vph)	773	2384	610	1973	1368	282	373	374	633
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.28	0.00	0.16	0.20	0.01	0.46	0.46	0.17

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis  
101: Northshore Dr & Town Center Blvd.

Buildout 2020 AM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	103	610	1	1	297	258	1	0	1	313	1	99
Future Volume (vph)	103	610	1	1	297	258	1	0	1	313	1	99
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (prot)	1770	3538		1770	3539	1583		1695		1681	1686	1583
Flt Permitted	0.50	1.00		0.40	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (perm)	935	3538		744	3539	1583		1695		1681	1686	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	112	663	1	1	323	280	1	0	1	340	1	108
RTOR Reduction (vph)	0	0	0	0	0	90	0	2	0	0	0	81
Lane Group Flow (vph)	112	664	0	1	323	190	0	0	0	170	171	27
Turn Type	pm+pt	NA		pm+pt	NA	pm+ov	Split	NA		Split	NA	pm+ov
Protected Phases	5	2		1	6	3	4	4		3	3	5
Permitted Phases	2			6		6						3
Actuated Green, G (s)	58.8	52.6		47.3	46.1	61.2		1.1		15.1	15.1	22.8
Effective Green, g (s)	58.8	52.6		47.3	46.1	61.2		1.1		15.1	15.1	22.8
Actuated g/C Ratio	0.65	0.58		0.53	0.51	0.68		0.01		0.17	0.17	0.25
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	682	2067		404	1812	1164		20		282	282	401
v/s Ratio Prot	c0.01	c0.19		0.00	0.09	0.03		c0.00		0.10	c0.10	0.01
v/s Ratio Perm	0.09			0.00		0.09						0.01
v/c Ratio	0.16	0.32		0.00	0.18	0.16		0.00		0.60	0.61	0.07
Uniform Delay, d1	5.9	9.6		10.1	11.8	5.2		43.9		34.7	34.7	25.5
Progression Factor	0.73	0.84		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Incremental Delay, d2	0.0	0.2		0.0	0.2	0.1		0.0		3.6	3.7	0.1
Delay (s)	4.4	8.2		10.1	12.0	5.3		43.9		38.3	38.4	25.6
Level of Service	A	A		B	B	A		D		D	D	C
Approach Delay (s)		7.7			8.9			43.9			35.3	
Approach LOS		A			A			D			D	

Intersection Summary

HCM 2000 Control Delay	14.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	49.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis  
 102: Town Center Blvd. & S. Shopping Cnt

Buildout 2020 AM Peak  
 Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↗	↕↕	↗	↗	↗	↕↕
Traffic Volume (veh/h)	1	3	48	47	4	4	67	197	97	8	316	41
Future Volume (Veh/h)	1	3	48	47	4	4	67	197	97	8	316	41
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	3	52	51	4	4	73	214	105	9	343	45
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked	1.00	1.00	1.00	1.00	1.00		1.00					
vC, conflicting volume	642	848	194	603	766	107	388			319		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	636	843	186	596	760	107	381			319		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	99	94	85	99	100	94			99		
cM capacity (veh/h)	338	278	822	340	310	926	1171			1238		
<b>Direction, Lane #</b>												
	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3			
Volume Total	56	59	73	107	107	105	9	229	159			
Volume Left	1	51	73	0	0	0	9	0	0			
Volume Right	52	4	0	0	0	105	0	0	45			
cSH	727	353	1171	1700	1700	1700	1238	1700	1700			
Volume to Capacity	0.08	0.17	0.06	0.06	0.06	0.06	0.01	0.13	0.09			
Queue Length 95th (ft)	6	15	5	0	0	0	1	0	0			
Control Delay (s)	10.4	17.3	8.3	0.0	0.0	0.0	7.9	0.0	0.0			
Lane LOS	B	C	A				A					
Approach Delay (s)	10.4	17.3	1.5				0.2					
Approach LOS	B	C										
<b>Intersection Summary</b>												
Average Delay			2.5									
Intersection Capacity Utilization			33.5%		ICU Level of Service				A			
Analysis Period (min)			15									

Queues  
103: Town Center Blvd. & N. Shopping Cnt

Buildout 2020 AM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	3	55	77	18	54	154	12	40	293
v/c Ratio	0.01	0.19	0.37	0.07	0.07	0.06	0.01	0.04	0.13
Control Delay	17.7	9.0	24.9	13.3	4.2	7.4	0.0	4.2	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.7	9.0	24.9	13.3	4.2	7.4	0.0	4.2	7.9
Queue Length 50th (ft)	1	1	23	2	5	7	0	4	25
Queue Length 95th (ft)	6	24	52	15	17	32	0	13	53
Internal Link Dist (ft)		180		236		207			432
Turn Bay Length (ft)					100		50	150	
Base Capacity (vph)	429	531	415	530	810	2463	1144	896	2290
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.10	0.19	0.03	0.07	0.06	0.01	0.04	0.13

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
103: Town Center Blvd. & N. Shopping Cnt

Buildout 2020 AM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↗	↘		↗	↘		↗	↑↑	↗	↗	↑↘	
Traffic Volume (vph)	3	5	46	71	6	10	50	142	11	37	247	23
Future Volume (vph)	3	5	46	71	6	10	50	142	11	37	247	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95	
Frt	1.00	0.86		1.00	0.91		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1609		1770	1692		1770	3539	1583	1770	3494	
Flt Permitted	0.75	1.00		0.72	1.00		0.55	1.00	1.00	0.65	1.00	
Satd. Flow (perm)	1389	1609		1343	1692		1022	3539	1583	1219	3494	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	5	50	77	7	11	54	154	12	40	268	25
RTOR Reduction (vph)	0	44	0	0	10	0	0	0	5	0	9	0
Lane Group Flow (vph)	3	11	0	77	8	0	54	154	7	40	284	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4			8		1	6		5	2	
Permitted Phases	4			8			6		6	2		
Actuated Green, G (s)	6.1	6.1		6.1	6.1		35.2	31.3	31.3	32.6	30.0	
Effective Green, g (s)	6.1	6.1		6.1	6.1		35.2	31.3	31.3	32.6	30.0	
Actuated g/C Ratio	0.11	0.11		0.11	0.11		0.64	0.57	0.57	0.59	0.55	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	154	178		148	187		707	2014	900	748	1905	
v/s Ratio Prot		0.01			0.00		c0.01	0.04		0.00	c0.08	
v/s Ratio Perm	0.00			c0.06			0.04		0.00	0.03		
v/c Ratio	0.02	0.06		0.52	0.04		0.08	0.08	0.01	0.05	0.15	
Uniform Delay, d1	21.8	21.9		23.1	21.8		3.7	5.3	5.1	4.7	6.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.1		3.3	0.1		0.0	0.0	0.0	0.0	0.2	
Delay (s)	21.8	22.0		26.3	21.9		3.7	5.4	5.1	4.7	6.4	
Level of Service	C	C		C	C		A	A	A	A	A	
Approach Delay (s)		22.0			25.5			4.9			6.2	
Approach LOS		C			C			A			A	

Intersection Summary

HCM 2000 Control Delay	9.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.20		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	38.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Intersection									
Intersection Delay, s/veh	5.1								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	139		318		165		120		
Demand Flow Rate, veh/h	141		324		168		122		
Vehicles Circulating, veh/h	219		183		15		322		
Vehicles Exiting, veh/h	225		0		345		185		
Follow-Up Headway, s	3.186		3.186		3.186		3.186		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	4.5		6.1		3.9		4.7		
Approach LOS	A		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LTR	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LTR	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.468	0.532	0.833	0.167	0.470	0.530	0.467	0.533	
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113	4.293	4.113	
Entry Flow, veh/h	66	75	270	54	79	89	57	65	
Cap Entry Lane, veh/h	959	969	985	994	1117	1118	888	902	
Entry HV Adj Factor	0.990	0.982	0.981	0.981	0.980	0.981	0.988	0.977	
Flow Entry, veh/h	65	74	265	53	77	87	56	64	
Cap Entry, veh/h	949	952	966	976	1095	1097	877	881	
V/C Ratio	0.069	0.077	0.274	0.054	0.071	0.080	0.064	0.072	
Control Delay, s/veh	4.4	4.5	6.5	4.2	3.9	4.0	4.7	4.8	
LOS	A	A	A	A	A	A	A	A	
95th %tile Queue, veh	0	0	1	0	0	0	0	0	

Queues  
105: Northshore Dr & Thunderhead Rd

Buildout 2020 AM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBT	WBR	NBT	SBT	SBR
Lane Group Flow (vph)	410	618	313	104	3	425	249
v/c Ratio	0.56	0.48	0.35	0.13	0.01	1.56	0.49
Control Delay	8.7	7.8	10.5	1.0	26.7	296.6	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.7	7.8	10.5	1.0	26.7	296.6	7.9
Queue Length 50th (ft)	80	138	47	0	1	~344	0
Queue Length 95th (ft)	122	205	78	4	9	#524	62
Internal Link Dist (ft)		320	870		80	759	
Turn Bay Length (ft)	100						200
Base Capacity (vph)	814	1293	899	819	221	273	508
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.48	0.35	0.13	0.01	1.56	0.49

Intersection Summary

~ 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.

HCM Signalized Intersection Capacity Analysis  
105: Northshore Dr & Thunderhead Rd

Buildout 2020 AM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	377	568	1	1	287	96	1	1	1	391	0	229
Future Volume (vph)	377	568	1	1	287	96	1	1	1	391	0	229
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00			1.00	0.85		0.95			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00		0.98			0.95	1.00
Satd. Flow (prot)	1770	1862			1862	1583		1750			1770	1583
Flt Permitted	0.46	1.00			1.00	1.00		0.64			0.76	1.00
Satd. Flow (perm)	848	1862			1861	1583		1133			1408	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	410	617	1	1	312	104	1	1	1	425	0	249
RTOR Reduction (vph)	0	0	0	0	0	54	0	1	0	0	0	201
Lane Group Flow (vph)	410	618	0	0	313	50	0	2	0	0	425	48
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	1	6			2			8			4	
Permitted Phases	6			2		2	8			4		4
Actuated Green, G (s)	62.5	62.5			43.5	43.5		17.5			17.5	17.5
Effective Green, g (s)	62.5	62.5			43.5	43.5		17.5			17.5	17.5
Actuated g/C Ratio	0.69	0.69			0.48	0.48		0.19			0.19	0.19
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)	732	1293			899	765		220			273	307
v/s Ratio Prot	c0.09	0.33										
v/s Ratio Perm	c0.30				0.17	0.03		0.00			c0.30	0.03
v/c Ratio	0.56	0.48			0.35	0.07		0.01			1.56	0.16
Uniform Delay, d1	6.3	6.3			14.4	12.4		29.3			36.2	30.1
Progression Factor	1.00	1.00			0.61	0.20		1.00			1.00	1.00
Incremental Delay, d2	1.0	1.3			1.1	0.2		0.0			267.8	0.2
Delay (s)	7.3	7.6			9.8	2.7		29.3			304.0	30.4
Level of Service	A	A			A	A		C			F	C
Approach Delay (s)		7.5			8.0			29.3			202.9	
Approach LOS		A			A			C			F	

Intersection Summary

HCM 2000 Control Delay	69.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	85.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



HCM Unsignalized Intersection Capacity Analysis  
 106: Thunderhead Rd & Boardwalk Blvd

Buildout 2020 AM Peak  
 Northshore Town Center GI Kids TIS



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	27	184	475	44	152	594
Future Volume (Veh/h)	27	184	475	44	152	594
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.62	0.62	0.62	0.62	0.62	0.62
Hourly flow rate (vph)	44	297	766	71	245	958
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (ft)			1106			
pX, platoon unblocked	0.96	0.96			0.96	
vC, conflicting volume	2250	802			837	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2283	771			808	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	23			69	
cM capacity (veh/h)	29	383			783	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	44	297	837	1203
Volume Left	44	0	0	245
Volume Right	0	297	71	0
cSH	29	383	1700	783
Volume to Capacity	1.53	0.77	0.49	0.31
Queue Length 95th (ft)	128	161	0	33
Control Delay (s)	567.7	40.2	0.0	9.0
Lane LOS	F	E		A
Approach Delay (s)	108.2		0.0	9.0
Approach LOS	F			

Intersection Summary			
Average Delay	20.1		
Intersection Capacity Utilization	80.7%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis  
 107: Boardwalk Blvd & Access

Buildout 2020 AM Peak  
 Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	132	13	14	174	35	6	3	11	18	2	9
Future Volume (Veh/h)	19	132	13	14	174	35	6	3	11	18	2	9
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	21	143	14	15	189	38	7	3	12	20	2	10
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	227			157			422	449	150	436	437	208
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	227			157			422	449	150	436	437	208
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			99			99	99	99	96	100	99
cM capacity (veh/h)	1341			1423			523	492	896	510	500	832
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	21	157	15	227	22	32						
Volume Left	21	0	15	0	7	20						
Volume Right	0	14	0	38	12	10						
cSH	1341	1700	1423	1700	669	580						
Volume to Capacity	0.02	0.09	0.01	0.13	0.03	0.06						
Queue Length 95th (ft)	1	0	1	0	3	4						
Control Delay (s)	7.7	0.0	7.6	0.0	10.6	11.6						
Lane LOS	A		A		B	B						
Approach Delay (s)	0.9		0.5		10.6	11.6						
Approach LOS					B	B						
Intersection Summary												
Average Delay			1.9									
Intersection Capacity Utilization			25.8%		ICU Level of Service				A			
Analysis Period (min)			15									

Queues  
105: Northshore Dr & Thunderhead Rd

Buildout 2020 AM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBT	WBR	NBT	SBT	SBR
Lane Group Flow (vph)	410	618	313	104	3	425	249
v/c Ratio	0.77	0.62	0.53	0.18	0.01	0.86	0.35
Control Delay	26.2	19.1	26.3	2.5	14.7	44.4	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.2	19.1	26.3	2.5	14.7	44.4	3.9
Queue Length 50th (ft)	141	245	154	0	1	211	0
Queue Length 95th (ft)	#280	381	155	9	6	#336	45
Internal Link Dist (ft)		320	870		80	759	
Turn Bay Length (ft)	100						200
Base Capacity (vph)	536	1000	588	571	665	563	782
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.76	0.62	0.53	0.18	0.00	0.75	0.32

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
 105: Northshore Dr & Thunderhead Rd

Buildout 2020 AM Peak  
 Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	377	568	1	1	287	96	1	1	1	391	0	229
Future Volume (vph)	377	568	1	1	287	96	1	1	1	391	0	229
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00			1.00	0.85		0.95			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00		0.98			0.95	1.00
Satd. Flow (prot)	1770	1862			1862	1583		1750			1770	1583
Flt Permitted	0.35	1.00			1.00	1.00		0.93			0.76	1.00
Satd. Flow (perm)	650	1862			1860	1583		1662			1408	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	410	617	1	1	312	104	1	1	1	425	0	249
RTOR Reduction (vph)	0	0	0	0	0	71	0	1	0	0	0	161
Lane Group Flow (vph)	410	618	0	0	313	33	0	2	0	0	425	88
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	1	6			2			8			4	
Permitted Phases	6			2		2	8			4		4
Actuated Green, G (s)	48.3	48.3			28.4	28.4		31.7			31.7	31.7
Effective Green, g (s)	48.3	48.3			28.4	28.4		31.7			31.7	31.7
Actuated g/C Ratio	0.54	0.54			0.32	0.32		0.35			0.35	0.35
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)	534	999			586	499		585			495	557
v/s Ratio Prot	c0.13	0.33										
v/s Ratio Perm	c0.28				0.17	0.02		0.00			c0.30	0.06
v/c Ratio	0.77	0.62			0.53	0.07		0.00			0.86	0.16
Uniform Delay, d1	14.1	14.5			25.4	21.5		18.9			27.1	20.0
Progression Factor	1.00	1.00			0.84	0.33		1.00			1.00	1.00
Incremental Delay, d2	6.5	2.9			3.4	0.3		0.0			13.8	0.1
Delay (s)	20.6	17.3			24.6	7.3		18.9			40.9	20.1
Level of Service	C	B			C	A		B			D	C
Approach Delay (s)		18.7			20.3			18.9			33.2	
Approach LOS		B			C			B			C	

Intersection Summary		
HCM 2000 Control Delay	23.6	HCM 2000 Level of Service C
HCM 2000 Volume to Capacity ratio	0.84	
Actuated Cycle Length (s)	90.0	Sum of lost time (s) 15.0
Intersection Capacity Utilization	85.9%	ICU Level of Service E
Analysis Period (min)	15	

c Critical Lane Group

Queues  
101: Northshore Dr & Town Center Blvd.

Buildout 2020 PM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	146	674	1	852	533	2	441	442	261
v/c Ratio	0.37	0.30	0.00	0.48	0.39	0.01	1.15	1.15	0.68
Control Delay	6.4	5.7	9.0	18.6	1.4	0.0	130.6	130.4	14.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.4	5.7	9.0	18.6	1.4	0.0	130.6	130.4	14.6
Queue Length 50th (ft)	17	44	0	164	0	0	~350	~350	0
Queue Length 95th (ft)	m30	m74	3	305	35	0	#549	#551	70
Internal Link Dist (ft)		1108		332		78		381	
Turn Bay Length (ft)	350				350				
Base Capacity (vph)	470	2228	579	1792	1356	277	383	384	460
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.30	0.00	0.48	0.39	0.01	1.15	1.15	0.57

Intersection Summary

- ~ 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.
- m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis  
101: Northshore Dr & Town Center Blvd.

Buildout 2020 PM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	134	619	1	1	784	490	1	0	1	811	1	240
Future Volume (vph)	134	619	1	1	784	490	1	0	1	811	1	240
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (prot)	1770	3538		1770	3539	1583		1695		1681	1686	1583
Flt Permitted	0.22	1.00		0.40	1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (perm)	406	3538		737	3539	1583		1695		1681	1686	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	146	673	1	1	852	533	1	0	1	882	1	261
RTOR Reduction (vph)	0	0	0	0	0	163	0	2	0	0	0	236
Lane Group Flow (vph)	146	674	0	1	852	370	0	0	0	441	442	25
Turn Type	pm+pt	NA		pm+pt	NA	pm+ov	Split	NA		Split	NA	Over
Protected Phases	5	2		1	6	3	4	4		3	3	5
Permitted Phases	2			6		6						
Actuated Green, G (s)	61.1	55.0		47.7	46.6	69.4		1.1		22.8	22.8	9.5
Effective Green, g (s)	61.1	55.0		47.7	46.6	69.4		1.1		22.8	22.8	9.5
Actuated g/C Ratio	0.61	0.55		0.48	0.47	0.69		0.01		0.23	0.23	0.10
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	377	1945		362	1649	1177		18		383	384	150
v/s Ratio Prot	c0.04	0.19		0.00	c0.24	0.07		c0.00		c0.26	0.26	0.02
v/s Ratio Perm	0.20			0.00		0.16						
v/c Ratio	0.39	0.35		0.00	0.52	0.31		0.00		1.15	1.15	0.17
Uniform Delay, d1	10.3	12.5		13.7	18.8	6.0		48.9		38.6	38.6	41.6
Progression Factor	0.67	0.56		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Incremental Delay, d2	0.3	0.2		0.0	1.2	0.2		0.0		94.0	93.8	0.5
Delay (s)	7.3	7.2		13.7	19.9	6.1		48.9		132.6	132.4	42.1
Level of Service	A	A		B	B	A		D		F	F	D
Approach Delay (s)		7.2			14.6			48.9			111.9	
Approach LOS		A			B			D			F	

Intersection Summary

HCM 2000 Control Delay	46.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis  
 102: Town Center Blvd. & S. Shopping Cnt

Buildout 2020 PM Peak  
 Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↗	↕	↗	↗	↕	↕
Traffic Volume (veh/h)	6	6	180	60	6	7	93	434	98	13	811	24
Future Volume (Veh/h)	6	6	180	60	6	7	93	434	98	13	811	24
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	7	196	65	7	8	101	472	107	14	882	26
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked	0.90	0.90	0.90	0.90	0.90		0.90					
vC, conflicting volume	1372	1704	454	1342	1610	236	908			579		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1187	1556	164	1154	1452	236	669			579		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	94	92	74	24	93	99	88			99		
cM capacity (veh/h)	109	87	765	86	101	766	823			991		
<b>Direction, Lane #</b>												
	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3			
Volume Total	210	80	101	236	236	107	14	588	320			
Volume Left	7	65	101	0	0	0	14	0	0			
Volume Right	196	8	0	0	0	107	0	0	26			
cSH	523	95	823	1700	1700	1700	991	1700	1700			
Volume to Capacity	0.40	0.84	0.12	0.14	0.14	0.06	0.01	0.35	0.19			
Queue Length 95th (ft)	48	115	10	0	0	0	1	0	0			
Control Delay (s)	16.4	131.3	10.0	0.0	0.0	0.0	8.7	0.0	0.0			
Lane LOS	C	F	A				A					
Approach Delay (s)	16.4	131.3	1.5				0.1					
Approach LOS	C	F										
<b>Intersection Summary</b>												
Average Delay			8.0									
Intersection Capacity Utilization			57.5%		ICU Level of Service				B			
Analysis Period (min)			15									

Queues  
103: Town Center Blvd. & N. Shopping Cnt

Buildout 2020 PM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	7	146	267	36	109	280	97	146	564
v/c Ratio	0.02	0.27	0.75	0.07	0.25	0.21	0.14	0.26	0.42
Control Delay	12.3	4.8	31.6	7.1	9.7	14.5	2.2	9.2	14.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.3	4.8	31.6	7.1	9.7	14.5	2.2	9.2	14.9
Queue Length 50th (ft)	2	2	76	2	17	36	0	23	75
Queue Length 95th (ft)	8	32	#145	17	41	62	16	52	116
Internal Link Dist (ft)		169		236		207			432
Turn Bay Length (ft)					100		50	150	
Base Capacity (vph)	472	642	427	588	439	1317	676	570	1355
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.23	0.63	0.06	0.25	0.21	0.14	0.26	0.42

Intersection Summary

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



HCM Signalized Intersection Capacity Analysis  
103: Town Center Blvd. & N. Shopping Cnt

Buildout 2020 PM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↕	↗	↖	↕	↗
Traffic Volume (vph)	6	8	126	246	8	25	100	258	89	134	474	45
Future Volume (vph)	6	8	126	246	8	25	100	258	89	134	474	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95	
Frt	1.00	0.86		1.00	0.89		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1601		1770	1653		1770	3539	1583	1770	3493	
Flt Permitted	0.73	1.00		0.66	1.00		0.41	1.00	1.00	0.56	1.00	
Satd. Flow (perm)	1367	1601		1237	1653		771	3539	1583	1043	3493	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	7	9	137	267	9	27	109	280	97	146	515	49
RTOR Reduction (vph)	0	98	0	0	19	0	0	0	63	0	12	0
Lane Group Flow (vph)	7	48	0	267	17	0	109	280	34	146	552	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4			8		1	6		5	2	
Permitted Phases	4			8			6		6	2		
Actuated Green, G (s)	15.7	15.7		15.7	15.7		23.6	19.5	19.5	25.0	20.2	
Effective Green, g (s)	15.7	15.7		15.7	15.7		23.6	19.5	19.5	25.0	20.2	
Actuated g/C Ratio	0.29	0.29		0.29	0.29		0.43	0.35	0.35	0.45	0.37	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	390	457		353	471		405	1254	561	537	1282	
v/s Ratio Prot		0.03			0.01		0.02	0.08		c0.02	c0.16	
v/s Ratio Perm	0.01			c0.22			0.10		0.02	0.10		
v/c Ratio	0.02	0.11		0.76	0.04		0.27	0.22	0.06	0.27	0.43	
Uniform Delay, d1	14.1	14.5		17.9	14.2		9.6	12.4	11.7	8.9	13.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	0.1		8.9	0.0		0.4	0.1	0.0	0.3	1.1	
Delay (s)	14.1	14.6		26.8	14.2		9.9	12.5	11.8	9.2	14.1	
Level of Service	B	B		C	B		A	B	B	A	B	
Approach Delay (s)		14.6			25.3			11.8			13.1	
Approach LOS		B			C			B			B	

Intersection Summary

HCM 2000 Control Delay	15.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	58.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Intersection									
Intersection Delay, s/veh	7.5								
Intersection LOS	A								
Approach	EB		WB		NB		SB		
Entry Lanes	2		2		2		2		
Conflicting Circle Lanes	2		2		2		2		
Adj Approach Flow, veh/h	193		549		302		374		
Demand Flow Rate, veh/h	196		560		308		382		
Vehicles Circulating, veh/h	551		328		20		527		
Vehicles Exiting, veh/h	358		0		727		361		
Follow-Up Headway, s	3.186		3.186		3.186		3.186		
Ped Vol Crossing Leg, #/h	0		0		0		0		
Ped Cap Adj	1.000		1.000		1.000		1.000		
Approach Delay, s/veh	6.2		9.6		4.5		7.6		
Approach LOS	A		A		A		A		
Lane	Left	Right	Left	Right	Left	Right	Left	Right	
Designated Moves	LTR	R	LT	R	LT	TR	LT	TR	
Assumed Moves	LTR	R	LT	R	LT	TR	LT	TR	
RT Channelized									
Lane Util	0.469	0.531	0.788	0.213	0.471	0.529	0.471	0.529	
Critical Headway, s	4.293	4.113	4.293	4.113	4.293	4.113	4.293	4.113	
Entry Flow, veh/h	92	104	441	119	145	163	180	202	
Cap Entry Lane, veh/h	747	768	884	898	1113	1114	761	781	
Entry HV Adj Factor	0.986	0.984	0.980	0.983	0.978	0.981	0.977	0.981	
Flow Entry, veh/h	91	102	432	117	142	160	176	198	
Cap Entry, veh/h	737	756	866	883	1088	1093	743	767	
V/C Ratio	0.123	0.135	0.499	0.132	0.130	0.146	0.237	0.259	
Control Delay, s/veh	6.2	6.2	10.7	5.4	4.5	4.6	7.5	7.6	
LOS	A	A	B	A	A	A	A	A	
95th %tile Queue, veh	0	0	3	0	0	1	1	1	

Queues  
105: Northshore Dr & Thunderhead Rd

Buildout 2020 PM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBT	WBR	NBT	SBT	SBR
Lane Group Flow (vph)	166	486	653	226	2	333	154
v/c Ratio	0.34	0.35	0.57	0.21	0.01	1.58	0.42
Control Delay	5.3	5.0	11.4	1.9	0.0	312.7	10.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	5.3	5.0	11.4	1.9	0.0	312.7	10.1
Queue Length 50th (ft)	24	87	325	27	0	~303	0
Queue Length 95th (ft)	41	127	507	2	0	#475	55
Internal Link Dist (ft)		320	870		77	759	
Turn Bay Length (ft)	100						200
Base Capacity (vph)	580	1397	1153	1066	223	211	368
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.35	0.57	0.21	0.01	1.58	0.42

Intersection Summary

- ~ 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.

HCM Signalized Intersection Capacity Analysis  
105: Northshore Dr & Thunderhead Rd

Buildout 2020 PM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	153	446	1	1	600	208	1	0	1	306	0	142
Future Volume (vph)	153	446	1	1	600	208	1	0	1	306	0	142
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00			1.00	0.85		0.93			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00		0.98			0.95	1.00
Satd. Flow (prot)	1770	1862			1863	1583		1695			1770	1583
Flt Permitted	0.28	1.00			1.00	1.00		0.61			0.76	1.00
Satd. Flow (perm)	525	1862			1862	1583		1064			1409	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	166	485	1	1	652	226	1	0	1	333	0	154
RTOR Reduction (vph)	0	0	0	0	0	86	0	2	0	0	0	131
Lane Group Flow (vph)	166	486	0	0	653	140	0	0	0	0	333	23
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	1	6			2			8			4	
Permitted Phases	6			2		2	8			4		4
Actuated Green, G (s)	75.0	75.0			61.9	61.9		15.0			15.0	15.0
Effective Green, g (s)	75.0	75.0			61.9	61.9		15.0			15.0	15.0
Actuated g/C Ratio	0.75	0.75			0.62	0.62		0.15			0.15	0.15
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)	494	1396			1152	979		159			211	237
v/s Ratio Prot	0.03	c0.26										
v/s Ratio Perm	0.22				c0.35	0.09		0.00			c0.24	0.01
v/c Ratio	0.34	0.35			0.57	0.14		0.00			1.58	0.10
Uniform Delay, d1	6.4	4.2			11.2	8.0		36.1			42.5	36.7
Progression Factor	1.00	1.00			0.82	1.26		1.00			1.00	1.00
Incremental Delay, d2	0.4	0.7			1.8	0.3		0.0			281.7	0.2
Delay (s)	6.8	4.9			10.9	10.3		36.1			324.2	36.8
Level of Service	A	A			B	B		D			F	D
Approach Delay (s)		5.4			10.8			36.1			233.3	
Approach LOS		A			B			D			F	

Intersection Summary

HCM 2000 Control Delay	62.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis  
 106: Thunderhead Rd & Boardwalk Blvd

Buildout 2020 PM Peak  
 Northshore Town Center GI Kids TIS



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	159	160	184	68	57	249
Future Volume (Veh/h)	159	160	184	68	57	249
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	173	174	200	74	62	271
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type						
			None			None
Median storage (veh)						
Upstream signal (ft)						
			1106			
pX, platoon unblocked						
vC, conflicting volume	632	237			274	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	632	237			274	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	59	78			95	
cM capacity (veh/h)	423	802			1289	
<b>Direction, Lane #</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>SB 1</b>		
Volume Total	173	174	274	333		
Volume Left	173	0	0	62		
Volume Right	0	174	74	0		
cSH	423	802	1700	1289		
Volume to Capacity	0.41	0.22	0.16	0.05		
Queue Length 95th (ft)	49	21	0	4		
Control Delay (s)	19.3	10.7	0.0	1.8		
Lane LOS	C	B		A		
Approach Delay (s)	15.0		0.0	1.8		
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay			6.1			
Intersection Capacity Utilization			48.9%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
107: Access & Boardwalk Blvd

Buildout 2020 PM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (veh/h)	29	71	27	28	239	66	15	8	28	76	8	41	
Future Volume (Veh/h)	29	71	27	28	239	66	15	8	28	76	8	41	
Sign Control		Free			Free			Stop			Stop		
Grade		0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	32	77	29	30	260	72	16	9	30	83	9	45	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type	None					None							
Median storage (veh)													
Upstream signal (ft)													
pX, platoon unblocked													
vC, conflicting volume	332			106			525	548	92	532	526	296	
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	332			106			525	548	92	532	526	296	
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2	
tC, 2 stage (s)													
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3	
p0 queue free %	97			98			96	98	97	80	98	94	
cM capacity (veh/h)	1227			1485			413	424	966	422	436	743	
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1							
Volume Total	32	106	30	332	55	137							
Volume Left	32	0	30	0	16	83							
Volume Right	0	29	0	72	30	45							
cSH	1227	1700	1485	1700	604	493							
Volume to Capacity	0.03	0.06	0.02	0.20	0.09	0.28							
Queue Length 95th (ft)	2	0	2	0	7	28							
Control Delay (s)	8.0	0.0	7.5	0.0	11.6	15.1							
Lane LOS	A		A		B	C							
Approach Delay (s)	1.9		0.6		11.6	15.1							
Approach LOS					B	C							
Intersection Summary													
Average Delay			4.6										
Intersection Capacity Utilization			43.6%		ICU Level of Service			A					
Analysis Period (min)			15										

Queues  
105: Northshore Dr & Thunderhead Rd

Buildout 2020 PM Peak  
Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBT	WBR	NBT	SBT	SBR
Lane Group Flow (vph)	166	486	653	226	2	333	154
v/c Ratio	0.50	0.42	0.69	0.25	0.00	0.86	0.28
Control Delay	14.0	11.6	18.6	3.3	0.0	56.2	5.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.0	11.6	18.6	3.3	0.0	56.2	5.7
Queue Length 50th (ft)	43	155	385	56	0	194	0
Queue Length 95th (ft)	75	234	557	2	0	#325	44
Internal Link Dist (ft)		320	870		77	759	
Turn Bay Length (ft)	100						200
Base Capacity (vph)	335	1166	947	915	544	437	596
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.42	0.69	0.25	0.00	0.76	0.26

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
105: Northshore Dr & Thunderhead Rd

Buildout 2020 PM Peak  
Northshore Town Center GI Kids TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	153	446	1	1	600	208	1	0	1	306	0	142
Future Volume (vph)	153	446	1	1	600	208	1	0	1	306	0	142
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00			1.00	1.00
Frt	1.00	1.00			1.00	0.85		0.93			1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00		0.98			0.95	1.00
Satd. Flow (prot)	1770	1862			1863	1583		1695			1770	1583
Flt Permitted	0.21	1.00			1.00	1.00		0.91			0.76	1.00
Satd. Flow (perm)	387	1862			1862	1583		1587			1409	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	166	485	1	1	652	226	1	0	1	333	0	154
RTOR Reduction (vph)	0	0	0	0	0	111	0	1	0	0	0	112
Lane Group Flow (vph)	166	486	0	0	653	115	0	1	0	0	333	42
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	1	6			2			8			4	
Permitted Phases	6			2		2	8			4		4
Actuated Green, G (s)	62.6	62.6			50.8	50.8		27.4			27.4	27.4
Effective Green, g (s)	62.6	62.6			50.8	50.8		27.4			27.4	27.4
Actuated g/C Ratio	0.63	0.63			0.51	0.51		0.27			0.27	0.27
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)	336	1165			945	804		434			386	433
v/s Ratio Prot	0.03	c0.26										
v/s Ratio Perm	0.28				c0.35	0.07		0.00			c0.24	0.03
v/c Ratio	0.49	0.42			0.69	0.14		0.00			0.86	0.10
Uniform Delay, d1	12.7	9.5			18.6	13.0		26.4			34.5	27.1
Progression Factor	1.00	1.00			0.74	1.32		1.00			1.00	1.00
Incremental Delay, d2	1.1	1.1			3.7	0.3		0.0			17.7	0.1
Delay (s)	13.9	10.6			17.5	17.6		26.4			52.2	27.2
Level of Service	B	B			B	B		C			D	C
Approach Delay (s)		11.4			17.5			26.4			44.3	
Approach LOS		B			B			C			D	

Intersection Summary

HCM 2000 Control Delay	22.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Queues

Buildout 2020 AM Peak w Double IT

105: Northshore Dr & Thunderhead Rd

Northshore Town Center GI Kids TIS























Lane Group	EBL	EBT	WBT	WBR	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	410	618	313	104	3	212	213	249
v/c Ratio	0.56	0.47	0.37	0.13	0.03	0.77	0.77	0.53
Control Delay	9.5	8.6	13.9	0.5	35.7	54.9	55.3	9.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.5	8.6	13.9	0.5	35.7	54.9	55.3	9.1
Queue Length 50th (ft)	74	129	59	0	1	120	121	0
Queue Length 95th (ft)	177	297	108	2	10	#223	#226	63
Internal Link Dist (ft)		320	870		80		759	
Turn Bay Length (ft)	100							200
Base Capacity (vph)	739	1302	850	802	311	298	298	486
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.47	0.37	0.13	0.01	0.71	0.71	0.51

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
105: Northshore Dr & Thunderhead Rd

Buildout 2020 AM Peak w Double IT  
Northshore Town Center GI Kids TIS

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	377	568	1	1	287	96	1	1	1	391	0	229
Future Volume (vph)	377	568	1	1	287	96	1	1	1	391	0	229
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00		0.95	0.95	1.00
Flt	1.00	1.00			1.00	0.85		0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (prot)	1770	1862			1862	1583		1750		1681	1681	1583
Flt Permitted	0.42	1.00			1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (perm)	782	1862			1861	1583		1750		1681	1681	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	410	617	1	1	312	104	1	1	1	425	0	249
RTOR Reduction (vph)	0	0	0	0	0	61	0	1	0	0	0	208
Lane Group Flow (vph)	410	618	0	0	313	43	0	2	0	212	213	41
Turn Type	pm+pt	NA		Perm	NA	Perm	Split	NA		Split	NA	Perm
Protected Phases	1	6			2		8	8		4	4	
Permitted Phases	6			2		2						4
Actuated Green, G (s)	59.0	59.0			37.2	37.2		1.2		14.8	14.8	14.8
Effective Green, g (s)	59.0	59.0			37.2	37.2		1.2		14.8	14.8	14.8
Actuated g/C Ratio	0.66	0.66			0.41	0.41		0.01		0.16	0.16	0.16
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	697	1220			769	654		23		276	276	260
v/s Ratio Prot	c0.11	0.33						c0.00		0.13	c0.13	
v/s Ratio Perm	c0.28				0.17	0.03						0.03
v/c Ratio	0.59	0.51			0.41	0.07		0.09		0.77	0.77	0.16
Uniform Delay, d1	8.1	8.0			18.6	15.9		43.9		36.0	36.0	32.3
Progression Factor	1.00	1.00			0.65	0.10		1.00		1.00	1.00	1.00
Incremental Delay, d2	1.3	1.5			1.6	0.2		1.6		12.1	12.5	0.3
Delay (s)	9.3	9.5			13.7	1.8		45.5		48.0	48.5	32.5
Level of Service	A	A			B	A		D		D	D	C
Approach Delay (s)		9.4			10.8			45.5			42.5	
Approach LOS		A			B			D			D	

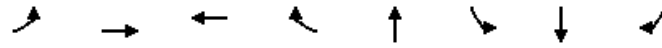
Intersection Summary

HCM 2000 Control Delay	20.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	75.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Queues  
105: Northshore Dr & Thunderhead Rd

Buildout 2020 PM Peak-Double LT  
Northshore Town Center GI Kids TIS























Lane Group	EBL	EBT	WBT	WBR	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	166	486	653	226	2	166	167	154
v/c Ratio	0.35	0.35	0.56	0.21	0.01	0.80	0.80	0.47
Control Delay	6.1	5.5	4.8	0.4	0.0	69.9	70.4	11.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.1	5.5	4.8	0.4	0.0	69.9	70.4	11.6
Queue Length 50th (ft)	22	78	35	0	0	109	109	0
Queue Length 95th (ft)	59	183	86	2	0	#216	#220	56
Internal Link Dist (ft)		320	870		77		759	
Turn Bay Length (ft)	100							200
Base Capacity (vph)	471	1406	1159	1070	365	218	218	339
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.35	0.56	0.21	0.01	0.76	0.77	0.45

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
105: Northshore Dr & Thunderhead Rd

Buildout 2020 PM Peak-Double LT  
Northshore Town Center GI Kids TIS

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	153	446	1	1	600	208	1	0	1	306	0	142
Future Volume (vph)	153	446	1	1	600	208	1	0	1	306	0	142
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00		0.95	0.95	1.00
Flt	1.00	1.00			1.00	0.85		0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (prot)	1770	1862			1863	1583		1695		1681	1681	1583
Flt Permitted	0.26	1.00			1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (perm)	485	1862			1862	1583		1695		1681	1681	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	166	485	1	1	652	226	1	0	1	333	0	154
RTOR Reduction (vph)	0	0	0	0	0	94	0	2	0	0	0	135
Lane Group Flow (vph)	166	486	0	0	653	132	0	0	0	166	167	19
Turn Type	pm+pt	NA		Perm	NA	Perm	Split	NA		Split	NA	Perm
Protected Phases	1	6			2		8	8		4	4	
Permitted Phases	6			2		2						4
Actuated Green, G (s)	71.5	71.5			58.3	58.3		1.1		12.4	12.4	12.4
Effective Green, g (s)	71.5	71.5			58.3	58.3		1.1		12.4	12.4	12.4
Actuated g/C Ratio	0.72	0.72			0.58	0.58		0.01		0.12	0.12	0.12
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	452	1331			1085	922		18		208	208	196
v/s Ratio Prot	0.03	c0.26						c0.00		0.10	c0.10	
v/s Ratio Perm	0.23				c0.35	0.08						0.01
v/c Ratio	0.37	0.37			0.60	0.14		0.00		0.80	0.80	0.10
Uniform Delay, d1	8.1	5.5			13.4	9.5		48.9		42.6	42.6	38.8
Progression Factor	1.00	1.00			0.24	0.03		1.00		1.00	1.00	1.00
Incremental Delay, d2	0.5	0.8			2.2	0.3		0.0		18.9	19.6	0.2
Delay (s)	8.6	6.3			5.4	0.5		48.9		61.4	62.2	39.1
Level of Service	A	A			A	A		D		E	E	D
Approach Delay (s)		6.9			4.1			48.9			54.6	
Approach LOS		A			A			D			D	








Intersection Summary

HCM 2000 Control Delay	17.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		























c Critical Lane Group

Queues  
105: Northshore Dr & Thunderhead Rd

Buildout 2020 AM Peak w 4-Lane Northshore  
Northshore Town Center GI Kids TIS

							
Lane Group	EBL	EBT	WBT	WBR	NBT	SBT	SBR
Lane Group Flow (vph)	410	618	313	104	3	425	249
v/c Ratio	0.67	0.33	0.33	0.20	0.00	0.83	0.34
Control Delay	21.1	14.0	23.0	4.7	13.3	40.3	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.1	14.0	23.0	4.7	13.3	40.3	3.6
Queue Length 50th (ft)	142	104	78	0	1	211	0
Queue Length 95th (ft)	244	159	73	16	6	304	42
Internal Link Dist (ft)		320	870		80	759	
Turn Bay Length (ft)	100						200
Base Capacity (vph)	635	1862	954	522	722	610	827
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.65	0.33	0.33	0.20	0.00	0.70	0.30
<b>Intersection Summary</b>							








HCM Signalized Intersection Capacity Analysis Buildout 2020 AM Peak w 4-Lane Northshore  
 105: Northshore Dr & Thunderhead Rd Northshore Town Center GI Kids TIS

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 				
Traffic Volume (vph)	377	568	1	1	287	96	1	1	1	391	0	229
Future Volume (vph)	377	568	1	1	287	96	1	1	1	391	0	229
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Lane Util. Factor	1.00	0.95			0.95	1.00		1.00			1.00	1.00
Fr <sub>t</sub>	1.00	1.00			1.00	0.85		0.95			1.00	0.85
Fl <sub>t</sub> Protected	0.95	1.00			1.00	1.00		0.98			0.95	1.00
Satd. Flow (prot)	1770	3538			3539	1583		1750			1770	1583
Fl <sub>t</sub> Permitted	0.44	1.00			0.95	1.00		0.94			0.76	1.00
Satd. Flow (perm)	823	3538			3375	1583		1665			1408	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	410	617	1	1	312	104	1	1	1	425	0	249
RTOR Reduction (vph)	0	0	0	0	0	75	0	1	0	0	0	159
Lane Group Flow (vph)	410	618	0	0	313	29	0	2	0	0	425	90
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	1	6			2			8			4	
Permitted Phases	6			2		2	8			4		4
Actuated Green, G (s)	47.4	47.4			25.5	25.5		32.6			32.6	32.6
Effective Green, g (s)	47.4	47.4			25.5	25.5		32.6			32.6	32.6
Actuated g/C Ratio	0.53	0.53			0.28	0.28		0.36			0.36	0.36
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)	611	1863			956	448		603			510	573
v/s Ratio Prot	c0.13	0.17										
v/s Ratio Perm	c0.23				0.09	0.02		0.00			c0.30	0.06
v/c Ratio	0.67	0.33			0.33	0.07		0.00			0.83	0.16
Uniform Delay, d <sub>1</sub>	13.5	12.2			25.5	23.6		18.3			26.2	19.4
Progression Factor	1.00	1.00			0.77	0.55		1.00			1.00	1.00
Incremental Delay, d <sub>2</sub>	2.9	0.5			0.9	0.3		0.0			11.2	0.1
Delay (s)	16.4	12.7			20.6	13.3		18.3			37.4	19.5
Level of Service	B	B			C	B		B			D	B
Approach Delay (s)		14.2			18.8			18.3			30.8	
Approach LOS		B			B			B			C	

Intersection Summary			
HCM 2000 Control Delay	20.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	74.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Queues  
105: Northshore Dr & Thunderhead Rd























							
Lane Group	EBL	EBT	WBT	WBR	NBT	SBT	SBR
Lane Group Flow (vph)	166	486	653	226	2	333	154
v/c Ratio	0.35	0.22	0.40	0.26	0.00	0.86	0.28
Control Delay	10.7	9.0	6.7	1.1	0.0	56.2	5.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.7	9.0	6.7	1.1	0.0	56.2	5.7
Queue Length 50th (ft)	43	70	96	1	0	194	0
Queue Length 95th (ft)	75	98	53	2	0	#325	44
Internal Link Dist (ft)		320	870		77	759	
Turn Bay Length (ft)	100						200
Base Capacity (vph)	505	2215	1627	879	544	437	596
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.22	0.40	0.26	0.00	0.76	0.26

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis  
105: Northshore Dr & Thunderhead Rd

Buildout 2020 PM Peak-Northshore 4-Lane  
Northshore Town Center GI Kids TIS

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 				
Traffic Volume (vph)	153	446	1	1	600	208	1	0	1	306	0	142
Future Volume (vph)	153	446	1	1	600	208	1	0	1	306	0	142
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Lane Util. Factor	1.00	0.95			0.95	1.00		1.00			1.00	1.00
Fr <sub>t</sub>	1.00	1.00			1.00	0.85		0.93			1.00	0.85
Fl <sub>t</sub> Protected	0.95	1.00			1.00	1.00		0.98			0.95	1.00
Satd. Flow (prot)	1770	3538			3539	1583		1695			1770	1583
Fl <sub>t</sub> Permitted	0.31	1.00			0.95	1.00		0.91			0.76	1.00
Satd. Flow (perm)	579	3538			3379	1583		1587			1409	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	166	485	1	1	652	226	1	0	1	333	0	154
RTOR Reduction (vph)	0	0	0	0	0	117	0	1	0	0	0	112
Lane Group Flow (vph)	166	486	0	0	653	109	0	1	0	0	333	42
Turn Type	pm+pt	NA		Perm	NA	Perm	Perm	NA		Perm	NA	Perm
Protected Phases	1	6			2			8				4
Permitted Phases	6			2		2	8			4		4
Actuated Green, G (s)	62.6	62.6			48.2	48.2		27.4			27.4	27.4
Effective Green, g (s)	62.6	62.6			48.2	48.2		27.4			27.4	27.4
Actuated g/C Ratio	0.63	0.63			0.48	0.48		0.27			0.27	0.27
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0			5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)	474	2214			1628	763		434			386	433
v/s Ratio Prot	c0.03	0.14										
v/s Ratio Perm	0.19				c0.19	0.07		0.00			c0.24	0.03
v/c Ratio	0.35	0.22			0.40	0.14		0.00			0.86	0.10
Uniform Delay, d <sub>1</sub>	8.7	8.1			16.6	14.4		26.4			34.5	27.1
Progression Factor	1.00	1.00			0.33	0.20		1.00			1.00	1.00
Incremental Delay, d <sub>2</sub>	0.4	0.2			0.7	0.3		0.0			17.7	0.1
Delay (s)	9.1	8.3			6.2	3.2		26.4			52.2	27.2
Level of Service	A	A			A	A		C			D	C
Approach Delay (s)		8.5			5.4			26.4			44.3	
Approach LOS		A			A			C			D	

Intersection Summary

HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	65.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Queues

Buildout 2020 AM Peak-2011 Improvements

105: Northshore Dr & Thunderhead Rd
























Northshore Town Center GI Kids TIS



Lane Group	EBL	EBT	WBT	WBR	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	410	618	313	104	3	212	213	249
v/c Ratio	0.53	0.25	0.20	0.13	0.03	0.72	0.72	0.52
Control Delay	9.7	6.5	14.5	1.5	35.7	48.6	48.8	8.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.7	6.5	14.5	1.5	35.7	48.6	48.8	8.4
Queue Length 50th (ft)	82	60	35	0	1	116	117	0
Queue Length 95th (ft)	188	123	71	10	10	195	196	61
Internal Link Dist (ft)		320	870		80		759	
Turn Bay Length (ft)	100							200
Base Capacity (vph)	820	2433	1563	811	311	336	336	515
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.25	0.20	0.13	0.01	0.63	0.63	0.48

Intersection Summary

HCM Signalized Intersection Capacity Analysis      Buildout 2020 AM Peak-2011 Improvements  
 105: Northshore Dr & Thunderhead Rd      Northshore Town Center GI Kids TIS

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 				
Traffic Volume (vph)	377	568	1	1	287	96	1	1	1	391	0	229
Future Volume (vph)	377	568	1	1	287	96	1	1	1	391	0	229
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.95			0.95	1.00		1.00		0.95	0.95	1.00
Frt	1.00	1.00			1.00	0.85		0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00			1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (prot)	1770	3538			3539	1583		1750		1681	1681	1583
Flt Permitted	0.49	1.00			0.95	1.00		0.98		0.95	0.95	1.00
Satd. Flow (perm)	917	3538			3376	1583		1750		1681	1681	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	410	617	1	1	312	104	1	1	1	425	0	249
RTOR Reduction (vph)	0	0	0	0	0	60	0	1	0	0	0	205
Lane Group Flow (vph)	410	618	0	0	313	44	0	2	0	212	213	44
Turn Type	pm+pt	NA		Perm	NA	Perm	Split	NA		Split	NA	Perm
Protected Phases	1	6			2		8	8		4	4	
Permitted Phases	6			2		2						4
Actuated Green, G (s)	57.9	57.9			37.7	37.7		1.2		15.9	15.9	15.9
Effective Green, g (s)	57.9	57.9			37.7	37.7		1.2		15.9	15.9	15.9
Actuated g/C Ratio	0.64	0.64			0.42	0.42		0.01		0.18	0.18	0.18
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	733	2276			1414	663		23		296	296	279
v/s Ratio Prot	c0.09	0.17						c0.00		0.13	c0.13	
v/s Ratio Perm	c0.26				0.09	0.03						0.03
v/c Ratio	0.56	0.27			0.22	0.07		0.09		0.72	0.72	0.16
Uniform Delay, d1	7.7	6.9			16.7	15.6		43.9		34.9	34.9	31.4
Progression Factor	1.00	1.00			0.81	0.54		1.00		1.00	1.00	1.00
Incremental Delay, d2	0.9	0.3			0.4	0.2		1.6		8.0	8.1	0.3
Delay (s)	8.6	7.2			13.9	8.7		45.5		42.9	43.1	31.6
Level of Service	A	A			B	A		D		D	D	C
Approach Delay (s)		7.8			12.6			45.5			38.8	
Approach LOS		A			B			D			D	

Intersection Summary		
HCM 2000 Control Delay	18.6	HCM 2000 Level of Service      B
HCM 2000 Volume to Capacity ratio	0.62	
Actuated Cycle Length (s)	90.0	Sum of lost time (s)      20.0
Intersection Capacity Utilization	63.4%	ICU Level of Service      B
Analysis Period (min)	15	

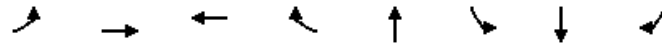
c Critical Lane Group

Queues

Buildout 2020 PM Peak-2011 Improvments

105: Northshore Dr & Thunderhead Rd

Northshore Town Center GI Kids TIS


























Lane Group	EBL	EBT	WBT	WBR	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	166	486	653	226	2	166	167	154
v/c Ratio	0.30	0.19	0.33	0.22	0.01	0.65	0.65	0.41
Control Delay	7.0	5.5	5.6	0.6	0.0	50.9	51.1	9.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.0	5.5	5.6	0.6	0.0	50.9	51.1	9.3
Queue Length 50th (ft)	25	41	37	0	0	105	105	0
Queue Length 95th (ft)	74	97	64	6	0	169	170	51
Internal Link Dist (ft)		320	870		77		759	
Turn Bay Length (ft)	100							200
Base Capacity (vph)	569	2568	1991	1025	365	336	336	439
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.19	0.33	0.22	0.01	0.49	0.50	0.35

Intersection Summary

HCM Signalized Intersection Capacity Analysis  
105: Northshore Dr & Thunderhead Rd

Buildout 2020 PM Peak-2011 Improvements  
Northshore Town Center GI Kids TIS

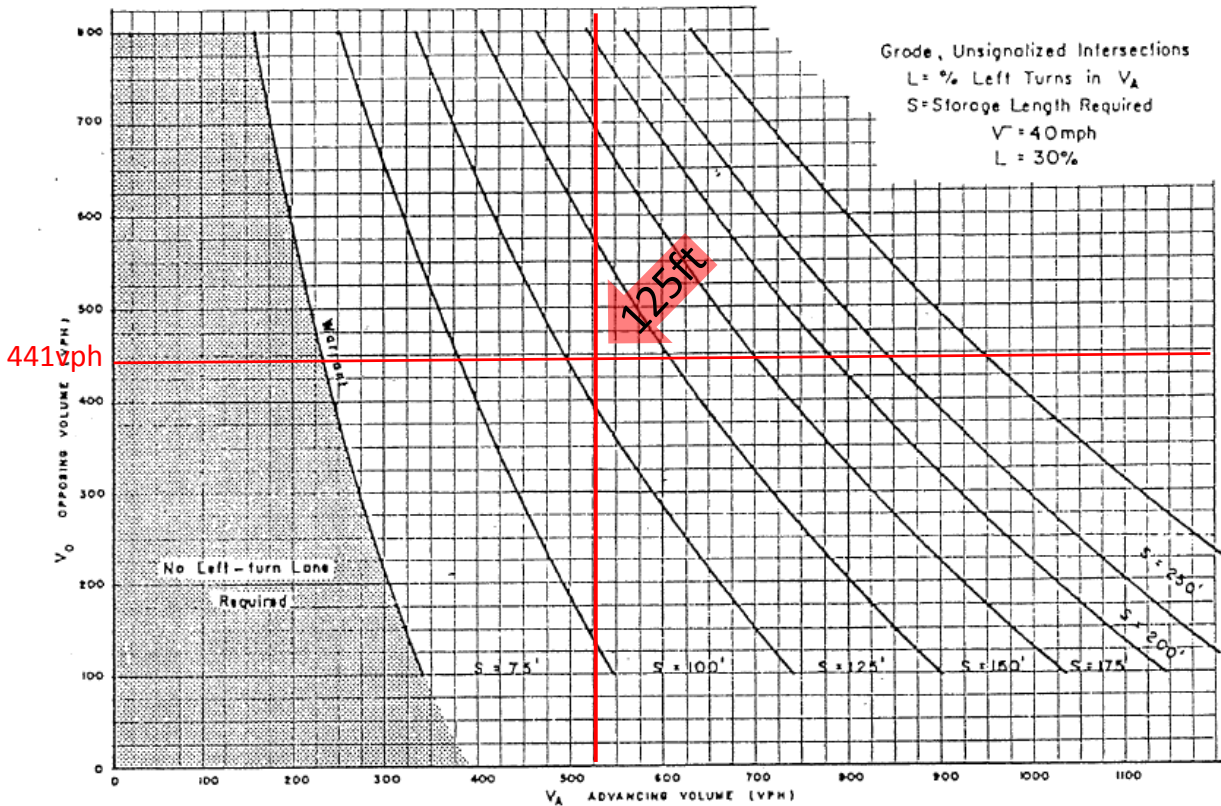
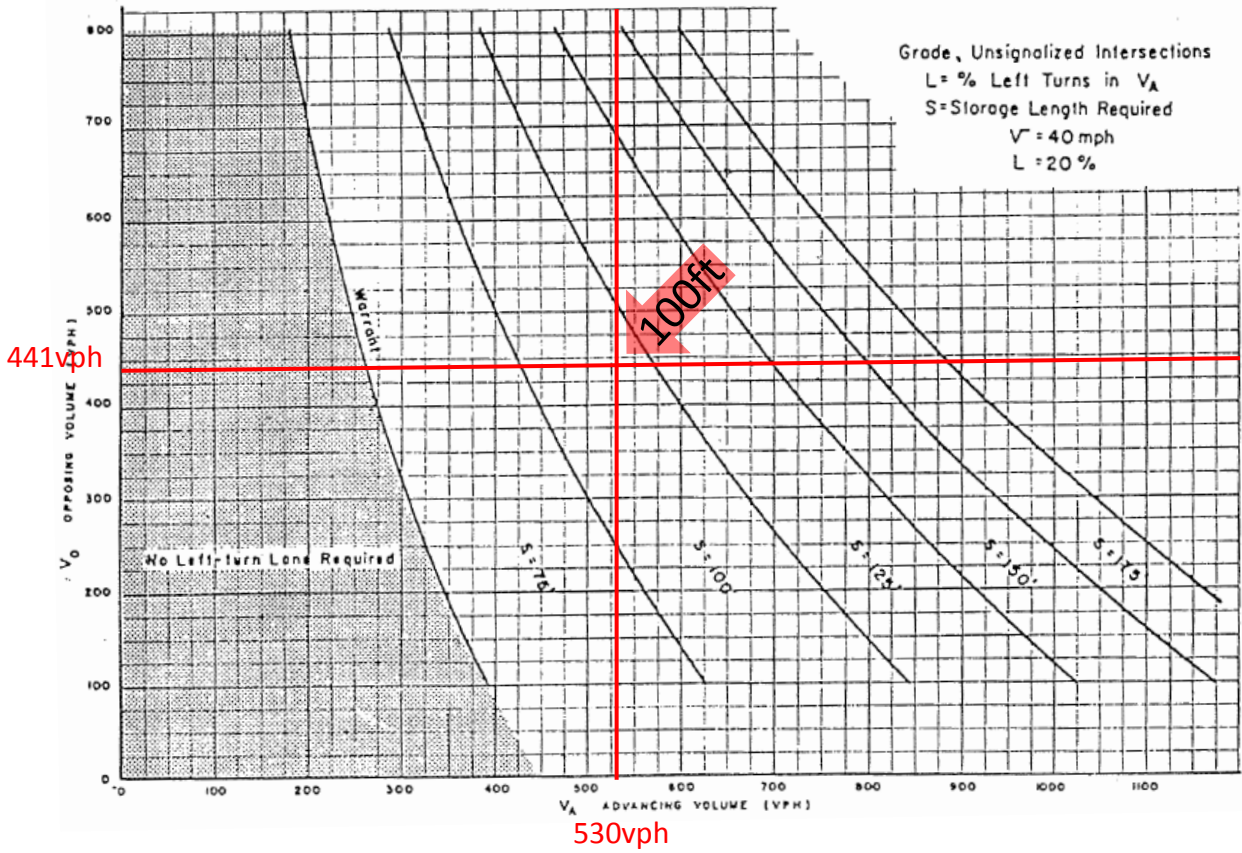
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 				
Traffic Volume (vph)	153	446	1	1	600	208	1	0	1	306	0	142
Future Volume (vph)	153	446	1	1	600	208	1	0	1	306	0	142
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0		5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	0.95			0.95	1.00		1.00		0.95	0.95	1.00
Fr <sub>t</sub>	1.00	1.00			1.00	0.85		0.93		1.00	1.00	0.85
Fl <sub>t</sub> Protected	0.95	1.00			1.00	1.00		0.98		0.95	0.95	1.00
Satd. Flow (prot)	1770	3538			3539	1583		1695		1681	1681	1583
Fl <sub>t</sub> Permitted	0.33	1.00			0.95	1.00		0.98		0.95	0.95	1.00
Satd. Flow (perm)	618	3538			3379	1583		1695		1681	1681	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	166	485	1	1	652	226	1	0	1	333	0	154
RTOR Reduction (vph)	0	0	0	0	0	102	0	2	0	0	0	130
Lane Group Flow (vph)	166	486	0	0	653	124	0	0	0	166	167	24
Turn Type	pm+pt	NA		Perm	NA	Perm	Split	NA		Split	NA	Perm
Protected Phases	1	6			2		8	8		4	4	
Permitted Phases	6			2		2						4
Actuated Green, G (s)	68.6	68.6			54.9	54.9		1.1		15.3	15.3	15.3
Effective Green, g (s)	68.6	68.6			54.9	54.9		1.1		15.3	15.3	15.3
Actuated g/C Ratio	0.69	0.69			0.55	0.55		0.01		0.15	0.15	0.15
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	524	2427			1855	869		18		257	257	242
v/s Ratio Prot	c0.03	0.14						c0.00		0.10	c0.10	
v/s Ratio Perm	0.19				c0.19	0.08						0.01
v/c Ratio	0.32	0.20			0.35	0.14		0.00		0.65	0.65	0.10
Uniform Delay, d <sub>1</sub>	6.2	5.7			12.6	11.0		48.9		39.8	39.8	36.4
Progression Factor	1.00	1.00			0.42	0.07		1.00		1.00	1.00	1.00
Incremental Delay, d <sub>2</sub>	0.4	0.2			0.5	0.3		0.0		5.5	5.6	0.2
Delay (s)	6.5	5.9			5.8	1.1		48.9		45.3	45.4	36.6
Level of Service	A	A			A	A		D		D	D	D
Approach Delay (s)		6.1			4.6			48.9			42.6	
Approach LOS		A			A			D			D	

Intersection Summary

HCM 2000 Control Delay	14.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	56.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

# THUNDERHEAD ROAD & BOARDWALK BOULEVARD SB LEFT-TURN LANE WARRANT ANALYSIS (2018)





**CDM  
Smith**





1100 Marion Street, Suite 300  
Knoxville, TN 37921  
tel: 865-963-4300  
fax: 865-963-4301

April 25, 2018

Ms. Tarren Barrett  
KNOX COUNTY MPC  
400 Main Street  
Knoxville, TN 37902

**RE: NORTSHORE TOWN CENTER GI FOR KIDS, KNOXVILLE, TN.**

Dear Ms. Barrett:

Please find further response to the comments received.

1. One of the main missing pieces of the TIS was a good evaluation of the previous recommendations from the 2011 study to what the new development will trigger and at what point it will trigger the road improvements mentioned in the previous study. We need to know if all access points will operate efficiently in the future condition, or if there will need to be modifications (specifically looking at the intersection of Northshore Drive and Thunderhead Road) with consideration of this development and further development within Zone D.

**RESPONSE:**

Most of the recommendations of the 2011 TIS have been constructed and are addressed in the analyses of this study with the exception of the following improvements:

1. SB double left-turn lanes on Thunderhead Rd at Northshore
2. Longer EB left-turn lane from Northshore Drive to Thunderhead Rd
3. NB right-turn lane on Thunderhead Rd at Boardwalk Blvd

All three of these potential improvements are associated with the impact of the school development. The 2011 TIS identified the SB double left-turn lane as a mitigation of possible adverse queues and school traffic during the morning peak hour. The trigger for this improvement was with the development of the school as previously identified. When considering the SB double left and longer EB left at the Thunderhead and Northshore intersection, the LOS and the intersection capacity, are acceptable but queues will occur during the peak hours.

**MPC RESPONSE:**

There needs to be a full evaluation on all previous recommendations, like the Aventine Northshore Apartments TIS (attached) completed by Cannon & Cannon. From here forward, we will negate what was not completed due to the school. If further development, including the GI for Kids Medical Office, warrants recommended traffic improvements, then it will be up to the developer to complete those improvements. The only items we need to know at this time are what recommended improvements this development will bring and what is still left to be completed. All analysis details should be included in the TIS revision for all peak hours, to include the queue analysis for the intersection of Thunderhead Road and Northshore Drive.



Ms. Tarren Barrett  
April 25, 2018  
Page 2

RESPONSE:

Further analyses and discussion was added to the report. Left-turn peak-hour queues for the intersection of Northshore Drive and Thunderhead Road were included in and found manageable during the peak hours with the current geometry. A LOS C is provided with the current intersection geometry. Pages 16-18 and 20.

2. The evaluation of the Elementary School, Aventine Apartments, and small Retail/Office on the west side of Thunderhead Road was not included within this study. We understand that the previous 2011 study did not include this area, but since that time there has been significant traffic added to the access roads of Northshore Towncenter from these land uses. We do see that the traffic from the school, apartments, and retail/office area are included in the existing and background traffic conditions, but the apartments may or may not be fully occupied which may need further evaluation. This area needs to be included in the traffic zones and distributions laid out in the appendix and in other locations deemed necessary to show the overall evaluation of the entire site.
  - a. With recent changes made to the housing area in the rear of the towncenter, please include an evaluation on the unoccupied housing units.

RESPONSE:

In review of the Aventine Apartment TIS, the projected 2016 traffic without NTC was very well represented by the current 2018 TMC; therefore, its traffic appears represented in the existing traffic. (See attached figures from the Aventine TIS). The buildout projections for both this study and the Aventine TIS are very comparable.

In reviewing historic aerial mapping from the 2011 TIS and the current aerial mapping, it appears that much of the SFU has developed; however, this TIS update did not assume the residential to be developed, and the trip generation for Zone E was fully applied for the projected traffic condition. Table 1 of the study identifies this trip generation and is included in the projected traffic. A review of Figure 5 shows the trips entering and exiting Zone E for the Northshore Town Center buildout condition. Note, this TIS update did not apply a discount in traffic for the currently occupied residential development. As such, this study takes a very conservative approach to the traffic condition by including the current residential development in the existing traffic, as well as the full traffic anticipated in the buildout condition.

MPC RESPONSE:

In a previous meeting, it was stated that CDM Smith had tried to reach out to the apartment complex. Please state what the outcome of that meeting or interaction was in reference to the stated question in part (a).

RESPONSE:

CDM Smith learned that Aventine Apartments was fully occupied in March and there is currently a waiting list. Therefore, the apartment use should be adequately represented in the traffic data collected.





Ms. Tarren Barrett  
April 25, 2018  
Page 3

3. On page 1, first paragraph please complete the sentence concerning Pellissippi Parkway. The sentence was not finished.
  - a. In this paragraph and throughout the document, please fix the name “Chik-fil-A” to “Chick-fil-A”.

RESPONSE:

Revised

MPC RESPONSE:

The sentence in the first paragraph was not corrected.

RESPONSE:

Revised

4. If traffic counts from the Chick-fil-A TIS (2018) were used then please add these to the Appendix. Also, the traffic counts from Town Center Blvd. on page 5 & 6 could not be found in the Appendix, which may be the missing Chick-fil-A traffic counts but the review team was unsure.

RESPONSE:

Chick fil-A counts were added to the Appendix.

MPC RESPONSE:

Corrected

5. Please provide supporting data for the 2% background growth factor on page 7.

RESPONSE:

TDOT count station was added to the Appendix. The growth rate employed was consistent with rates utilized for the Aventine, Chick-fil-A, and the 2011 TISs. A discussion was added to page 7 of the report for clarification.

MPC RESPONSE:

Corrected

6. How does Table 1 (pg 8) compare to what was previously proposed? Was there a reduction or an increase? Please show and explain.

RESPONSE:

Table 1 reflects an updated trip generation based on the 9<sup>th</sup> edition of ITE **Trip Generation** with changes in land use and densities as identified in the table in RED. There were not any significant changes in the update other than land use changes with the Chick -fil-A and the medical office. These changes are documented in the respective reports.

MPC RESPONSE:

The reviewers would like to see the original Trip Generation table from the 2011 study for a comparison of trips.

RESPONSE:

The 2011 trip generation was added to the Appendix for comparison. Appendix



Are the zones the same as the original, as discussed on page 9? This was not thoroughly discussed in the report. It was mentioned in the first paragraph that there were some “refinements” completed to the distribution. What are those refinements? Explain.

**RESPONSE:**

The zones in this updated TIS are identical to the original 2011 report. Refinements were limited to the Chick-fil-A and the medical office as their specific distribution may vary some from their respective zone due to the more immediate access. Further clarification was added to page 9 of the report. For the Chick-fil-A (in a near fully developed zone), the Zone B distribution would no longer be fully applicable for the driveways as the southern access will be its primary ingress. The overall distribution remained consistent with the 2011 study.

**MPC RESPONSE:**

Please explain further what “refinements” were completed. It is still not clear what these are.

**RESPONSE:**

The refinement is that the trip distribution for Chick fil-A and the GI for Kids accounted for the more direct accesses.

- a. On the same page there needs to be further explanation on the difference between Figures 5 & 6, and how totals were achieved in Figures 7 & 8. There needs to be more detail provided, perhaps with a spreadsheet.

**RESPONSE:**

Figure 5 reflects the Northshore Town Center trip assignment for site buildout as stated in the report, and Figure 6 is the projected Background Traffic. A note was added to Figure 5 to further clarify its representation.

**MPC RESPONSE:**

Corrected

- b. Figure 7 shows the entering trip distribution total to 105%: 40% from East Northshore Dr., 25% from West Northshore Dr., 25% from Pellissippi Pkwy ramp, and 15% internal trip capture. Please revise to show 100%. In Figure 8, where is the 5% entering trip assignment for the GI for Kids Medical Office mid-block access?

**RESPONSE:**

This is incorrect. Table 1 identifies a 10% internal trip capture and is represented in the Distribution and Assignment with 5% on Thunderhead Rd from the north and 5% to and from Zone B, Publix. These are very few trips as the trip generation for the GI for Kids is nominal.

**MPC RESPONSE:**

Figure 7 still shows 5% entering from Zone C at the intersection mid-way down Boardwalk Blvd. Please correct Figure 7 and any corresponding figures.

**RESPONSE:**

Revised



7. On page 16, the study mentions a right turn lane from Thunderhead Road to Boardwalk Boulevard. When is this triggered? Please evaluate.

RESPONSE:

As stated, the medical office does not trigger the need for a NB right-turn from Thunderhead to Boardwalk, but when Zones C and D fully develop (Buildout of Northshore Town Center), the lane should be provided. This need is more predicated on the school traffic impact. The school traffic will impede the right-turn movement during the school peak hours, and as the right turn movement increases with the Northshore Town Center buildout, the need for a right-turn lane will increase.

MPC RESPONSE:

Corrected

8. In the Recommendations and Conclusions, there needs to be more explanation on the right turn lane evaluation mentioned in point #8 (is there ROW to add this, when is it triggered, etc.) and detail discussion about the needed signage and pavement markings at the Target & new Office access intersection. This intersection by the TDOT off-ramp is not signed and does not have proper pavement markings showing lane-drops, where the flow of traffic is located, etc. Please evaluate according to MUTCD recommendations.

RESPONSE:

A recommendation for the signs and markings of the existing lane drop into the Target parking was added to the report and its identified in the discussion of the existing conditions.

MPC RESPONSE:

As stated in the MPC Conditions (#6) at the April 12, 2018 meeting, the installation of this was required as part of the Development Plan approval and will have to be approved by the City of Knoxville Department of Engineering.

RESPONSE:

Understood

9. In the Appendix, please revise ALL intersections to include all direction of travel and proper lane usage for the analysis. For example, the Synchro analysis for Northshore Drive and Thunderhead Road shows two EBT movements when there is only one, two WBT movements when there is only one, does not account for the EBR lane-drop, etc. Please show the existing movements as they exist.

- a. Also, please contact the City of Knoxville Traffic Office for the current traffic signal plans for the intersections within the study, not the optimized setting. There is room to use this as a recommendation if it is seen that the optimized setting is better for the system as a whole, but these signal plans will need to be provided.

RESPONSE:

Appendix revised as requested. Current signal timing has been included as requested.

Ms. Tarren Barrett  
April 25, 2018  
Page 6

**MPC RESPONSE:**  
Corrected

Please feel free to contact me if additional information or clarification is needed.

Sincerely,  
**CDM SMITH INC.**



John F. Gould, P.E.  
Senior Transportation Engineer

