TRAFFIC IMPACT STUDY

TAPESTRY TURKEY CREEK RESIDENTIAL DEVELOPMENT

11616 SNYDER ROAD
OUTLET DRIVE/SNYDER ROAD
KNOX COUNTY, TN

CCI PROJECT NO 01271-0000

REV 1.

PREPARED FOR
Arlington Properties, Inc.
2117 2nd Avenue North
Birmingham, AL 35203

SUBMITTED BY
CANNON & CANNON INC
CONSULTING ENGINEERS
FIELD SURVEYORS

SEPTEMBER 28
2016

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REVISION 1 (9/28/16)

This report replaces the original traffic impact Study report dated 8/31/16, prepared for this Project in its entirety. The associated changes Are related to MPC comments received on 9/19/16 which are located in APPENDIX D.

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EXECUTIVE SUMMARY

This report provides a summary of a traffic impact study that was performed for a proposed multi-family residential development to be located along Outlet Drive at the intersection with Snyder Road in West Knox County. The project site is located on the north side of Outlet Drive and the east side of Snyder Road. The conceptual development plan for this project, Tapestry Turkey Creek, proposes a maximum of 220 residential apartment units. The project is to have a single access driveway onto Outlet Drive, located approximately 250 feet east of Snyder Road. A secondary gated access driveway is located on Snyder Road and is provided for emergency access only.

The purpose of this study was the evaluation of the traffic operational and safety impacts of the proposed residential development upon roadways in the vicinity of the site. Of particular interest were the intersections of Outlet Drive and Snyder Road and Outlet Drive at the proposed site driveway. Appropriate intersection evaluations were conducted at these locations for existing and future conditions, both with and without traffic volumes generated from the proposed residential development, in order to determine the anticipated impacts and to establish recommended measures to mitigate these impacts. These evaluations included intersection capacity analyses, corner sight distance reviews and others as appropriate.

The primary conclusion of this study is that the traffic generated from the proposed multi-family residential development will not have a significant impact on the study intersections. Intersection sight distance at the proposed site driveway location on Outlet Drive is more than adequate for the posted speed limit. Under existing and projected conditions, the intersections of Outlet Drive and Snyder Road, as well as at the proposed site driveway are anticipated to operate at acceptable levels-of-service during both the A.M. and P.M. peak hours. The following listing is a summary of the improvements and recommendations that resulted from this study:

1. Locate the proposed site driveway on Outlet Drive as allowed by the rezoning condition. Maximize the distance between the Snyder Road intersection and the proposed site driveway to the extent possible. Install a STOP sign on the site entrance roadway approach to Outlet Drive.
2. Maintain intersection corner sight distance at the proposed site entrance roadway on Outlet Drive, as well as at the gated secondary entrance on Snyder Road, by ensuring any site landscaping or site signage is properly placed such that sight distance is not restricted.

INTRODUCTION & PURPOSE OF STUDY

This report provides a summary of a traffic impact study that was performed for a proposed multi-family residential development to be located along Outlet Drive at the intersection with Snyder Road in West Knox County. The project site is located on the north side of Outlet Drive and the east side of Snyder Road. FIGURE 1 is a location map identifying the major roadways in the vicinity of the site.

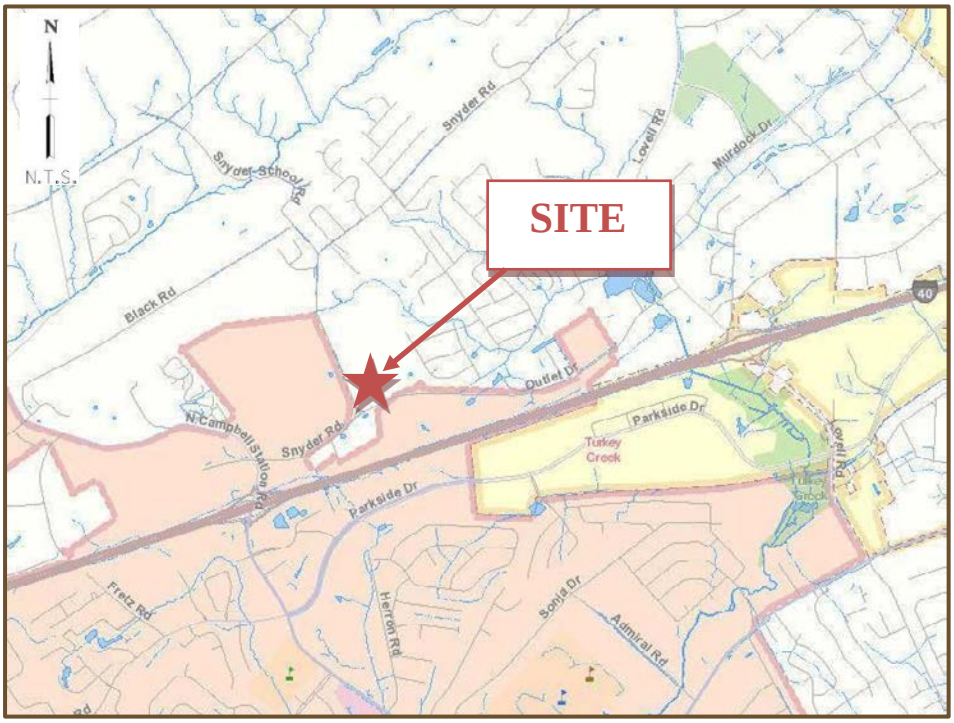


FIGURE 1
LOCATION MAP

The conceptual development plan for this project, Tapestry Turkey Creek, proposes a maximum of 220 residential apartment units. The project is to have a single access driveway onto Outlet Drive, located approximately 250 feet east of Snyder Road. At the request of staff, a secondary gated access driveway was added from the proposed development onto Snyder Road. This gated driveway is provided for emergency access only. FIGURE 2 is a Conceptual Site Plan which illustrates the proposed site configuration.

The purpose of this study was the evaluation of the traffic operational and safety impacts of the proposed residential development upon roadways in the vicinity of the site. Of particular interest were the intersections of Outlet Drive and Snyder Road and Outlet Drive at the proposed site driveway. Appropriate intersection evaluations were conducted at these locations for existing and future conditions, both with and without traffic volumes generated from the proposed residential development, in order to determine the anticipated impacts and to establish recommended measures to mitigate these impacts. These evaluations included intersection capacity analyses, corner sight distance reviews and others as appropriate.

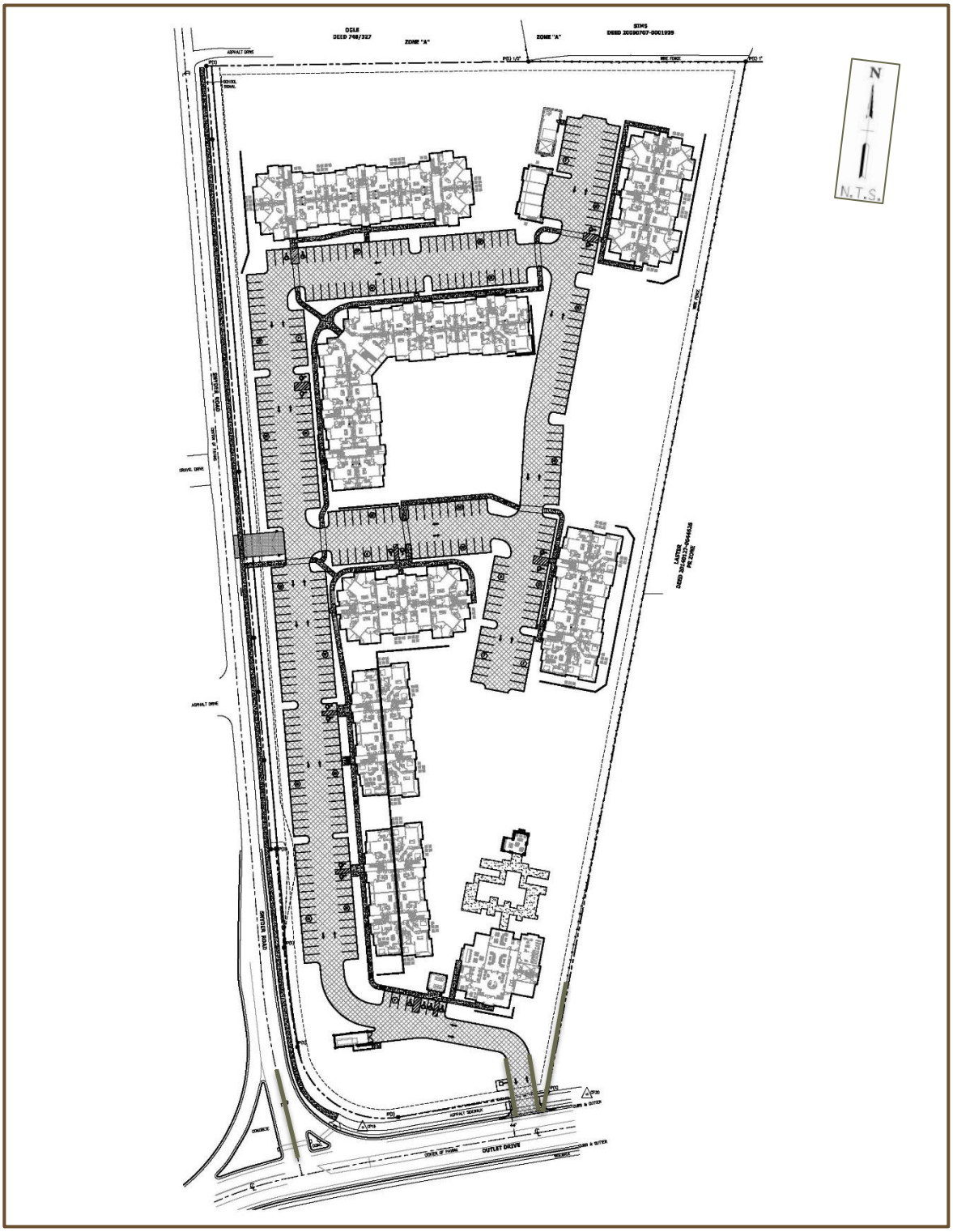


FIGURE 2
CONCEPTUAL SITE PLAN

EXISTING CONDITIONS

EXISTING ROADWAY CONDITIONS

Outlet Drive / Snyder Road is a Major Collector roadway that provides east-west access between N. Campbell Station Road to the west and Lovell Road to the east. To the west of the site the roadway is named Snyder Road and to the east of the site the name is Outlet Drive. In the vicinity of the proposed development, the roadway consists of one through travel lane in each direction, with a center two-way left-turn lane. Sidewalks and bike lanes are also located along both sides of the roadway. The speed limit on Outlet Drive is posted as 35 mph. The 2014 ADT on Outlet Drive was 6,220.

Snyder Road is a two-lane Minor Collector roadway that has one through travel lane in each direction. Snyder Road stretches from Outlet Drive north to Lovell Road. The intersection of Snyder Road with Outlet Drive is controlled by a STOP sign on the Snyder Road approach to Outlet Drive. There is a dedicated right-turn lane on Snyder Road with YIELD control onto Outlet Drive. The speed limit on Snyder Road is posted as 30 mph in the non-school zone section. The 2014 ADT on Snyder Road near east of Campbell Station Road was 6,150.

EXISTING SITE CONDITIONS

The existing site consists of approximately 13 acres located east of Snyder Road and north of Outlet Drive. The site is bordered to the north and east by undeveloped land and residential uses, to the south by Outlet Drive, and to the west by Snyder Road.

FIGURE 3
EXISTING SITE CONDITIONS

EXISTING TRAFFIC DATA

Existing traffic data was gathered for this study. The Metropolitan Planning Commission (MPC) collects average daily traffic data (ADT) annually on roadways in the study area. Two count stations were found near the project site that were felt to have particular relevance for this study. The most currently available data from these count stations are contained in TABLE 1.

TABLE 1
ANNUAL AVERAGE DAILY TRAFFIC COUNT SUMMARY

COUNT YEAR	MPC COUNT STATION M97 OUTLET DRIVE WEST OF LOVELL ROAD	MPC COUNT STATION M67 SNYDER ROAD EAST OF CAMPBELL ST. RD.
2014	6,220	6,150
2013	5,180	5,770*
2012	-	3,770*
2011	-	3,870
2010	-	3,760

* During this time period Outlet Drive was extended to connect to Snyder Road and Campbell Station Road.

In addition to the available ADT data, an intersection turning movement traffic count was conducted at the intersection of Outlet Drive and Snyder Road and was utilized to determine the current AM and PM peak hour operating volumes. The existing traffic count is summarized on FIGURE 4, and the raw data traffic count summary sheets are contained in the APPENDIX.

EXISTING CAPACITY ANALYSES / LEVELS-OF-SERVICE

Capacity analyses employing the methods of the Highway Capacity Manual (HCM2010) were conducted for the intersection of Outlet Drive and Snyder Road. The unsignalized capacity analyses were performed utilizing the 2016 existing traffic volumes, existing intersection traffic control, and lane configurations. Existing analyses indicate that the intersection is operating at an acceptable level-of-service (LOS) "B" during both the A.M. and P.M. peak traffic periods. The EVALUATIONS section of this report may be referenced for tabular summaries of these analyses, while more detailed summaries are presented on the computer printouts contained in the APPENDIX. Also contained in the APPENDIX is a section entitled "Capacity and Level of Service Concepts", which provides a description of the utilized procedures.

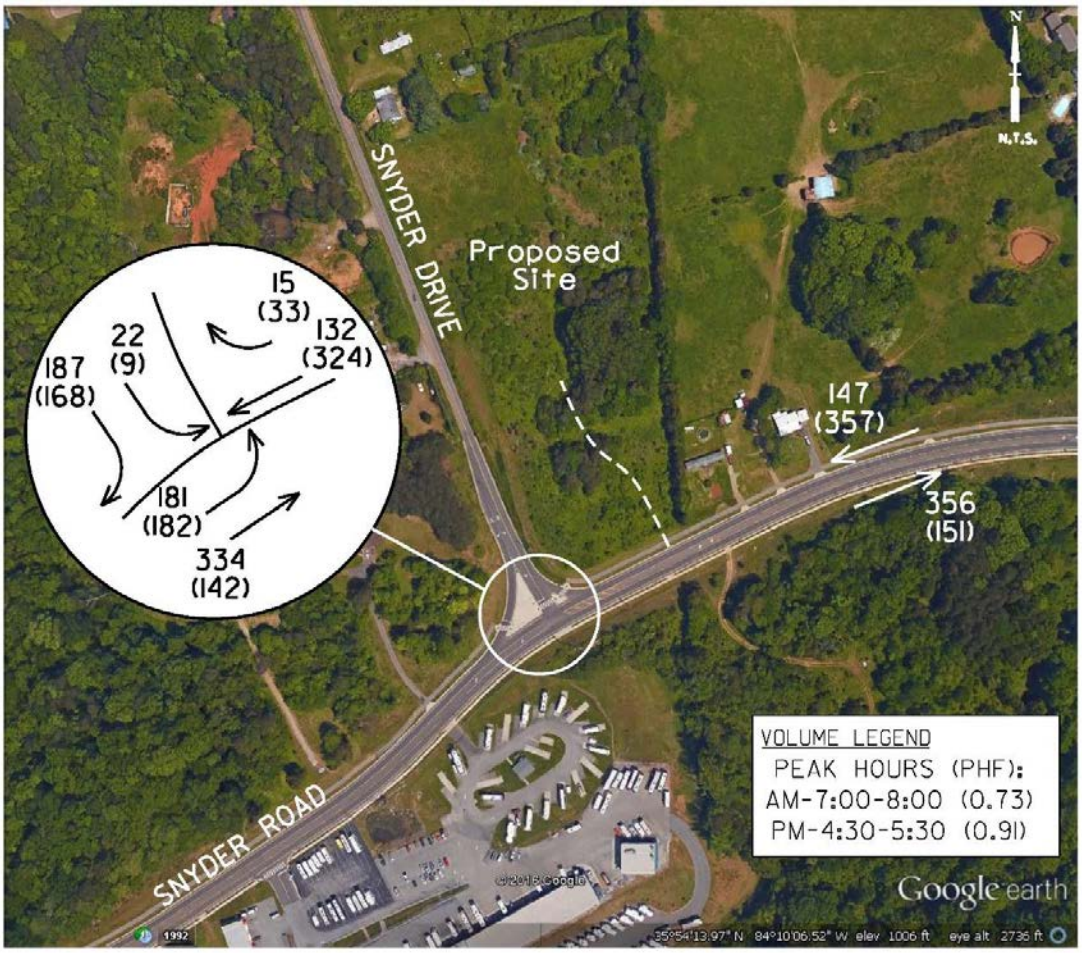


FIGURE 4
2016 EXISTING TRAFFIC VOLUMES

4.0 BACKGROUND CONDITIONS

BACKGROUND TRAFFIC GROWTH

The proposed multi-family residential development is anticipated to be constructed in one general phase with anticipated completion in approximately three years. Therefore, year 2019 was established as the appropriate analysis year for this study. In order to determine traffic volumes resulting solely from background traffic growth to year 2019, it was necessary to establish an annual growth rate for existing traffic. The MPC ADT values previously discussed, as well as knowledge of the area, were used to determine an approximate annual growth rate. Based on the available data, a background annual growth rate of 2.5% was assumed. FIGURE 5 contains the background traffic volumes that would result from a 2.5% annual growth rate from year 2016, when the count was conducted, to year 2019. The background traffic volumes shown on FIGURE 5 represent Year 2019 background growth conditions without traffic related to the proposed multi-family residential development.

BACKGROUND CAPACITY ANALYSES / LEVELS-OF-SERVICE

Capacity analyses as described in the Existing Conditions section of this report were conducted utilizing the Year 2019 background volumes shown in FIGURES 5, and existing intersection traffic control and lane configurations. Background capacity analyses indicate that the intersection of Outlet Drive and Snyder Road is anticipated to continue to operate at an acceptable LOS "B" under Year 2019 background conditions. The EVALUATIONS section of this report may be referenced for tabular summaries of these analyses, while more detailed summaries are presented on the computer printouts contained in the APPENDIX.

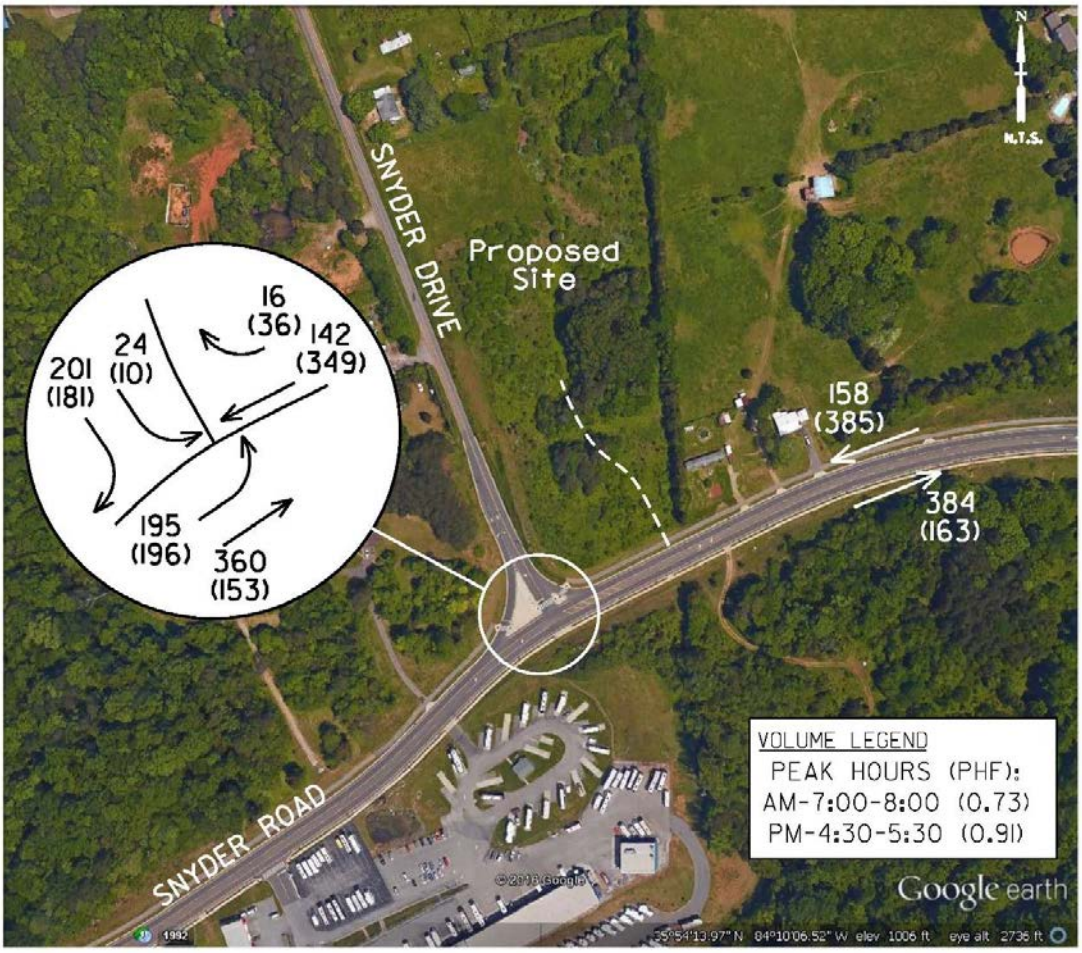


FIGURE 5
2019 BACKGROUND TRAFFIC VOLUMES

5.0 FUTURE CONDITIONS

TRIP GENERATION

In order to estimate the expected traffic volumes to be generated by the proposed development, the procedures recommended by the Institute of Transportation Engineers and Knox County were utilized. Local trip generation rates developed by the Knoxville-Knox County Metropolitan Planning Commission for multi-family apartment type developments in Knox County were utilized to generate the estimated trips for the proposed apartments. The generated traffic volumes were determined based on the data for the peak hours of adjacent street traffic. See TABLE 2 for a summary of the traffic generated for this project. More detailed information is contained in the APPENDIX.

TABLE 2
TRIP GENERATION SUMMARY

LAND USE	ITE CODE	SIZE	WEEKDAY (TRIPS/DAY)	AM PEAK HOUR (TRIPS/HR)	PM PEAK HOUR (TRIPS/HR)
Apartments	*	220 Units	1,938	110	157
Entering Trips			969	24	86
Exiting Trips			969	86	71

* Trip Generation using Knox County Local Apartment Trip Generation Study (7/17/2000).

TRIP DISTRIBUTION AND ASSIGNMENT

FIGURE 6 provides a summary of the trip distribution patterns assumed for this study. These patterns were based on the existing traffic patterns derived from the traffic counts, as well as knowledge of the area. A distribution pattern of 65% / 35% was assumed for this study with 65% destined to/from the west and 35% to/from the east. The distribution patterns of existing traffic at the intersection of Outlet Drive at Snyder Road was more on the order of a 90% / 10% with 90% destined to/from the west. It was felt that origins / destinations located along the northern portion of Snyder Road most likely utilize the Snyder Road at Lovell Road intersection in order to travel to the east of the area, thus not traversing the study intersection. This appears to result in a higher percentage of westerly destined traffic in the southbound Snyder Road traffic approaching the intersection with Outlet Drive.

FIGURE 7 provides a summary of the anticipated trips as assigned to the study intersections utilizing the trip generation data from TABLE 2 and the distribution patterns shown on FIGURE 6.

Future projected traffic volumes were developed by adding the generated trips shown in FIGURE 7 to the 2019 background traffic volumes developed in the previous section (Figure 5). These combined year 2019 volumes reflect the existing traffic, the background traffic growth, and the newly generated traffic from the proposed multi-family residential development. FIGURE 8 represents the 2019 combined traffic data with trips generated from the proposed multi-family residential development.

The volumes shown in FIGURE 8 are the combined volumes used in the analysis of the future conditions.

FUTURE CAPACITY ANALYSES / LEVELS-OF-SERVICE

Capacity analyses as described in the Existing Conditions section of this report were conducted for 2019 full build-out conditions utilizing the Year 2019 combined volumes shown in FIGURE 8, and existing intersection traffic control for the intersection of Outlet Drive at Snyder Road and side street STOP control at the proposed site driveway intersection onto Outlet Drive.

Unsignalized capacity analyses indicate that the intersection of Outlet Drive and Snyder Road is anticipated to continue to operate at an acceptable LOS "B" during the P.M. peak and a LOS "C" during the A.M. peak.

Capacity analyses were also conducted for the proposed site driveway location on Outlet Drive. The unsignalized capacity analyses included one southbound approach lane (shared right / left lane) for the site driveway with STOP control on the site driveway approach to the intersection. The unsignalized capacity analyses indicate a side street LOS "B" for the site driveway approach for both peak traffic periods under 2019 combined volume conditions. The EVALUATIONS section of this report may be referenced for tabular summaries of these analyses, while more detailed summaries are presented on the computer printouts contained in the APPENDIX.

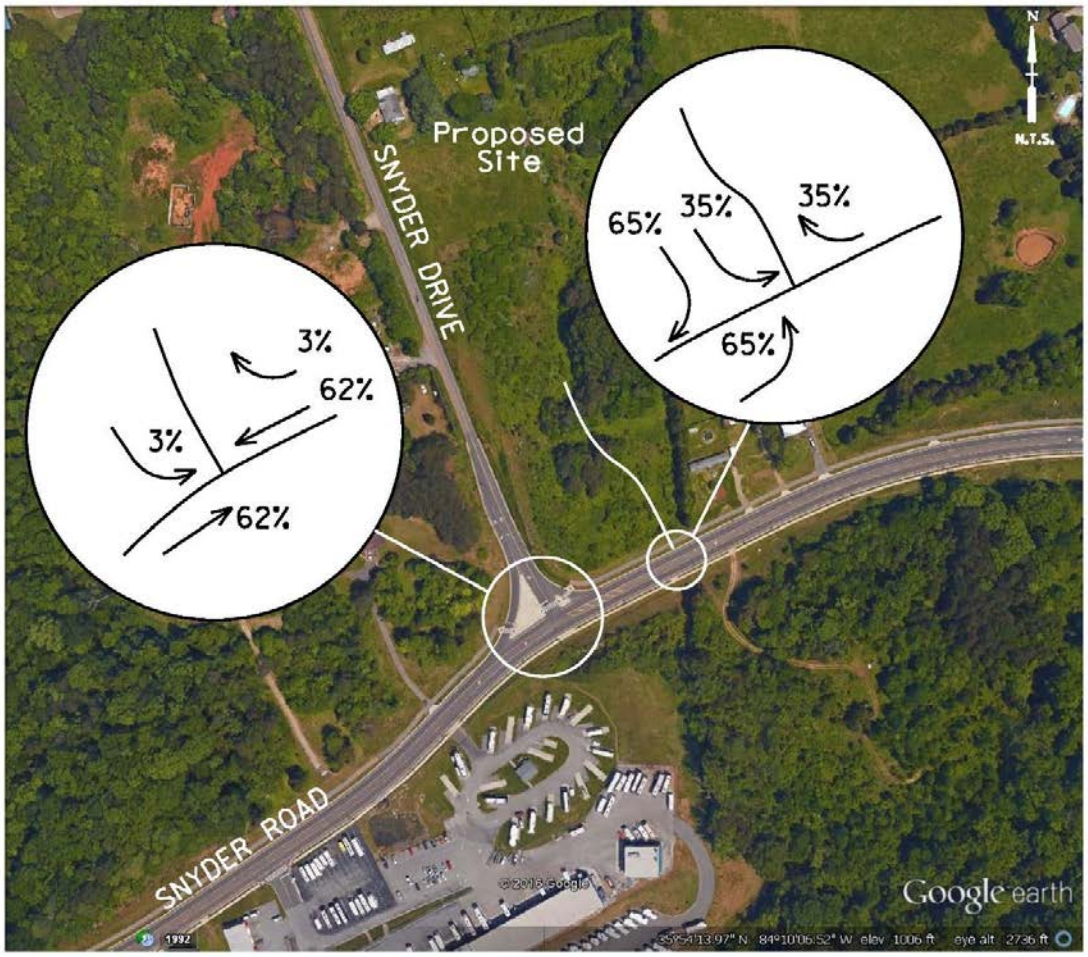


FIGURE 6
TRIP DISTRIBUTION PATTERNS

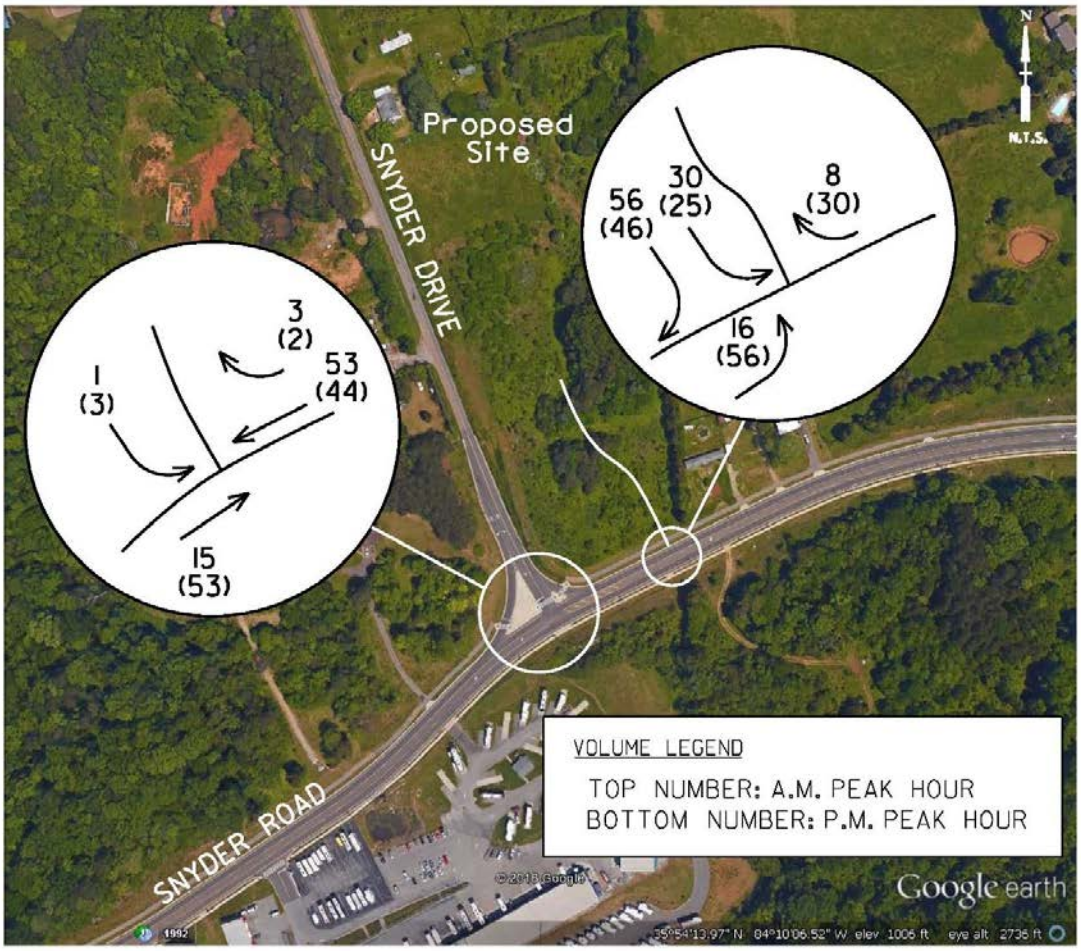


FIGURE 7
GENERATED TRIPS

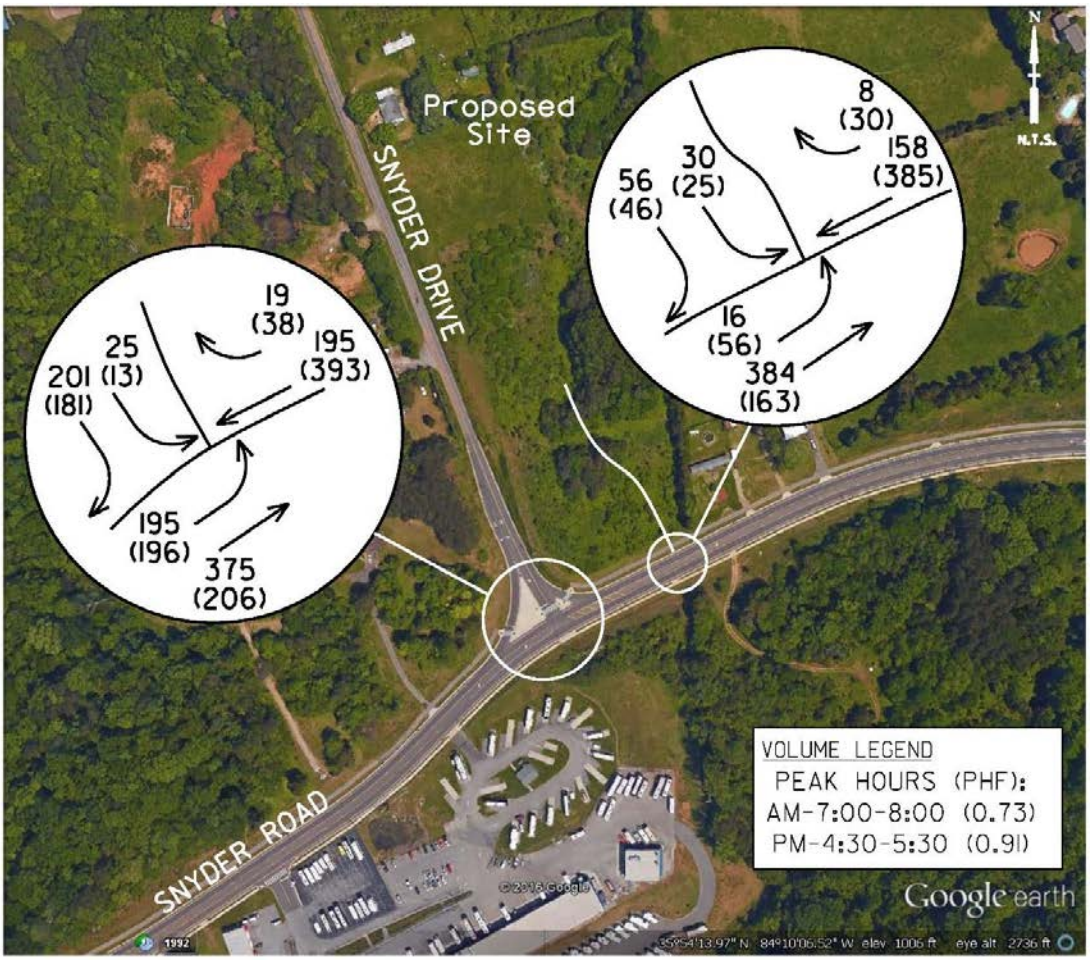


FIGURE 8
2019 COMBINED TRAFFIC DATA

6.0 EVALUATIONS

INTERSECTION CAPACITY ANALYSES:

As discussed in the preceding sections of this report, capacity analyses employing the methods of the Highway Capacity Manual (HCM) were conducted for the study intersections. These analyses were performed for existing, background, and anticipated 2019 combined traffic conditions. Existing geometry and traffic control were used in the analyses of the intersection of Outlet Drive and Snyder Road for existing, background, and combined conditions. A summary of the capacity analysis results for the Year 2016 Existing Conditions, Year 2019 Background Conditions, and Year 2019 Combined Conditions is shown in TABLE 3.

TABLE 3
CAPACITY ANALYSIS SUMMARY

INTERSECTION	TIME PERIOD	YEAR 2016 EXISTING (LOS/DELAY)	YEAR 2019 BACKGROUND (LOS/DELAY)	YEAR 2019 PROJECTED (LOS/DELAY)
Outlet Drive at Snyder Road	A.M.	B 12.8	B 13.7	C 15.6
(SIDE-STREET STOP)[1] SB Approach	P.M.	B 12.7	B 13.4	B 14.7
Outlet Drive at Snyder Road	A.M.	D 28.6	D 33.6	E 40.7
(SIDE-STREET STOP)[2] SB Left Turn	P.M.	C 20.1	C 22.2	D 26.1
Outlet Drive at Site Driveway	A.M.	-	-	B 13.2
(SIDE-STREET STOP)[1]	P.M.	-	-	B 13.5

[1]SIDE STREET STOP CONTROL – Level-of-Service and Average Vehicular Delay (seconds) for side street (southbound) approach utilizing HCM methodology.
[2]SIDE STREET STOP CONTROL – Level-of-Service and Average Vehicular Delay (seconds) for side street (southbound) left-turn movement utilizing HCM methodology.
See APPENDIX for detailed computer print-out summaries and discussion of Capacity and Level-of-Service concepts.

As shown in TABLE 3, the proposed site driveway onto Outlet Drive is anticipated to operate at a good LOS of "B". This intersection is assumed to have one entering and one exiting travel lane. The intersection of Outlet Drive and Snyder Road was also found to operate at acceptable levels-of-service under existing, background, and combined conditions with existing traffic control and geometry, although some increase in delay will result.

TURN LANE ASSESSMENT

A center two-way left-turn lane currently exists on Outlet Drive at the proposed site driveway location. Therefore, only right-turn lane warrants were evaluated for the proposed site driveway under anticipated development conditions. These analyses employed Table 4B from the Knox County Access Control and Driveway Design Policy, which is based on turn lane warrants developed by Harmelink. The results were that a westbound right-turn lane is not warranted at the proposed site driveway location. The turn lane warrant worksheet is located in the APPENDIX.

SITE DRIVEWAY LOCATION

The proposed site driveway is to be located on Outlet Drive at the eastern side of the site. A condition of the rezoning of this property is that only one access shall be granted for this site and the location shall be on Outlet Drive. No access to Snyder Road will be allowed. Based on the length of frontage on Outlet Drive, the distance between the centerline of Snyder Road and the centerline of the proposed site driveway will be approximately 250 feet. This assumes a 25' curb radius and a two lane driveway cross-section. The proposed driveway location meets the Knox County Engineering and Public Works Access Control and Driveway Design Policy.

The existing pavement markings on Outlet Drive in front of the proposed development consist of a center two-way left-turn lane. There is a section of hatching located in the center turn lane beginning at Snyder Road and extending approximately 100 feet to the east. The hatching ends approximately 100 feet west of the proposed site driveway.

HCS 95% vehicle queues were found to be less than one vehicle with the exception of the southbound Snyder Road right-turn lane which was found to be less than two vehicles. An approximation of 95% queues are shown in FIGURE 9 along with existing pavement markings along Outlet Drive and Snyder Road. Existing turn-lane storage lengths are appropriate for proposed conditions.

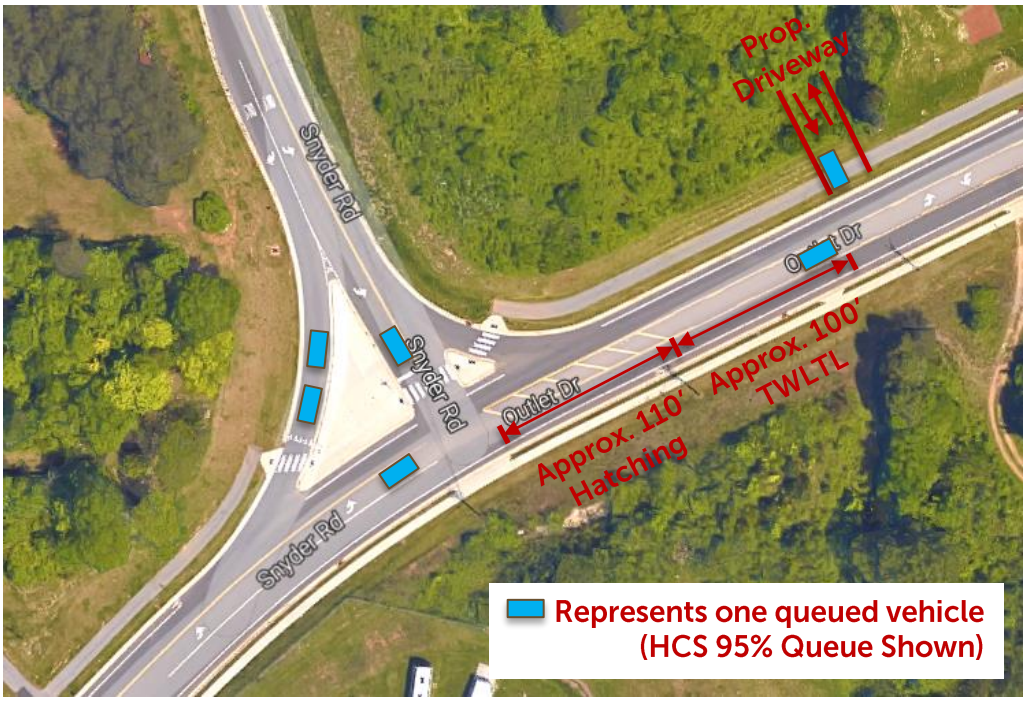


FIGURE 9
INTERSECTION QUEUES

SIGHT DISTANCE ASSESSMENT

Intersection sight distance was assessed looking both directions along Outlet Drive from the proposed site driveway intersection. The speed limit along Outlet Drive is 35 mph, so the minimum required sight distance to oncoming traffic is 350 feet. The sight distance field assessment found a sight distance in excess of 800 feet looking to the left (east) and approximately 400 feet looking to the right (west). Photographs of existing sight distance are shown in FIGURE 10. Care should be taken during the site development to ensure that site landscaping and signage does not restrict intersection sight distance views.

Sight distance looking east along Outlet Drive is in excess of 800 feet.

Sight distance looking west along Outlet Drive is approximately 400 feet.

FIGURE 10
SIGHT DISTANCE ASSESSMENT

As mentioned earlier, a gated "emergency access only" driveway is planned on Snyder Road. This driveway will be located approximately 700 feet north of the intersection of Snyder Road and Outlet Drive. A cursory review of intersection sight distances was conducted for this location. The speed limit along Snyder Road is 30 mph, so the minimum required sight distance to oncoming traffic is 300 feet. Based on field observations, it appears that a minimum of 300 feet sight distance can be achieved at this location looking both north and south along Snyder Road.

7.0 CONCLUSIONS & RECOMMENDATIONS

The primary conclusion of this study is that the traffic generated from the proposed multi-family residential development will not have a significant impact on the study intersections. Intersection sight distance at the proposed site driveway location on Outlet Drive is more than adequate for the posted speed limit. Under existing and projected conditions, the intersections of Outlet Drive and Snyder Road, as well as at the proposed site driveway are anticipated to operate at acceptable levels-of-service during both the A.M. and P.M. peak hours. The following listing is a summary of the improvements and recommendations that resulted from this study:

1. Locate the proposed site driveway on Outlet Drive as allowed by the rezoning condition. Maximize the distance between the Snyder Road intersection and the proposed site driveway to the extent possible. Install a STOP sign on the site entrance roadway approach to Outlet Drive.
2. Maintain intersection corner sight distance at the proposed site entrance roadway on Outlet Drive, as well as at the gated secondary entrance on Snyder Road, by ensuring any site landscaping or site signage is properly placed such that sight distance is not restricted.

8.0 APPENDIX

APPENDIX A | TRAFFIC DATA

APPENDIX B | TRIP GENERATION

APPENDIX C | ANALYSES

APPENDIX D | MPO COMMENTS

APPENDIX A | TRAFFIC DATA

Type of peak hour being reported: Intersection Peak

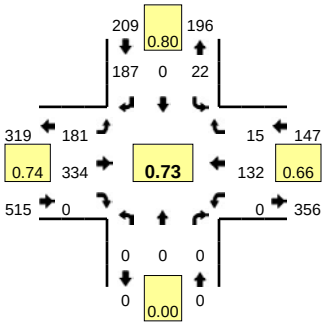
Method for determining peak hour: Total Entering Volume

LOCATION: Snyder Dr -- Outlet Dr

CITY/STATE: Knox County, TN

QC JOB #: 13691728

DATE: Tue, Jan 26 2016



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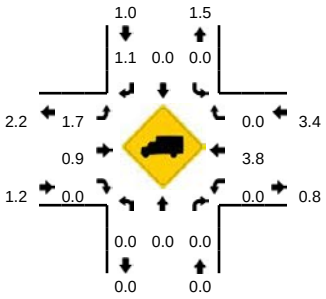
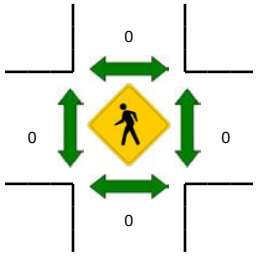
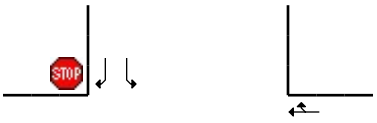
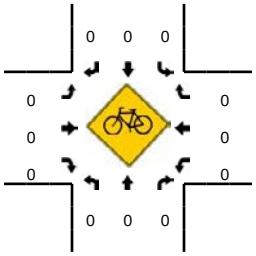
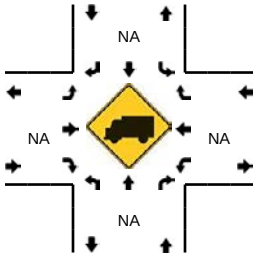
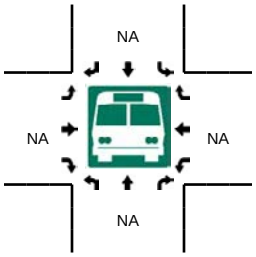












15-Min Count Period Beginning At	Snyder Dr (Northbound)				Snyder Dr (Southbound)				Outlet Dr (Eastbound)				Outlet Dr (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	0	0	0	1	0	35	0	14	39	0	0	0	11	0	0	100	
7:15 AM	0	0	0	0	2	0	49	0	31	59	0	0	0	18	1	0	160	
7:30 AM	0	0	0	0	7	0	54	0	49	94	0	0	0	28	8	0	240	
7:45 AM	0	0	0	0	11	0	56	0	74	100	0	0	0	50	6	0	297	797
8:00 AM	0	0	0	0	2	0	28	0	27	81	0	0	0	36	0	0	174	871
8:15 AM	0	0	0	0	1	0	31	0	21	65	0	0	0	20	0	0	138	849
8:30 AM	0	0	0	0	4	0	22	0	21	42	0	0	0	21	0	0	110	719
8:45 AM	0	0	0	0	0	0	16	0	10	36	0	0	0	19	1	0	82	504

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	44	0	224	0	296	400	0	0	0	200	24	0	1188
Heavy Trucks	0	0	0		0	0	0		0	0	0		0	12	0		12
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 2/5/2016 1:16 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

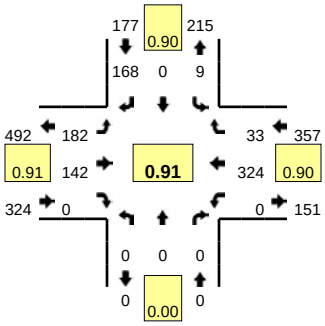
Method for determining peak hour: Total Entering Volume

LOCATION: Snyder Dr -- Outlet Dr

CITY/STATE: Knox County, TN

QC JOB #: 13691730

DATE: Tue, Jan 26 2016



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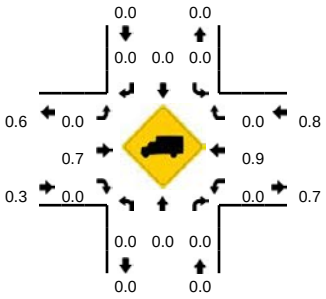
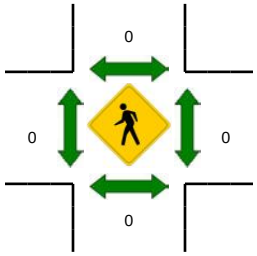
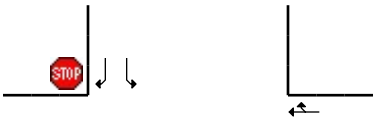
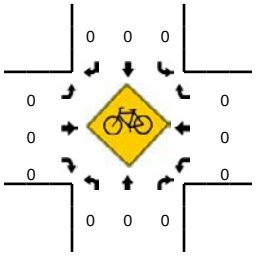
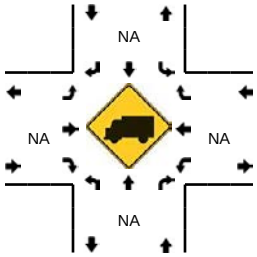
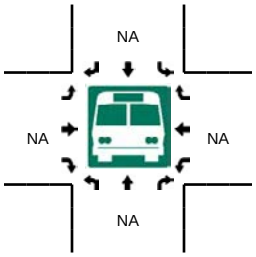












15-Min Count Period Beginning At	Snyder Dr (Northbound)				Snyder Dr (Southbound)				Outlet Dr (Eastbound)				Outlet Dr (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	0	0	0	2	0	24	0	32	37	0	0	0	54	5	1	155	
4:15 PM	0	0	0	0	1	0	27	0	36	19	0	0	0	51	7	0	141	
4:30 PM	0	0	0	0	4	0	44	0	34	35	0	0	0	62	10	0	189	
4:45 PM	0	0	0	0	0	0	41	0	44	36	0	0	0	55	6	0	182	667
5:00 PM	0	0	0	0	5	0	38	0	39	36	0	0	0	93	6	0	217	729
5:15 PM	0	0	0	0	2	0	42	0	57	32	0	0	0	89	14	0	236	824
5:30 PM	0	0	0	0	2	0	47	0	42	38	0	0	0	87	7	0	223	858
5:45 PM	0	0	0	0	8	0	31	0	37	28	0	0	0	63	10	1	178	854

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	0	0	0	8	0	168	0	228	128	0	0	0	356	56	0	944
Heavy Trucks	0	0	0		0	0	0		0	0	0		0	8	0		8
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 2/5/2016 1:16 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

STATION	STREET	LOCATION	2010	2011	2012	2013	2014
M64	Oak Ridge Hwy	1000' E of Byington/Beaver Creek Rd	15270	15570	14770	14250	
T078	Oak Ridge Hwy	E of Hazelnut Ln	18226	17587	18626	20690	
T082	Oak Ridge Hwy	at Guinn Rd	49623	52055	54517	50706	
T092	Oak Ridge Hwy	W of 44th St	24766	23321	24021	24742	
T262	Oak Ridge Hwy	W of Weaver Rd	15208	14876	15509	14490	
T364	Oak Ridge Hwy	E of Pellissippi Py	11033	11488	11997	10969	
T167	Oak St	S of I-40/I-75 Interchange	504	377	420	425	
T501	Old Broadway	N of Broadway	8666	8292	8524	9066	
T448	Old Callahan Dr	E of Clinton Highway	21381	21292	23130	23484	
T185	Old Clinton Pk Rd	At Anderson Co Line	803	786	821	967	
M215	Old Maynardville Pk	E of Maynardville Pk			790		
T040	Old Rutledge Pk	E of Branville Rd	971	1003	1042	1147	
T343	Old Rutledge Pk	E of Clear Springs Rd	1627	1676	1664	1681	
M79	Old Stage Rd	400' S of Kingston Pk	5680				
T425	Old Stage Rd	E of McFee Rd	5308	5334	5322	5771	
T443	Old Stage Rd	E of Triple Crown Blvd	750	773	930	856	
M245	Osborne Rd	N of Strawberry Plains Pk					
M97	Outlets Dr	W of Lovell Rd				5180	6220
M67	Outlets Dr/Snyder Dr	200' E of Campbell Station Rd	3760	3870	3770	5770	6150

APPENDIX B | TRIP GENERATION

CANNON & CANNON INC
CONSULTING ENGINEERS · FIELD SURVEYORS

TRIP GENERATION

Tapestry Turkey Creek
Proj. No. 01271-0000

Land Use: Land Use: Multi-family Apartments
Land Use Code: Land Use Code: Knox Co. Local Apartment Trip Gen. Study

220 DWELLING UNITS

WEEKDAY

$T = 15.193(X)^{0.899}$
T = 1938

50%	ENTERING =	969 trips
50%	EXITING =	969 trips
	TOTAL =	1938 trips

AM PEAK HOUR

$T = 0.758(X)^{0.924}$
T = 110

22%	ENTERING =	24 trips
78%	EXITING =	86 trips
	TOTAL =	110 trips

PM PEAK HOUR

T = 0.669(X)+10.069
T = 157.00

55%	ENTERING =	86 trips
45%	EXITING =	71 trips
	TOTAL =	157 trips

Local Apartment
Trip Generation Study

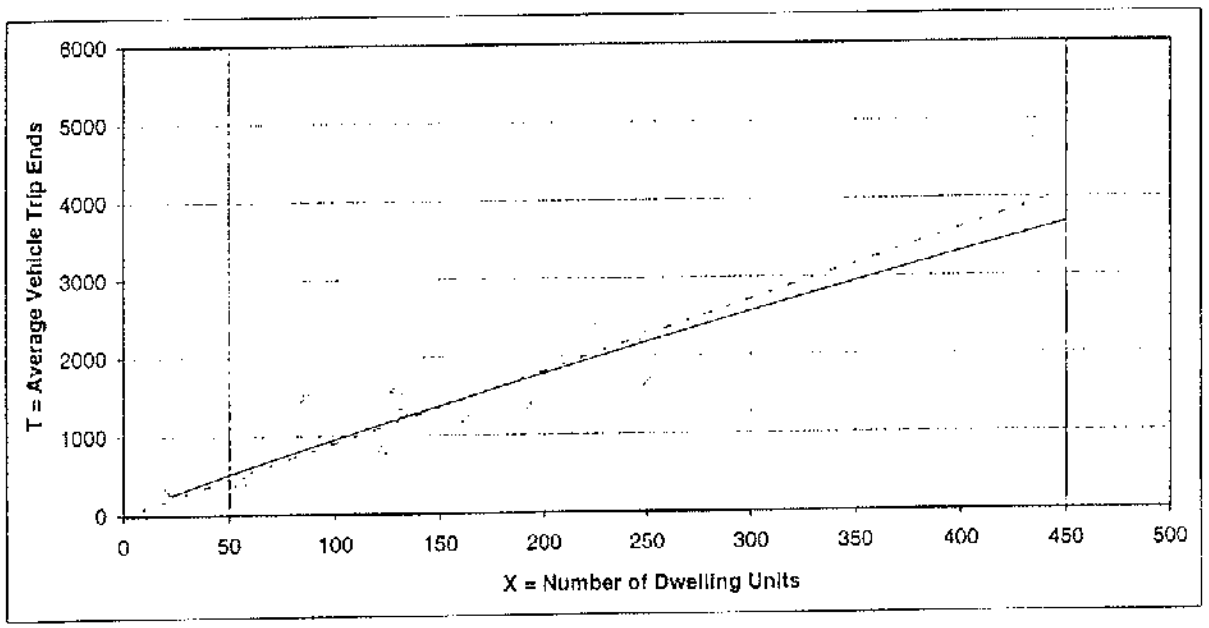
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Number of Studies: 13
Average Number of Dwelling Units: 193
Directional Distribution: 50% entering, 50% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
9.03	6.59 - 17.41	2.47

Data Plot and Equation



Fitted Curve Equation: $T = 15.193(X)^{0.899}$ $R^2 = 0.88$

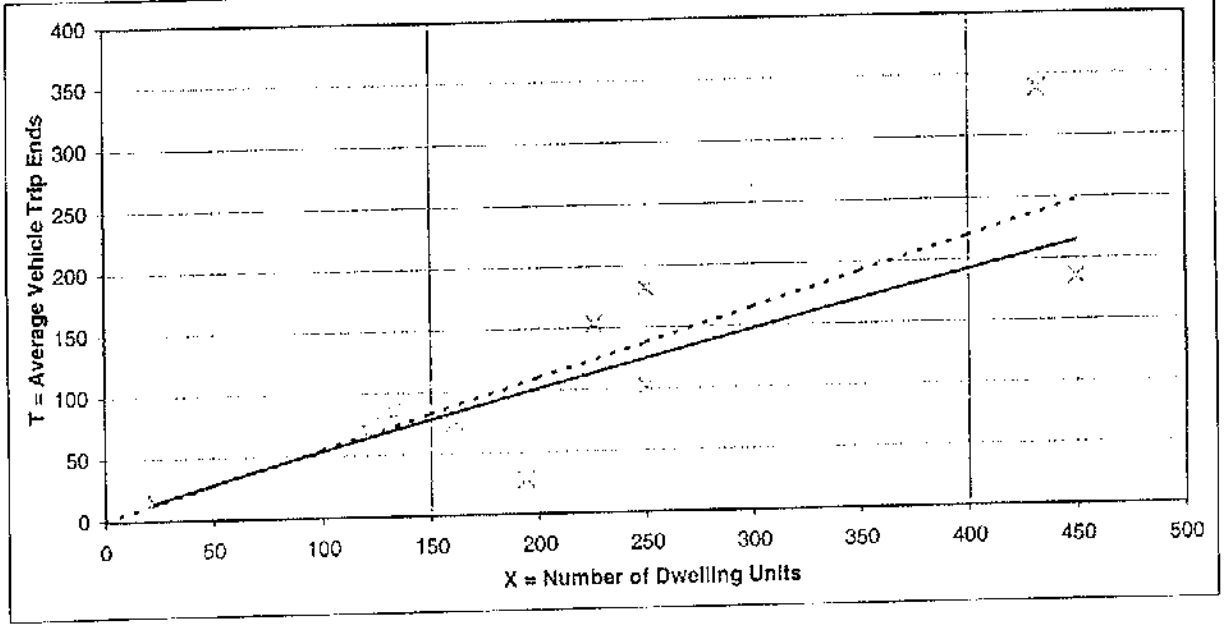
Local Apartment
Trip Generation Study

Average Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,** **Peak Hour of Adjacent Street Traffic,** **One Hour Between 7 and 9 a.m.**
Number of Studies:	13
Average Number of Dwelling Units:	193
Directional Distribution:	22% entering, 78% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
0.55	0.14 - 0.78	0.18

Data Plot and Equation



X Actual Data Points ——— Fitted Curve ····· Average Rate

Fitted Curve Equation: $T = 0.758(X)^{0.924}$ $R^2 = 0.75$

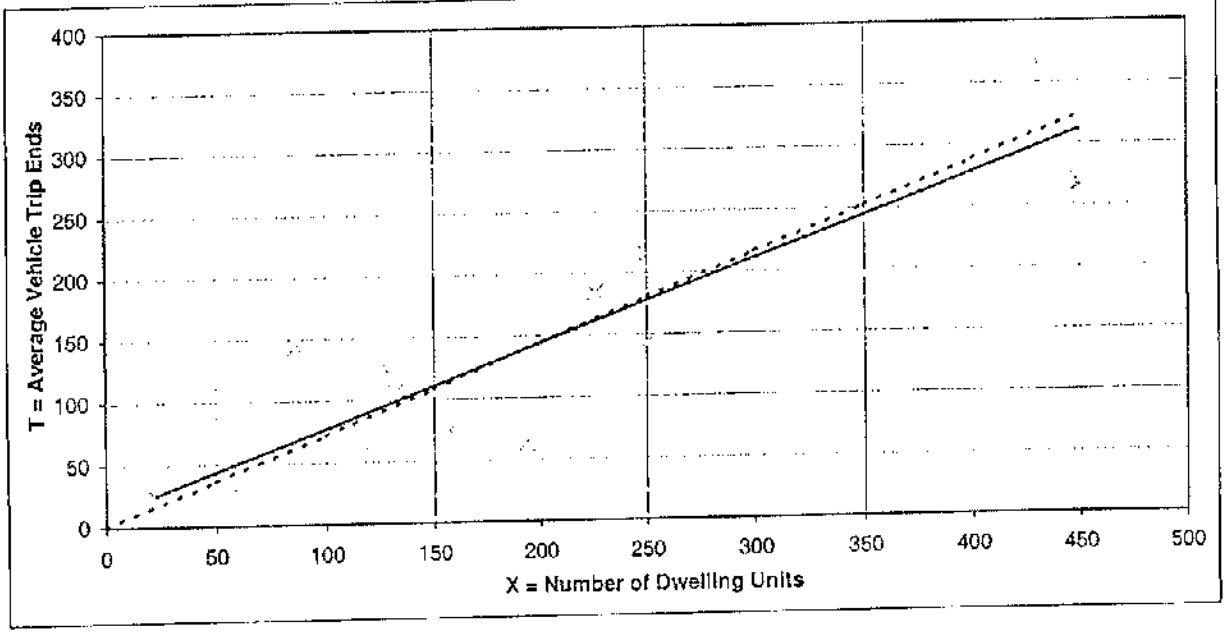
Local Apartment
Trip Generation Study

Average Vehicle Trip Ends vs:	Dwelling Units
On a:	Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m.
Number of Studies:	13
Average Number of Dwelling Units:	193
Directional Distribution:	55% entering, 45% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
0.72	0.32 - 1.66	0.25

Data Plot and Equation



Fitted Curve Equation: $T = 0.669(X) + 10.069$ $R^2 = 0.79$

APPENDIX C | ANALYSES

CAPACITY AND LEVEL-OF-SERVICE CONCEPTS

In a general sense, a roadway is similar to a pipeline or other material carrying conduit in that it has a certain capacity for the amount of material (vehicles) that it can efficiently carry. As the number of vehicles in a given time period gradually increases, the quality of traffic flow gradually decreases. On roadway sections this results in increasing turbulence in the traffic stream, and at intersections it results in increasing stops and delay. As the volumes begin to approach the capacity of the facility, these problems rapidly magnify, with resulting serious levels of congestion, stops, delay, excess fuel consumption, pollutant emissions, etc.

The Transportation Research Board has published the Year 2010 Highway Capacity Manual (HCM2010), which establishes theoretical techniques to quantify the capacity conditions on all types of roadways, intersections, ramps, pedestrian facilities, etc. A basic concept that is applicable to most of these techniques is the idea of level of service (LOS). This concept establishes a rating system that quantifies the quality of traffic flow, as perceived by motorists and/or passengers. The general system is similar to a school grade scale, and is outlined as follows:

Level of Service (LOS)	General Quality of Traffic Flow	Description of Corresponding Conditions
A	Excellent	Roadways – Free flow, high maneuverability Intersections – Very few stops, very low delay
B	Very Good	Roadways – Free flow, slightly lower maneuverability Intersections – Minor stops, low delay
C	Good	Roadways – Stable flow, restricted maneuverability Intersections – Significant stops, significant delay
D	Fair	Roadways – Marginally stable flow, congestion seriously restricts maneuverability Intersections – High stops, long but tolerable delay
E	Poor	Roadways – Unstable flow*, lower operating speeds, congestion severely restricts maneuverability Intersections – All vehicles stop, very long queues and very long intolerable delay
F	Very Poor	Roadways – Forced flow, stoppages may be lengthy, congestion severely restricts maneuverability Intersections – All vehicles stop, extensive queues and extremely long intolerable delay

*Unstable flow is such that minor fluctuations or disruptions can result in rapid degradation to LOS F.

Another measure of intersection capacity that is often used in the evaluation of intersection operations is the volume to capacity (V/C) ratio. This ratio is defined as “the ratio of flow rate to capacity”, and is a good measure of how much of an intersection’s available capacity has been used up by the analysis volumes. Conversely, it also provides an indication of the reserve capacity available for future growth in traffic volumes.

The Intersection Capacity Utilization (ICU) is another measure that expresses a value similar to the V/C ratio. Specifically, the ICU method “sums the amount of the time required to serve all movements at saturation for a given cycle length and divides by that reference cycle length.” The ICU is considered a more accurate measure of volume to capacity conditions for a signalized intersection, primarily because it accounts for the effects of the signal timing on intersection capacity.

HCS 2010 Two-Way Stop Control Summary Report

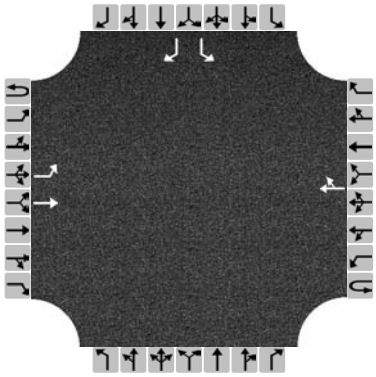
General Information

Analyst	BB
Agency/Co.	CCI
Date Performed	9/26/2016
Analysis Year	2016
Time Analyzed	AM - EXISTING
Intersection Orientation	East-West
Project Description	01271-0000; Tapestry Turkey Creek

Site Information

Intersection	Outlet Dr at Snyder Rd
Jurisdiction	Knox County
East/West Street	Outlet Drive
North/South Street	Snyder Road
Peak Hour Factor	0.73
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		L	T					TR						L		R
Volume (veh/h)		181	334				132	15						22		187
Percent Heavy Vehicles		0												0		0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				Yes			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		248												30		256
Capacity		1382												183		855
v/c Ratio		0.18												0.16		0.30
95% Queue Length		0.7												0.6		1.3
Control Delay (s/veh)		8.2												28.6		11.0
Level of Service (LOS)		A												D		B
Approach Delay (s/veh)	2.9												12.8			
Approach LOS													B			

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HCS 2010 Two-Way Stop Control Summary Report

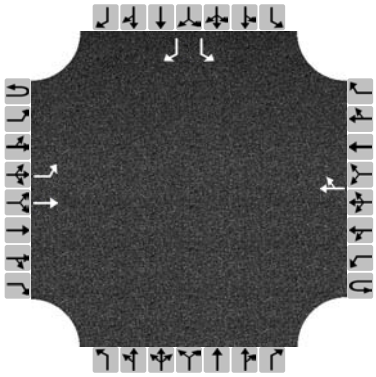
General Information

Analyst	BB
Agency/Co.	CCI
Date Performed	9/26/162016
Analysis Year	2016
Time Analyzed	PM - EXISTING
Intersection Orientation	East-West
Project Description	01271-0000; Tapestry Turkey Creek

Site Information

Intersection	Outlet Drive at Snyder Road
Jurisdiction	Knox County
East/West Street	Outlet Drive
North/South Street	Snyder Road
Peak Hour Factor	0.91
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		L	T					TR						L		R
Volume (veh/h)		182	142				324	33						9		168
Percent Heavy Vehicles		0												0		0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				Yes			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		200												10		185
Capacity		1178												248		677
v/c Ratio		0.17												0.04		0.27
95% Queue Length		0.6												0.1		1.1
Control Delay (s/veh)		8.7												20.1		12.3
Level of Service (LOS)		A												C		B
Approach Delay (s/veh)	4.9												12.7			
Approach LOS													B			

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HCS 2010 Two-Way Stop Control Summary Report

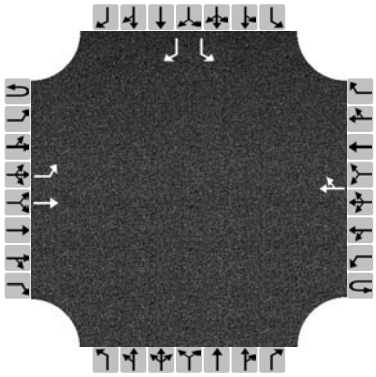
General Information

Analyst	BB
Agency/Co.	CCI
Date Performed	9/26/2016
Analysis Year	2019
Time Analyzed	AM - BACKGROUND
Intersection Orientation	East-West
Project Description	01271-0000; Tapestry Turkey Creek

Site Information

Intersection	Outlet Drive at Snyder Road
Jurisdiction	Knox County
East/West Street	Outlet Drive
North/South Street	Snyder Road
Peak Hour Factor	0.73
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		L	T					TR						L		R
Volume (veh/h)		195	360				142	16						24		201
Percent Heavy Vehicles		0												0		0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				Yes			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		267												33		275
Capacity		1365												159		840
v/c Ratio		0.20												0.21		0.33
95% Queue Length		0.7												0.8		1.4
Control Delay (s/veh)		8.3												33.6		11.4
Level of Service (LOS)		A												D		B
Approach Delay (s/veh)	2.9												13.7			
Approach LOS													B			

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HCS 2010 Two-Way Stop Control Summary Report

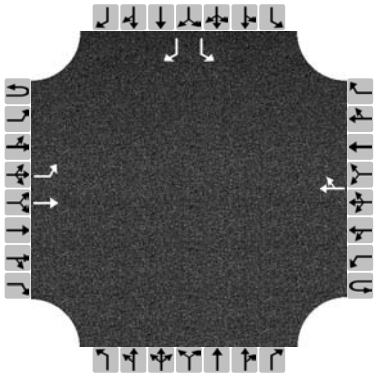
General Information

Analyst	BB
Agency/Co.	CCI
Date Performed	9/26//2016
Analysis Year	2019
Time Analyzed	PM - BACKGROUND
Intersection Orientation	East-West
Project Description	01271-0000; Tapestry Turkey Creek

Site Information

Intersection	Outlet Drive at Snyder Road
Jurisdiction	Knox County
East/West Street	Outlet Drive
North/South Street	Snyder Road
Peak Hour Factor	0.91
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		L	T					TR						L		R
Volume (veh/h)		196	153				349	36						10		181
Percent Heavy Vehicles		0												0		0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				Yes			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		215												11		199
Capacity		1146												220		651
v/c Ratio		0.19												0.05		0.31
95% Queue Length		0.7												0.2		1.3
Control Delay (s/veh)		8.9												22.2		12.9
Level of Service (LOS)		A												C		B
Approach Delay (s/veh)	5.0												13.4			
Approach LOS													B			

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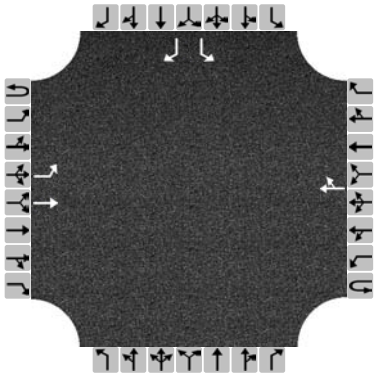
HCS 2010 Two-Way Stop Control Summary Report

General Information		Site Information	
Analyst	BB	Intersection	Outlet Drive at Snyder Road
Agency/Co.	CCI	Jurisdiction	Knox County
Date Performed	9/26/2016	East/West Street	Outlet Drive
Analysis Year	2019	North/South Street	Snyder Road
Time Analyzed	AM - COMBINED	Peak Hour Factor	0.73
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	01271-0000; Tapestry Turkey Creek		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		L	T					TR						L		R
Volume (veh/h)		195	375				195	19						25		201
Percent Heavy Vehicles		3												3		3
Proportion Time Blocked																
Right Turn Channelized	No				No				No				Yes			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		267												34		275
Capacity		1262												134		756
v/c Ratio		0.21												0.25		0.36
95% Queue Length		0.8												0.9		1.7
Control Delay (s/veh)		8.6												40.7		12.5
Level of Service (LOS)		A												E		B
Approach Delay (s/veh)	2.9												15.6			
Approach LOS													C			

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HCS 2010 Two-Way Stop Control Summary Report

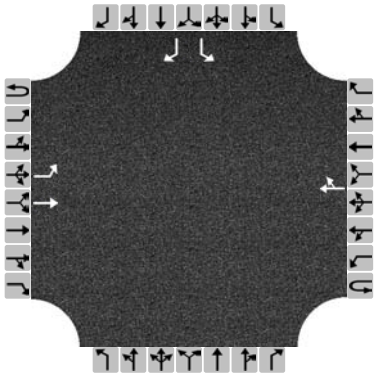
General Information

Analyst	BB
Agency/Co.	CCI
Date Performed	9/26/2016
Analysis Year	2019
Time Analyzed	PM - COMBINED
Intersection Orientation	East-West
Project Description	01271-0000; Tapestry Turkey Creek

Site Information

Intersection	Outlet Drive at Snyder Road
Jurisdiction	Knox County
East/West Street	Outlet Drive
North/South Street	Snyder Road
Peak Hour Factor	0.91
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		L	T					TR						L		R
Volume (veh/h)		196	206				393	38						13		181
Percent Heavy Vehicles		3												3		3
Proportion Time Blocked																
Right Turn Channelized	No				No				No				Yes			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		215												14		199
Capacity		1082												185		604
v/c Ratio		0.20												0.08		0.33
95% Queue Length		0.7												0.2		1.4
Control Delay (s/veh)		9.2												26.1		13.9
Level of Service (LOS)		A												D		B
Approach Delay (s/veh)	4.5												14.7			
Approach LOS													B			

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HCS 2010 Two-Way Stop Control Summary Report

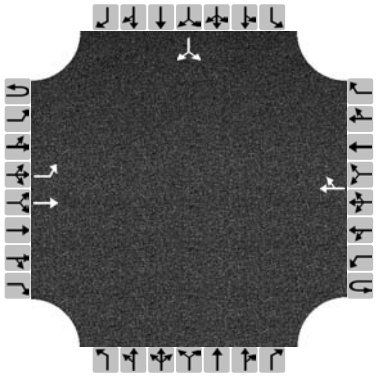
General Information

Analyst	BB
Agency/Co.	CCI
Date Performed	9/26/16
Analysis Year	2019
Time Analyzed	AM - COMBINED
Intersection Orientation	East-West
Project Description	01271-0000; Tapestry Turkey Creek

Site Information

Intersection	Outlet Drive at Driveway
Jurisdiction	Knox County
East/West Street	Outlet Drive
North/South Street	Driveway
Peak Hour Factor	0.73
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	0	1	0		0	0	0		0	0	0
Configuration		L	T					TR							LR	
Volume (veh/h)		16	384				158	8						30		56
Percent Heavy Vehicles		3												3		3
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		22													118	
Capacity		1334													558	
v/c Ratio		0.02													0.21	
95% Queue Length		0.1													0.8	
Control Delay (s/veh)		7.7													13.2	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	0.3												13.2			
Approach LOS													B			

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HCS 2010 Two-Way Stop Control Summary Report

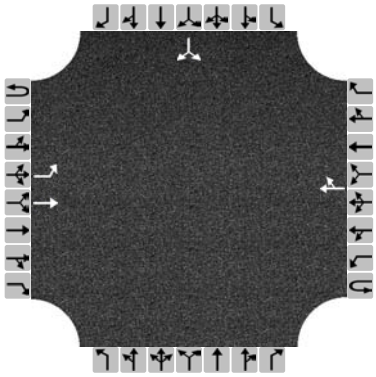
General Information

Analyst	BB
Agency/Co.	CCI
Date Performed	9/26/2016
Analysis Year	2019
Time Analyzed	PM - COMBINED
Intersection Orientation	East-West
Project Description	01271-0000; Tapestry Turkey Creek

Site Information

Intersection	Outlet Drive at Driveway
Jurisdiction	Knox County
East/West Street	Outlet Drive
North/South Street	Driveway
Peak Hour Factor	0.91
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	1	1	0	0	0	1	0		0	0	0		0	0	0
Configuration		L	T					TR							LR	
Volume (veh/h)		56	163				385	30						25		46
Percent Heavy Vehicles		0												0		0
Proportion Time Blocked																
Right Turn Channelized	No				No				No				No			
Median Type	Undivided															
Median Storage																

Delay, Queue Length, and Level of Service

Flow Rate (veh/h)		62													78	
Capacity		1116													500	
v/c Ratio		0.06													0.16	
95% Queue Length		0.2													0.5	
Control Delay (s/veh)		8.4													13.5	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	2.2												13.5			
Approach LOS													B			

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TABLE 4B

RIGHT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

Outlet Drive at Proposed Site Driveway

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	< 100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399
Fewer Than 25 25 - 49 50 - 99		AM				PM
100 - 149 150 - 199						
200 - 249 250 - 299						Yes
300 - 349 350 - 399				Yes	Yes Yes	Yes Yes
400 - 449 450 - 499			Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599		Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 600	+ / > 600
Fewer Than 25 25 - 49 50 - 99					Yes	Yes Yes
100 - 149 150 - 199			Yes	Yes Yes	Yes Yes	Yes Yes
200 - 249 250 - 299	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
300 - 349 350 - 399	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

* Or through volume only if a left-turn lane exists.

AM PEAK
RT Volume = 8
THRU Volume = 158

PM PEAK
RT Volume = 30
THRU Volume = 385

APPENDIX D | MPO COMMENTS

KNOXVILLE·KNOX COUNTY
MPC
METROPOLITAN PLANNING COMMISSION
TENNESSEE

September 19, 2016

Becky Bottoms, P.E.
Cannon & Cannon Inc.
8550 Kingston Pike
Knoxville, TN 37919

SUBJECT: Tapestry Turkey Creek Apartments Traffic Impact Study Review

Dear Mrs. Bottoms:

The Traffic Impact Study (TIS) submitted for the above referenced proposed development has been reviewed by staff from Knox County Department of Engineering and MPC. We have identified the following issues related to the TIS and site plan that need to be further addressed.

1. On page 4 under Existing Conditions, the 2013 ADT for Snyder Road is not the same as listed in Table 3. We do understand that it is a discrepancy between the interactive GIS map and the pdf spreadsheet on the TPO website. It would be better if the most current count from 2014 (6,150) displayed on the interactive GIS map was used for this count.

Revised

2. On page 10, the first line should read "Unsignalized capacity analyses" instead of "analysis". Also, the capacity analyses for the site driveway assumed separate left-and right-turn exit lanes, but those are not shown on the site plan. Please correct one or the other to ensure they are concurrent with one another.

Site plan was correct.
Re-ran analyses with shared lane.

3. In Figure 6 of the Trip Distribution (page 11), it shows an assumed site trip distribution split of 35% to and from the east and 65% to and from the west. The existing volumes at the intersection of Outlet Drive and Snyder Road reflect a split more in the order of about 10% to and from the east and 90% to and from the west. It would be helpful to include a brief explanation of other factors considered in the assumed trip distribution. One of those factors may be that Snyder Road traffic has access to Lovell Road outside of the Outlet Drive intersection. The clarification of assumptions would be helpful.

Further narrative was added on page 9.

4. The Outlet Drive/Snyder Road intersection capacity analyses summarized in Table 3, page 14, are for the southbound Snyder Road approach as a whole and reflect an assumption of no channelized right-turns on to Snyder Road. However, with the channelized right-turn lane YIELD condition (as stated on page 4) that should be accounted for in the capacity analyses. The approach Level-of-Service (LOS) shows a different picture of the intersection performance that may be misleading. Under Turn

Re-ran analyses with channelized right-turn and updated / modified Table 3.

Lane Assessment on the same page, "evaluated" should replace "conducted" in regard to testing of right-turn lane warrants. Also, with the mention of the center two-way left-turn lane (TWLTL), is this TWLTL long enough to accommodate future traffic projections?

a. Along with this, please show an aerial which highlights the striping of the TWLTL, and shows the existing vs. required storage length.
b. All of the projected queue lengths are less than one vehicle length except the southbound right-turn movement on Snyder Road. Please show this in a figure with the aerial.

Added a new figure and narrative on page 15.

5. If the access was not restricted to Outlet Drive (per Knox County Commission at the Rezoning case hearing), what would be the recommendations for the access point(s)?

Please provide 5 hard copies of the updated traffic study including all revisions by Wednesday, September 28, 2016 or before, so that adequate time is available for review prior to the October MPC meeting. If you have any questions, please do not hesitate to contact me at 865-215-3826.

If adequate capacity is available at the Outlet Drive / Snyder Road intersection, the preferred driveway location would be on Snyder Road. However, additional trip distribution and analysis would be needed to determine impacts of added site related traffic to the northern leg of the intersection.

Sincerely,

Tarren Barrett
Transportation Engineer, MPC/TPO

C: Tom Brechko, MPC
Cindy Pionke, Knox County Department of Engineering & Public Works
John Sexton, Knox County Department of Engineering & Public Works