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TRAFFIC IMPACT STUDY FOR THE PROPOSED CORNERSTONE DRIVE APARTMENTS

Lovell Road (SR 131) and
Cornerstone Drive

Knox County, Tennessee

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EXECUTIVE SUMMARY

General Overview of the Development

- Development to occur on the northeast corner of the intersection of Lovell Road (SR 131) and Cornerstone Drive in Knox County, Tennessee.
- Development to consist of the construction of a 318 unit, multifamily apartment complex.
- Access to the development proposed via the construction of two (2) site driveways:
  - The proposed western site driveway to Cornerstone Drive, the centerline of which will be located approximately 225 feet east of the centerline of Lovell Road (SR 131). This driveway will provide ingress and egress for site traffic; and
  - The proposed eastern site driveway to Cornerstone Drive, the centerline of which will be located approximately 620 feet east of the centerline of Lovell Road (SR 131). Similarly, this driveway will provide ingress and egress for site traffic.

List of Study Intersections

- Lovell Road (SR 131) with Cornerstone Drive (existing unsignalized);
- Murdock Drive with Cornerstone Drive (existing unsignalized);
- Western Site Driveway with Cornerstone Drive (proposed): and
- Eastern Site Driveway with Cornerstone Drive (proposed).

Trip Generation and Distribution

- Trip generation of the proposed development was determined using rates and equations published by Knoxville-Knox County Planning, December 1999:
  - *Local Apartment - Trip Generation Study – 318 Units*, was used to determine the trip generation of the proposed 318 unit, multifamily residential development;
- Anticipated Peak Hour Trip Generation:
  <u>318 Unit Local Apartment</u>
  - AM Peak Hour = 156 Trips (34 Entering/122 Exiting)
  - PM Peak Hour = 223 Trips (123 Entering/100 Exiting)

Mitigation Measures to be Constructed Concurrent with Development

- Construct the proposed western site driveway to the Cornerstone Drive to provide one (1) lane for ingress traffic and one (1) lane for egress traffic. The driveway should be controlled by a Stop sign on the southbound site driveway approach to the Cornerstone Drive.
- Construct the proposed Eastern site driveway to the Cornerstone Drive to provide one (1) lane for ingress traffic and one (1) lane for egress traffic. The driveway should be controlled by a Stop sign on the southbound site driveway approach to the Cornerstone Drive.

TRAFFIC IMPACT STUDY
FOR THE PROPOSED
CORNERSTONE DRIVE APARTMENTS
Knox County, Tennessee

Civil & Environmental Consultants, Inc. (CEC) has completed this Traffic Impact Study for the proposed Cornerstone Drive Apartments which are to be located on the northeast corner of the intersection of Lovell Road (SR 131) with Cornerstone Drive in Knox County, Tennessee.

The following sections of this report contain a project description, data collection, site traffic generation and distribution, projected traffic volumes, analysis, and conclusions and recommendations.

PROJECT DESCRIPTION/DATA COLLECTION/EXISTING CONDITIONS

PROJECT DESCRIPTION

The proposed development to consist of the construction of a 318 unit, multi-building apartment complex. The site location is shown in Figure 1.

Access to the development proposed via the construction of two (2) site driveways:

- The proposed western site driveway to Cornerstone Drive, the centerline of which will be located approximately 225 feet east of the centerline of Lovell Road (SR 131). This driveway will provide ingress and egress for site traffic; and
- The proposed eastern site driveway to Cornerstone Drive, the centerline of which will be located approximately 620 feet east of the centerline of Lovell Road (SR 131). Similarly, this driveway will provide ingress and egress for site traffic.

As per the current Knoxville-Knox County Subdivision Regulations, intersections located along local streets should be spaced a minimum of 125 feet apart (centerline to centerline). Therefore, the proposed intersection spacing satisfies the subdivision regulation criteria.

A copy of the proposed site plan for the development has been included with this report as Figure 2.

The following intersections were selected for study:

- Lovell Road (SR 131) with Cornerstone Drive (existing unsignalized);
- Murdock Drive with Cornerstone Drive (existing unsignalized);
- Western Site Driveway with Cornerstone Drive (proposed): and
- Eastern Site Driveway with Cornerstone Drive (proposed).

A total of two (2) existing intersections and two (2) proposed site driveway intersections were included in the scope of the study. The study intersections with respect to the site are illustrated in Figure 3.

DATA COLLECTION

Turning movement counts were performed at each of the existing study intersections on Thursday, September 22, 2022 from 7:00 A.M. to 9:00 A.M. and from 4:00 P.M. to 6:00 P.M. These time periods are assumed to include the weekday A.M. and weekday P.M. peak hours of vehicular traffic within the study area. The results of the turning movement counts are presented in Figure 4.

The overall peak hours determined from these counts are as follows:

- A.M. Peak Hour – 7:30 A.M. to 8:30 A.M.
- P.M. Peak Hour – 5:00 P.M. to 6:00 P.M.

Summaries of the data collected during the turning movement counts at the study intersections have been included in Appendix A to this report.

EXISTING CONDITIONS

A field reconnaissance of the study area was conducted by CEC to obtain information such as roadway widths, roadway grades, and posted speed limits within the environs of the study intersections. A description of the study roadways is as follows:

Lovell Road (SR 131) – Lovell Road is classified as a minor arterial. At its intersection with Cornerstone Drive, Lovell Road is a State-owned roadway, providing a five (5) lane, 70-foot wide bituminous surface with variable width, concrete curbs and sidewalks. Lovell Road provides a three (3) lane approach to Cornerstone Drive for northbound vehicular traffic (two way center left turn lane, one (1) exclusive through lane and a shared through/right turn lane) and a three (3) lane approach to Cornerstone Drive for southbound vehicular traffic (an exclusive left turn lane and two (2) exclusive through lanes). Lovell Road currently serves pedestrian traffic via approximately six (6) foot wide concrete sidewalks on both sides of the roadway. Furthermore, Lovell Road provides designated bicycle lanes, approximately 4.5 feet wide, for both the northbound direction and southbound direction. Knoxville Area Transit (KAT) does not provide service within the study area of the development.

The posted speed limit of Lovell Road (SR 131) in the study area is 45 miles per hour. The intersection of Lovell Road with Cornerstone Drive is controlled by a stop sign on the minor street (Cornerstone Drive) approach.

Murdock Drive – Murdock Drive is classified as a minor arterial. At its intersection with Cornerstone Drive, the Murdock Drive southbound approach provides a four (4) lane, 48-foot wide bituminous surface. The northbound approach of Murdock Road provides a three (3) lane, 36-foot wide bituminous surface.

Murdock Drive provides a three (3) lane approach to Cornerstone Drive for southbound vehicular traffic (a two-way center left turn lane, an exclusive through lane and an exclusive right turn lane) and a two (2) lane approach to Cornerstone Drive for northbound vehicular traffic (a two-way center left turn lane and a shared through/right turn lane). Murdock Drive currently does not have

pedestrian or bicycle facilities. Knoxville Area Transit (KAT) does not provide service within the study area of the development.

The posted speed limit of Murdock Drive in the study area is 40 miles per hour. The intersection of Murdock Drive with Cornerstone Drive is controlled by a stop sign on the minor street (Cornerstone Drive) approach.

Cornerstone Drive – Cornerstone Drive is classified as a local street. At its intersection with Lovell Road (SR 131) and its intersection with Murdock Drive, Cornerstone Drive is a Locally-owned roadway, providing a three (3) lane, 38-foot wide, bituminous surface with concrete curb/gutter on both sides. Cornerstone Drive serves pedestrian traffic via approximately six (6) foot wide concrete sidewalks on both sides of the roadway. No transit stops or routes are present along Cornerstone Drive within the environs of the study intersections. Cornerstone Drive provides a two (2) lane approach to Lovell Road (SR 131) for westbound vehicular traffic (exclusive left turn lane and an exclusive right turn lane) and a two (2) lane approach to Murdock Drive for eastbound vehicular traffic (exclusive left turn lane and an exclusive right turn lane). There is no posted speed limit on Cornerstone Drive. For the purposes of this analysis, 30 miles per hour was assumed to be the legal speed limit.

US Cellular Loop - An approximately 1.25 mile paved trail loop surrounds the property from Lovell Road to Murdock Drive and continues behind the US Cellular Complex.

Greenways - The nearest greenway to the development is the Parkside Greenway which is located south of the site and on the southern side of I-40 near the Turkey Creek Shopping Center.

EXISTING 2022 PEAK HOUR CAPACITY ANALYSIS

Capacity calculations were performed for the study intersections using the methodologies published in the *Highway Capacity Manual*, Sixth Edition, by the Transportation Research Board, 2017. This methodology determines how well an intersection, approach to an intersection, or movement at an intersection operates, and assigns to it a Level of Service (LOS) A through F, with LOS A representing the best operating conditions and LOS F, the worst. Detailed definitions of LOS have been included in Appendix B to this report.

The results of the capacity calculations performed are summarized in Table 1 and Table 2 for the weekday A.M. peak hour and the weekday P.M. peak hour, respectively.

The results of the capacity calculations performed revealed that each of the study intersection approaches and movements currently operate at a Level of Service D or better during each of the peak periods analyzed with the following exception:

- The westbound Cornerstone Drive left turn movement at its intersection with Lovell Road (SR 131) currently operates at a Level of Service E during the weekday P.M. peak hour.

Copies of the capacity calculations performed using existing 2022 weekday A.M. and weekday P.M. peak hour traffic volumes are included in Appendix C to this report.

FORECASTED OPENING YEAR 2024 NO-BUILD (BASE) PEAK HOUR TRAFFIC VOLUMES

Opening year traffic volumes were developed for each of the study intersections. The proposed development is anticipated to be completed and fully occupied in 2024. Therefore, opening year traffic volumes were projected for forecasted 2024 conditions.

A background traffic growth rate for the study area was calculated by CEC based on historical Average Annual Daily Traffic (AADT) volumes available from the TDOT Transportation Data Management System. This background traffic growth rate was calculated using AADT volumes for calendar years 2014 -2018 for the following locations:

- Lovell Road (SR 131) – north of I-40 (Count Station ID # 47000285);
- Murdock Drive – Farragut (Count Station ID 47000464).

Using this methodology, a background traffic growth rate of 2.50% percent per year, linear, was calculated for the study area. A copy of the calculations performed in order to determine the background traffic growth rate has been included in Appendix D to this report.

An approved background development, *875 Cornerstone Drive Apartments*, is located adjacent to the proposed Cornerstone Drive Residential Development. Therefore, anticipated traffic volumes to be generated by this background development were included in the analyses. Details of the trip generation for this development are included in Appendix E to this report and presented in Figure 5.

Forecasted opening year 2024 no-build (base) traffic volumes for each of the peak periods analyzed were determined by applying this background traffic growth rate to the existing 2022 peak hour traffic volumes (Figure 4) and adding the approved background trips (Figure 5). The resultant forecasted opening year 2024 no-build (base) peak hour traffic volumes during the weekday A.M. and weekday P.M. peak hours are presented in Figure 6.

FORECASTED OPENING YEAR 2024 NO-BUILD (BASE) PEAK HOUR CAPACITY CALCULATIONS

Capacity calculations were performed for each of the study intersections using forecasted opening year 2024 no-build (base) peak hour volumes. The results of the capacity calculations performed are summarized in Table 1 and Table 2 for the weekday A.M. peak hour and the weekday P.M. peak hour, respectively.

The results of the capacity calculations revealed that each of the study intersection approaches and movements can be anticipated to operate at a Level of Service D or better with the following exceptions:

- The westbound Cornerstone Drive left turn movement at its intersection with Lovell Road (SR 131) is anticipated to continue to operate at a Level of Service E during the weekday 2024 no-build (base) P.M. peak hour.

Copies of the capacity calculations performed using forecasted opening year 2024 no-build (base) peak hour volumes are included in Appendix F to this report.

SITE TRIP GENERATION AND DISTRIBUTION

VEHICULAR TRIP GENERATION

Vehicular trip generation for the proposed development was projected based upon data published by the Knoxville-Knox County Planning, December 1999. Using this methodology, the proposed development can be anticipated to generate a total of 2,700 trips on a typical weekday with approximately 156 of these trips (34 trips entering/122 trips exiting) occurring during the weekday A.M. peak hour and approximately 223 of these trips (123 trips entering/100 trips exiting) occurring during the weekday P.M. peak hour.

The site-generated trips for the proposed Cornerstone Drive Apartments are summarized in Table 3 and presented in Figure 8. Copies of the trip generation calculations have been included in Appendix G to this report.

SITE TRAFFIC DISTRIBUTION

The forecasted trips to be generated by the proposed development were distributed on to the study roadway network based on the location of the regional employment centers obtained from the US Census Bureau's data as well as the expected fastest travel routes using Google Maps. Additionally, consideration for the trip distribution utilized in the approved adjacent retail development, 875 Cornerstone Drive Apartments, was given. Based on this regional distribution data, it was assumed that approximately 70% of trips would be destined to the north/east and the I-40 corridor. Therefore, the trips assigned to this area were assumed to travel north on Lovell Road and Murdock Road. Due to the traffic volumes on these roads, it was determined that making a right turn from Cornerstone Drive would have a similar travel time as making a left turn onto Murdock Drive. Even though Murdock Drive may be a more direct route according to Google maps, making a right turn onto Lovell Road would have less conflicts than making a left turn onto Murdock Drive. Therefore, in order to be conservative, the distributions were split evenly between these two directions. The anticipated arrival/departure distribution of the trips to be generated by the proposed development are presented in Figure 7. A copy of the census map is included in Appendix G to this report.

The forecasted trips to be added to each of the study intersections by the proposed development are presented in Figure 8.

FORECASTED OPENING YEAR 2024 BUILD (WITH DEVELOPMENT) PEAK HOUR TRAFFIC VOLUMES

The forecasted opening year 2024 build condition (with the proposed development) peak hour volumes were determined by adding the forecasted site generated trips to the study intersections (Figure 8) to the forecasted opening year 2024 no-build (base) condition peak hour volumes

(Figure 6). The resultant forecasted opening year 2024 build (with development) condition peak hour volumes are presented in Figure 9.

FORECASTED OPENING YEAR 2024 BUILD (WITH DEVELOPMENT) PEAK HOUR CAPACITY CALCULATIONS

Capacity calculations were performed for each of the study intersections using forecasted opening year 2024 build condition (with development) peak hour volumes. The results of the capacity calculations performed are summarized in Table 1 and Table 2 for the weekday A.M. peak hour and the weekday P.M. peak hour, respectively. It should be noted that heavy vehicle percentages have been recalculated to account for the increase in passenger sized vehicles resulting from the proposed development. This change corrects abnormally high heavy vehicle percentages that were present in existing conditions due to lower traffic volumes. A copy of the heavy vehicle adjustments is included in Appendix A.

The results of the capacity calculations revealed that each of the existing study intersection approaches and movements can be anticipated to continue to operate at a Level of Service D or better, with the following exceptions:

- The westbound Cornerstone Drive left turn movement at its intersection with Lovell Road (SR 131) is anticipated to continue to operate at a Level of Service E during the weekday P.M. peak hour.

Both of the proposed site driveway intersections with Cornerstone Drive can be anticipated to have movements operate at a Level of Service A during the weekday A.M. peak hour and Level of Service B or better during the weekday P.M. peak hour.

ADDITIONAL ANALYSES

Additional analyses performed include a traffic signal warrants evaluation, an auxiliary turn lane warrants evaluation, queuing analysis and a sight distance analysis.

TRAFFIC SIGNAL WARRANTS EVALUATION

Traffic volumes at the intersections of Lovell Road (SR 131) with Cornerstone Drive and at Murdock Drive with Cornerstone Drive were compared with warrants for the installation of traffic signal control. These warrants for the installation of traffic signal control are found in the Federal Highway Administration (FHWA) publication, *Manual of Uniform Traffic Control Devices (MUTCD)*, 2009. The MUTCD explicitly states that a traffic control signal should not be installed unless one or more of the manual's signal warrants are met. However, the satisfaction of a warrant does not entirely in itself justify the need for a traffic signal. Sometimes further engineering studies and judgments must be applied before justifying the need for a traffic signal installation. For analysis purpose, signal warrant criteria was evaluated for both the peak hour and the four hour warrants. It should also be noted that per MUTCD guidelines, the study should consider the effects of the right-turn vehicles from the minor-street approaches. Engineering judgment should be used to determine what, if any, portion of the right-turn traffic is subtracted from the minor-street traffic count when evaluating the count against the signal warrants. Considering that the subject study intersections provide separate turning lanes for the minor street approaches, the volume of right

turns to be included in the signal warrant analysis was adjusted using pagones theorem. For minor street approaches with an exclusive right turn lane, the volume of right turns can be reduced by 75% for signal warrant analysis. For minor street approaches with an exclusive left turn lane and a shared through/right turn lane, the volume of right turns can be reduced by 60% when the volume of right turns is equal to three times the through volume.

At the intersection of Lovell Road with Cornerstone Drive, signal warrant criteria for both the peak hour and four hour volume warrants was evaluated. Based on the results of the analysis, the intersection does not satisfy the criteria for installation of a traffic signal.

Likewise, signal warrant criteria was evaluated at the intersection of Murdock Drive with Cornerstone Drive. Based on the results of the analysis, the intersection does not satisfy the criteria for installation of a traffic signal.

Copies of the charts and graphs used to verify warrants for the installation of traffic signal control are included in Appendix I to this report.

AUXILIARY TURN LANE WARRANTS EVALUATION

The need for auxiliary right turn lanes at the proposed Western and Eastern Site Driveways with Cornerstone Drive was evaluated based on the Right-Turn Lane Volume Thresholds for Two-Lane Roadways with a Prevailing Speed of 35 MPH of Less, published in the *Knox County Access Control and Driveway Design Policy*, 1996.

Warrants for the construction of a westbound auxiliary right turn lanes on Cornerstone Drive are not forecasted to be satisfied at its intersection with the proposed western and eastern site driveways.

Copies of the worksheets used to evaluate the guidelines for the consideration of the auxiliary right turn lanes have been included in Appendix J to this report.

QUEUING ANALYSIS

Traffic volumes at each of the study intersections were used to perform queuing analyses for each approach to each intersection. These queuing analyses were reported as the 95th percentile queue obtained from the results of the Highway Capacity Software (HCS) analyses performed for each of the study intersections, multiplied by an assumed 25 feet per vehicle. The results of these queuing analyses are summarized in Table 4 and Table 5 for the weekday A.M. peak hour and weekday P.M. peak hour, respectively.

As shown in the tables, existing auxiliary turn lanes are reported to be of sufficient length to accommodate the existing and projected 95th percentile queue lengths at each of the study intersections. Additionally, the reported queue lengths along Cornerstone Drive at Lovell Road are not anticipated to queue beyond the proposed site driveways. Therefore, no queueing issues are anticipated with the proposed development.

SIGHT DISTANCE CALCULATION

Measurements were performed in order to verify the available sight distance at the proposed Western and Eastern Site Driveway intersections with Cornerstone Drive. The measurements were performed in accordance with the Knoxville-Knox County Minimum Subdivision Regulations. According to the subdivision regulations, intersection sight distance is calculated as 10 times the posted speed. Therefore, for Cornerstone Drive, the intersection sight distance was calculated to be 300 feet.

A summary of the available and the required intersection sight distances at the proposed driveway intersection locations are presented in Table 6. As shown in the table, the available sight distance exceeds the required intersection sight distance at the proposed driveway intersection locations.

CONCLUSIONS/RECOMMENDATIONS

This study has concluded that the construction of the proposed Cornerstone Drive Apartments will have no significant impact on the operation of the adjacent study intersections.

Therefore, CEC recommends the following:

- Construct the proposed western site driveway to the Cornerstone Drive to provide one (1) lane for ingress traffic and one (1) lane for egress traffic. The driveway should be controlled by a Stop sign on the southbound site driveway approach to the Cornerstone Drive.
- Construct the proposed eastern site driveway to the Cornerstone Drive to provide one (1) lane for ingress traffic and one (1) lane for egress traffic. The driveway should be controlled by a Stop sign on the southbound site driveway approach to the Cornerstone Drive.

This concludes CEC's Traffic Impact Study for the proposed Cornerstone Drive Apartments development, to be constructed on the northeast corner of the intersection of Lovell Road (SR 131) and Cornerstone Drive in Knox County, Tennessee.

This report includes a Technical Appendix containing all counts, analyses and calculations.

TABLES

TABLE 1
LEVEL OF SERVICE - WEEKDAY AM PEAK HOUR [(1)(2)]
Traffic Impact Study for the Proposed Cornerstone Drive Apartments
Knox County, Tennessee

Direction	Approach/ Movement	2022 Existing	Forecasted 2024 Opening Year - Without Development	Forecasted 2024 Opening Year - With Development
INTERSECTION	**LOVELL ROAD WITH CORNERSTONE DRIVE**			
CORNERSTONE DRIVE WESTBOUND	**Left**	D (27.2)	D (29.2)	D (28.7)
	Right	B (10.8)	B (11.0)	B (11.3)
	Approach	B (13.0)	B (13.2)	B (13.5)
LOVELL ROAD NORTHBOUND	**Through**	- -	- -	- -
	Right	- -	- -	- -
	Approach	- -	- -	- -
LOVELL ROAD SOUTHBOUND	**Left**	A (9.3)	A (9.5)	A (9.6)
	Through	- -	- -	- -
	Approach	A (1.4)	A (1.4)	A (1.5)
	OVERALL	- -	- -	- -
INTERSECTION	**MURDOCK DRIVE WITH CORNERSTONE DRIVE**			
CORNERSTONE DRIVE EASTBOUND	**Left**	C (17.7)	C (20.3)	C (25.0)
	Through	B (11.4)	B (11.5)	B (11.4)
	Right			
	Approach	C (16.2)	C (17.9)	C (20.7)
CONCORD TILE DRIVEWAY WESTBOUND	**Approach**	B (14.8)	C (15.6)	C (16.3)
MURDOCK DRIVE NORTHBOUND	**Left**	A (8.1)	A (8.2)	A (8.2)
	Through	- -	- -	- -
	Right			
	Approach	A (0.2)	A (0.3)	A (0.4)
MURDOCK DRIVE SOUTHBOUND	**Left**	A (8.5)	A (8.6)	A (8.6)
	Through	- -	- -	- -
	Right	- -	- -	- -
	Approach	A (0.1)	A (0.1)	A (0.1)
	OVERALL	- -	- -	- -

TABLE 1 (con't)
LEVEL OF SERVICE - WEEKDAY AM PEAK HOUR [1][2]
Traffic Impact Study for the Proposed Dominion Cornerstone Residential Development
Knox County, Tennessee

Direction	Approach/ Movement	2022 Existing	Forecasted 2024 Opening Year - Without Development	Forecasted 2024 Opening Year - With Development
INTERSECTION	**CORNERSTONE DRIVE WITH WESTERN SITE DRIVEWAY**			
CORNERSTONE DRIVE EASTBOUND	**Left**	- -	- -	A (7.4)
	Through	- -	- -	- -
	Approach	- -	- -	A (0.3)
CORNERSTONE DRIVE WESTBOUND	**Through**	- -	- -	- -
	Right			
	Approach	- -	- -	- -
WESTERN SITE DRIVEWAY SOUTHBOUND	**Approach**	- -	- -	A (9.7)
	OVERALL	- -	- -	- -
INTERSECTION	**CORNERSTONE DRIVE WITH EASTERN SITE DRIVEWAY**			
CORNERSTONE DRIVE EASTBOUND	**Left**	- -	- -	A (7.4)
	Through	- -	- -	- -
	Approach	- -	- -	A (0.2)
CORNERSTONE DRIVE WESTBOUND	**Through**	- -	- -	- -
	Right			
	Approach	- -	- -	- -
EASTERN SITE DRIVEWAY SOUTHBOUND	**Approach**	- -	- -	A (9.7)
	OVERALL	- -	- -	- -

(1) Level of Service and vehicular delay calculated using methodologies published by the Transportation Research Board in their *Highway Capacity Manual,* Sixth Edition, 2017.

(2) A.M. Peak Hour - 7:30-8:30 A.M.

Source: Analysis by CEC.

TABLE 2
LEVEL OF SERVICE - WEEKDAY PM PEAK HOUR [(1)(2)]
Traffic Impact Study for the Proposed Cornerstone Drive Apartments
Knox County, Tennessee

Direction	Approach/ Movement	2022 Existing	Forecasted 2024 Opening Year - Without Development	Forecasted 2024 Opening Year - With Development
INTERSECTION	**LOVELL ROAD WITH CORNERSTONE DRIVE**			
CORNERSTONE DRIVE WESTBOUND	**Left**	E (36.9)	E (41.5)	E (49.4)
	Right	C (19.3)	C (21.3)	C (24.5)
	Approach	C (21.9)	C (24.3)	D (28.1)
LOVELL ROAD NORTHBOUND	**Through**	- -	- -	- -
	Right	- -	- -	- -
	Approach	- -	- -	- -
LOVELL ROAD SOUTHBOUND	**Left**	B (13.1)	B (13.8)	B (15.0)
	Through	- -	- -	- -
	Approach	A (1.2)	A (1.4)	A (2.0)
	OVERALL	- -	- -	- -
INTERSECTION	**MURDOCK DRIVE WITH CORNERSTONE DRIVE**			
CORNERSTONE DRIVE EASTBOUND	**Left**	C (18.7)	C (22.1)	D (30.3)
	Through	B (12.3)	B (13.0)	B (13.7)
	Right			
	Approach	C (17.0)	C (19.2)	C (24.3)
CONCORD TILE DRIVEWAY WESTBOUND	**Approach**	C (17.3)	C (19.7)	C (22.7)
MURDOCK DRIVE NORTHBOUND	**Left**	A (9.9)	B (10.4)	B (11.1)
	Through	- -	- -	- -
	Right			
	Approach	A (1.0)	A (1.3)	A (2.0)
MURDOCK DRIVE SOUTHBOUND	**Left**	A (8.1)	A (8.2)	A (8.2)
	Through	- -	- -	- -
	Right	- -	- -	- -
	Approach	A (0.0)	A (0.0)	A (0.0)
	OVERALL	- -	- -	- -

TABLE 2 (con't)
LEVEL OF SERVICE - WEEKDAY PM PEAK HOUR [1][2]
Traffic Impact Study for the Proposed Dominion Cornerstone Residential Development
Knox County, Tennessee

Direction	Approach/ Movement	2022 Existing	Forecasted 2024 Opening Year - Without Development	Forecasted 2024 Opening Year - With Development
INTERSECTION	**CORNERSTONE DRIVE WITH WESTERN SITE DRIVEWAY**			
CORNERSTONE DRIVE EASTBOUND	**Left**	- -	- -	A (7.9)
	Through	- -	- -	- -
	Approach	- -	- -	A (0.9)
CORNERSTONE DRIVE WESTBOUND	**Through**	- -	- -	- -
	Right			
	Approach	- -	- -	- -
WESTERN SITE DRIVEWAY SOUTHBOUND	**Approach**	- -	- -	B (10.5)
	OVERALL	- -	- -	- -
INTERSECTION	**CORNERSTONE DRIVE WITH EASTERN SITE DRIVEWAY**			
CORNERSTONE DRIVE EASTBOUND	**Left**	- -	- -	A (8.1)
	Through	- -	- -	- -
	Approach	- -	- -	A (0.9)
CORNERSTONE DRIVE WESTBOUND	**Through**	- -	- -	- -
	Right			
	Approach	- -	- -	- -
EASTERN SITE DRIVEWAY SOUTHBOUND	**Approach**	- -	- -	B (11.0)
	OVERALL	- -	- -	- -

(1) Level of Service and vehicular delay calculated using methodologies published by the Transportation Research Board in their *Highway Capacity Manual,* Sixth Edition, 2017.

(2) P.M. Peak Hour - 5:00-6:00 P.M.

Source: Analysis by CEC.

TABLE 3
ANTICIPATED TRIP GENERATION [1]
Traffic Impact Study for the Proposed Cornerstone Drive Apartments
Knox County, Tennessee

Land Use Code	Description	Size	Trip Generation [1]						
			Weekday 24-Hour	Weekday A.M. Peak Hour			Weekday P.M. Peak Hour		
				Enter	Exit	Total	Enter	Exit	Total
N/A	Local Apartment - Trip Generation Study	318 units	2,700	34	122	156	123	100	223

(1) Anticipated trip generation calculated based on the rates published by Knoxville/Knox Co. MPC, December 1999.

TABLE 4
WEEKDAY A.M. PEAK HOUR QUEUE LENGTH [1]
Traffic Impact Study for the Proposed Cornerstone Drive Apartments
Knox County, Tennessee

Intersection/Approach/Movement			QUEUE LENGTH (feet)[2]				
			Existing 2022	Forecasted 2024 Opening Year – Without Development	Forecasted 2024 Opening Year – With Development	Available Storage (feet)	Adequate Storage (Yes/No)
Lovell Road with Cornerstone Drive	WB	L	3	8	8	145[3]	Yes
		R	5	13	13	145	Yes
	NB	TR	-	-	-	500+	Yes
	SB	L	15	18	18	500+	Yes
Murdock Drive with Cornerstone Drive	EB	L	33	75	75	150[3]	Yes
		TR	5	13	13	470	Yes
	WB	TRL	0	0	0	N/A	Yes
	NB	L	3	3	3	130[3]	Yes
		TR	0	0	0	130	Yes
	SB	L	0	0	0	500+	Yes
		R	0	0	0	150[4]	Yes
Cornerstone Drive with Western Site Driveway	EB	L	N/A	N/A	0	145	Yes
	WB	TR	N/A	N/A	0	370	Yes
	SB	LR	N/A	N/A	8	N/A	Yes
Cornerstone Drive with Eastern Site Driveway	EB	L	N/A	N/A	0	370	Yes
	WB	TR	N/A	N/A	0	45	Yes
	SB	LR	N/A	N/A	8	N/A	Yes

(1) 7:30 A.M. to 8:30 A.M.
(2) Queues reported as 95th Percentile Queue reported by Highway Capacity Software, multiplied by an assumed vehicle length of 25 feet.
(3) Queues may extend into the center two-way left turn lane if necessary.
(4) Available storage reflective of *875 Cornerstone Drive Apartments* background study.
N/A = Intersection does not exist prior to development.
Source: Analysis by CEC

TABLE 5
WEEKDAY P.M. PEAK HOUR QUEUE LENGTH [1]
Traffic Impact Study for the Proposed Cornerstone Drive Apartments
Knox County, Tennessee

Intersection/Approach/Movement			QUEUE LENGTH (feet)[2]				
			Existing 2022	Forecasted 2024 Opening Year – Without Development	Forecasted 2024 Opening Year – With Development	Available Storage (feet)	Adequate Storage (Yes/No)
Lovell Road with Cornerstone Drive	WB	L	20	20	30	145[3]	Yes
		R	45	53	75	145	Yes
	NB	TR	-	-	-	500+	Yes
	SB	L	15	20	30	500+	Yes
Murdock Drive with Cornerstone Drive	EB	L	15	53	53	150[3]	Yes
		TR	3	13	13	470	Yes
	WB	TRL	3	3	3	N/A	Yes
	NB	L	5	13	13	130[3]	Yes
		TR	0	0	0	130	Yes
	SB	L	0	0	0	500+	Yes
		R	0	0	0	150[4]	Yes
Cornerstone Drive with Western Site Driveway	EB	L	N/A	N/A	3	145	Yes
	WB	TR	N/A	N/A	0	370	Yes
	SB	LR	N/A	N/A	8	N/A	Yes
Cornerstone Drive with Eastern Site Driveway	EB	L	N/A	N/A	3	370	Yes
	WB	TR	N/A	N/A	0	45	Yes
	SB	LR	N/A	N/A	8	N/A	Yes

(1) 5:00 P.M. to 6:00 P.M.
(2) Queues reported as 95th Percentile Queue reported by Highway Capacity Software, multiplied by an assumed vehicle length of 25 feet.
(3) Queues may extend into the center two-way left turn lane if necessary.
(4) Available storage reflective of *875 Cornerstone Drive Apartments* background study.
N/A = Intersection does not exist prior to development.
Source: Analysis by CEC

TABLE 6

SIGHT DISTANCE SUMMARY [(1)]

Traffic Impact Study for the Proposed Cornerstone Drive Apartments

Knox County, Tennessee

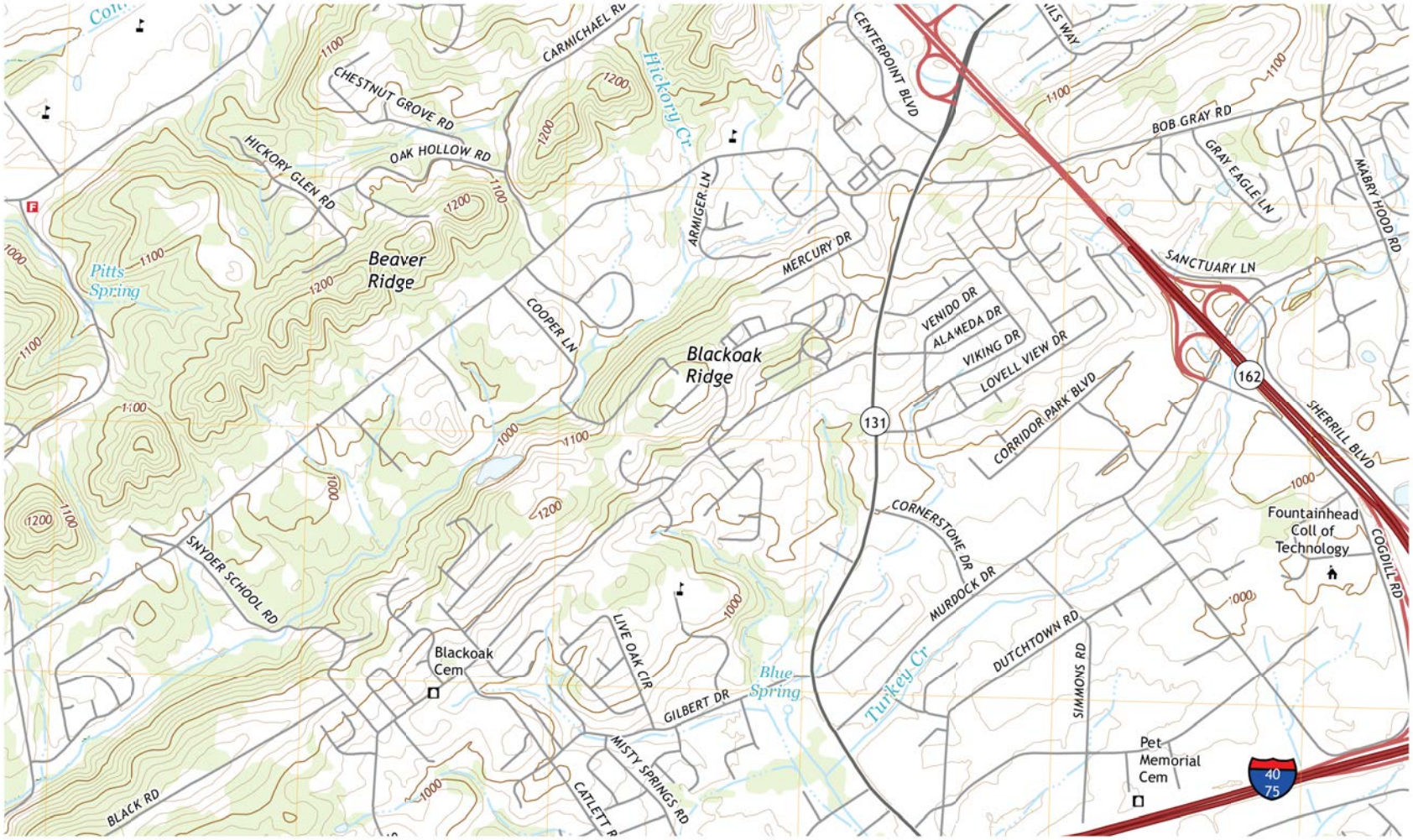
Location	Measured Sight Distance (feet)	Required Sight Distance (feet)	Sight Distance Acceptable (Yes/No)
CORNERSTONE DRIVE AND WESTERN SITE DRIVEWAY-30 MPH			
Looking Left from Driveway	400'+	300'	YES
Looking Right from Driveway	310'	300'	YES
CORNERSTONE DRIVE AND EASTERN SITE DRIVEWAY-30 MPH			
Looking Left from Driveway	400'+	300'	YES
Looking Right from Driveway	400'+	300'	YES

(1) Source: intersection sight distance for Cornerstone road calculated as 10 times the posted speed limit (30 mph) as per Knoxville-Knox County Minimum Subdivision Regulations.

Source: Analysis by CEC

FIGURES

NORTH



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CORNERSTONE RESIDENTIAL DEVELOPMENT
TRAFFIC IMPACT STUDY
KNOX COUNTY, TENNESSEE

SITE LOCATION

DRAWN BY:	ANL	CHECKED BY:	CAD	APPROVED BY:	CAD	FIGURE NO.:	1
DATE:	NOVEMBER 2022	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	325-727		

NORTH

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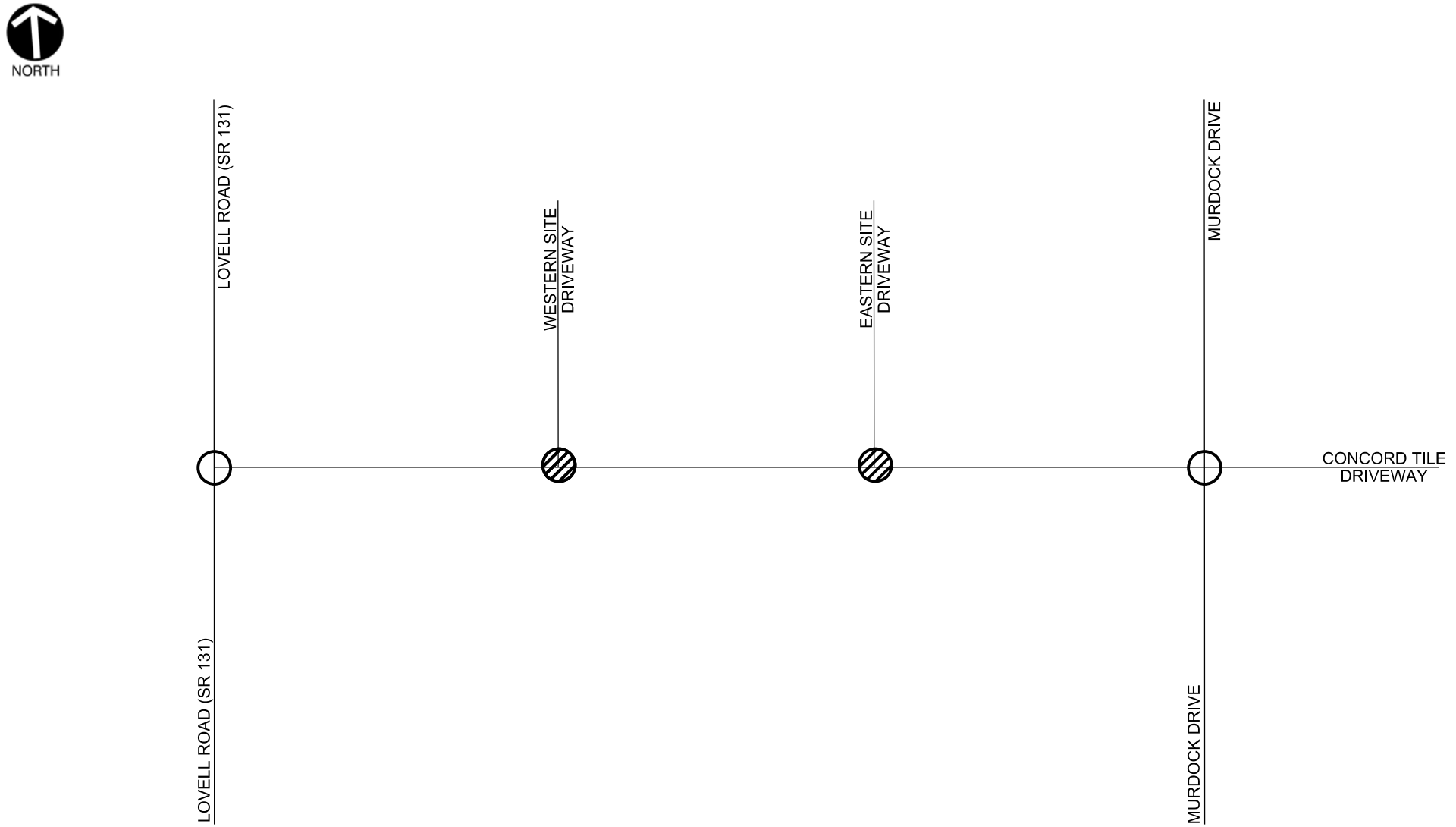
TRAFFIC IMPACT STUDY
KNOX COUNTY, TENNESSEE

SITE PLAN

DRAWN BY:	ANL	CHECKED BY:	CAD	APPROVED BY:	CAD	FIGURE NO.: 2
DATE:	NOVEMBER 2022	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	325-727	



LEGEND

EXISTING UNSIGNALIZED INTERSECTION

PROPOSED UNSIGNALIZED INTERSECTION

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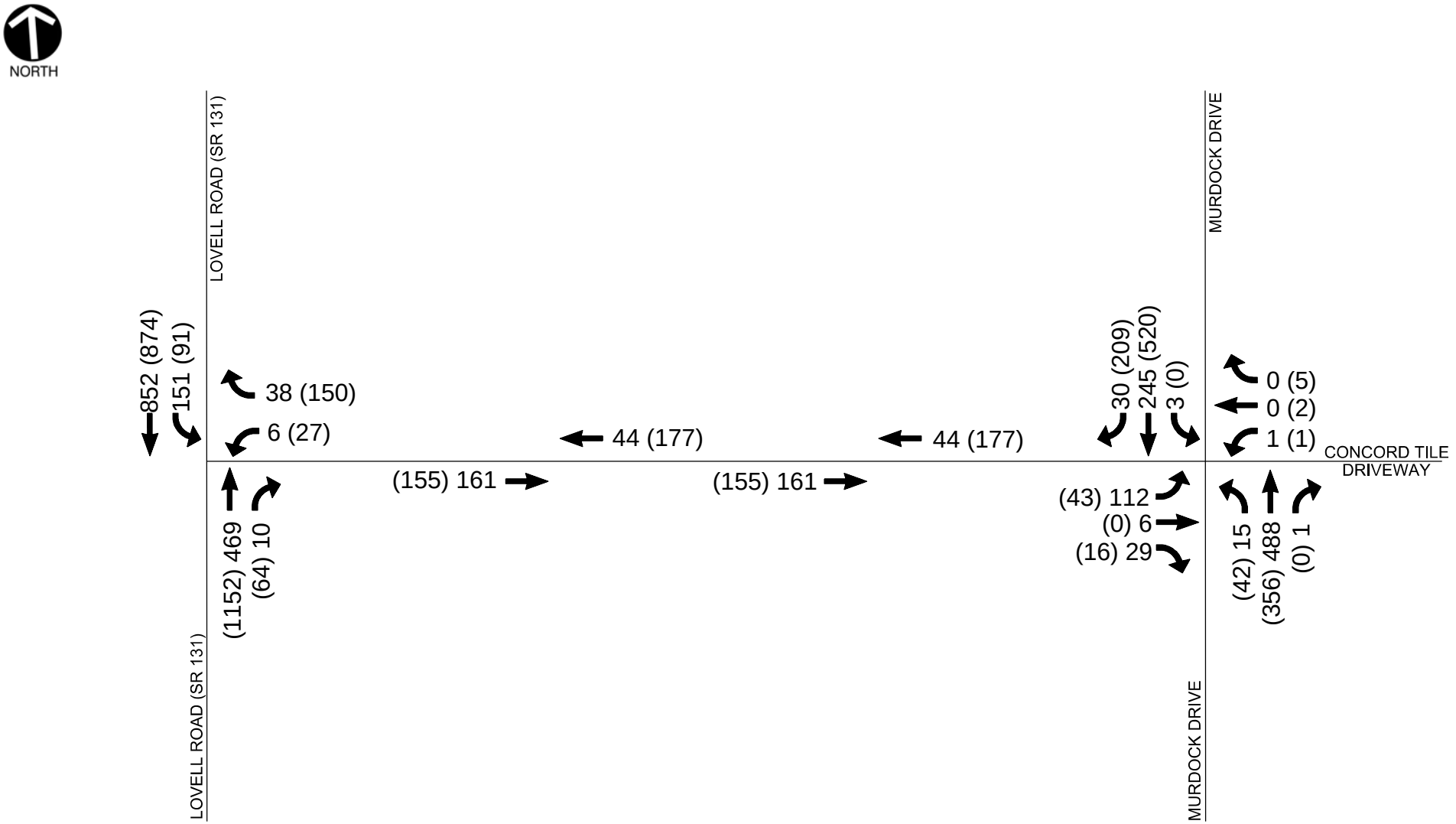
STUDY INTERSECTIONS

DRAWN BY:	ANL	CHECKED BY:	CAD	APPROVED BY:	CAD	FIGURE NO.: 3
DATE:	NOVEMBER 2022	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	325-727	



LEGEND

123 AM PEAK HOUR TRAFFIC VOLUMES

(123) PM PEAK HOUR TRAFFIC VOLUMES

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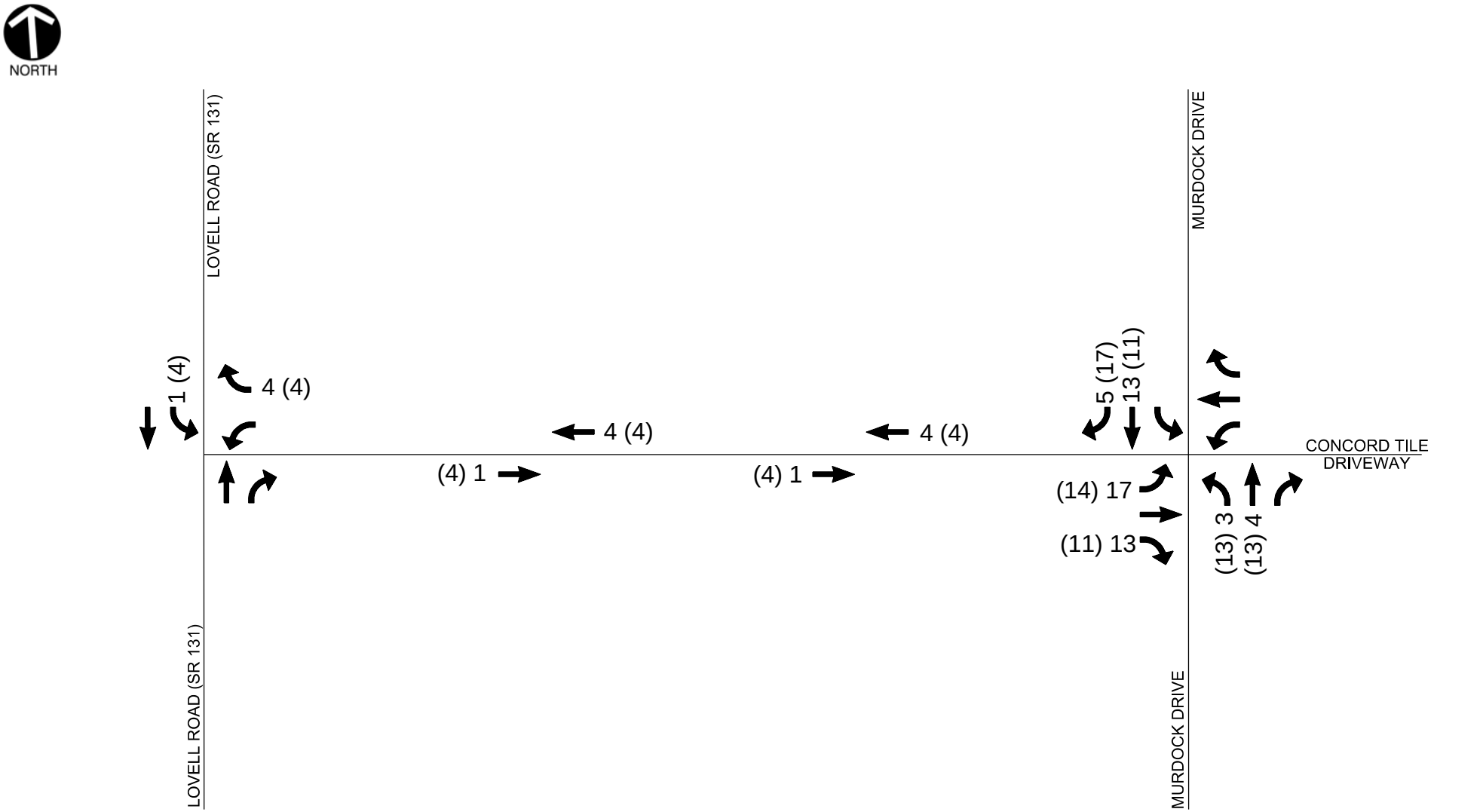
EXISTING 2022
PEAK HOUR TRAFFIC VOLUMES

DRAWN BY:	ANL	CHECKED BY:	CAD	APPROVED BY:	CAD	FIGURE NO.: 4
DATE:	NOVEMBER 2022	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	325-727	



LEGEND

123 AM PEAK HOUR TRAFFIC VOLUMES

(123) PM PEAK HOUR TRAFFIC VOLUMES

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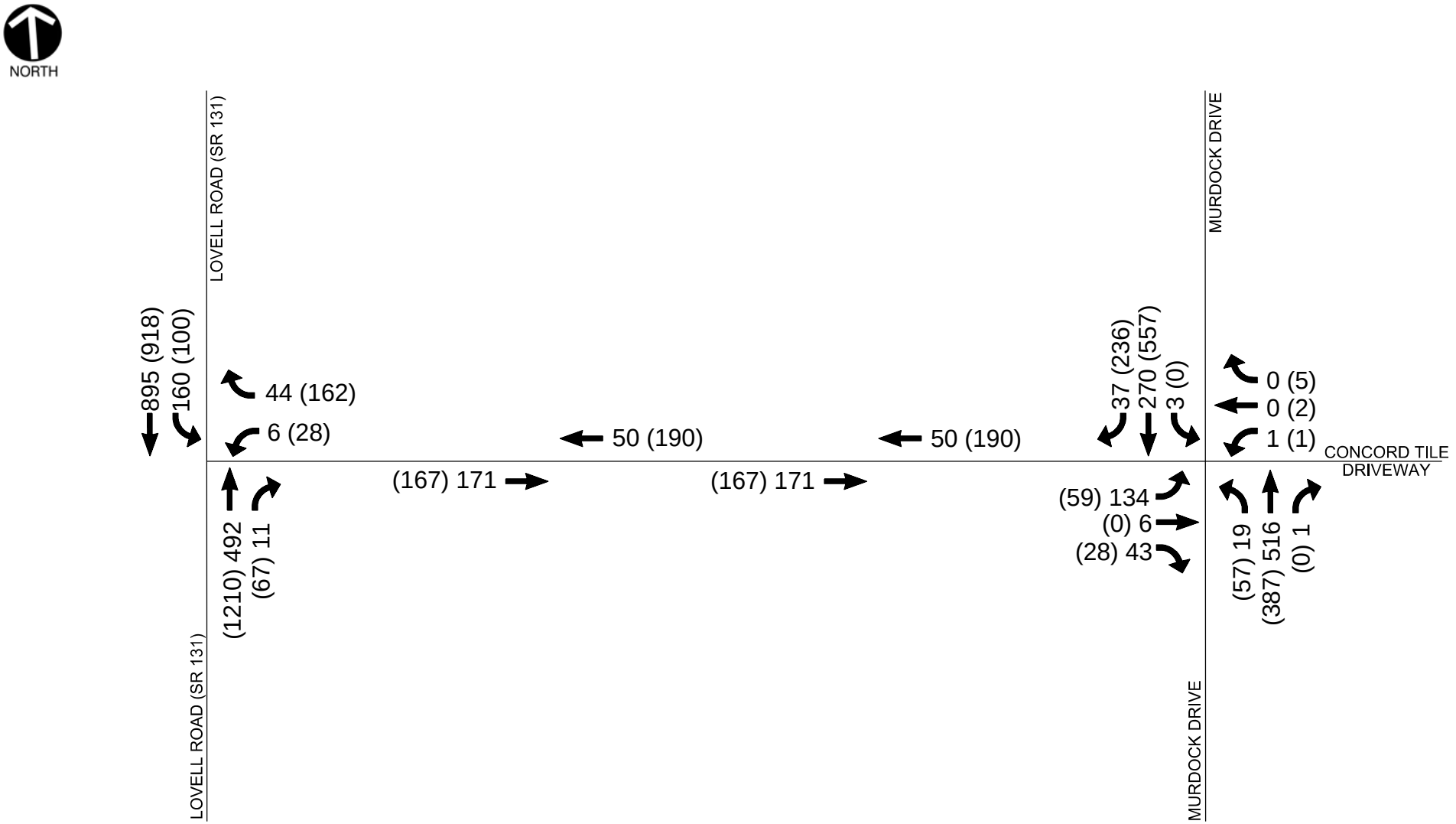
TRAFFIC IMPACT STUDY
KNOX COUNTY, TENNESSEE

APPROVED BACKGROUND DEVELOPMENT TRIPS

DRAWN BY:	ANL	CHECKED BY:	CAD	APPROVED BY:	CAD
DATE:	NOVEMBER 2022	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	325-727

FIGURE NO.: 5



LEGEND

123 AM PEAK HOUR TRAFFIC VOLUMES

(123) PM PEAK HOUR TRAFFIC VOLUMES

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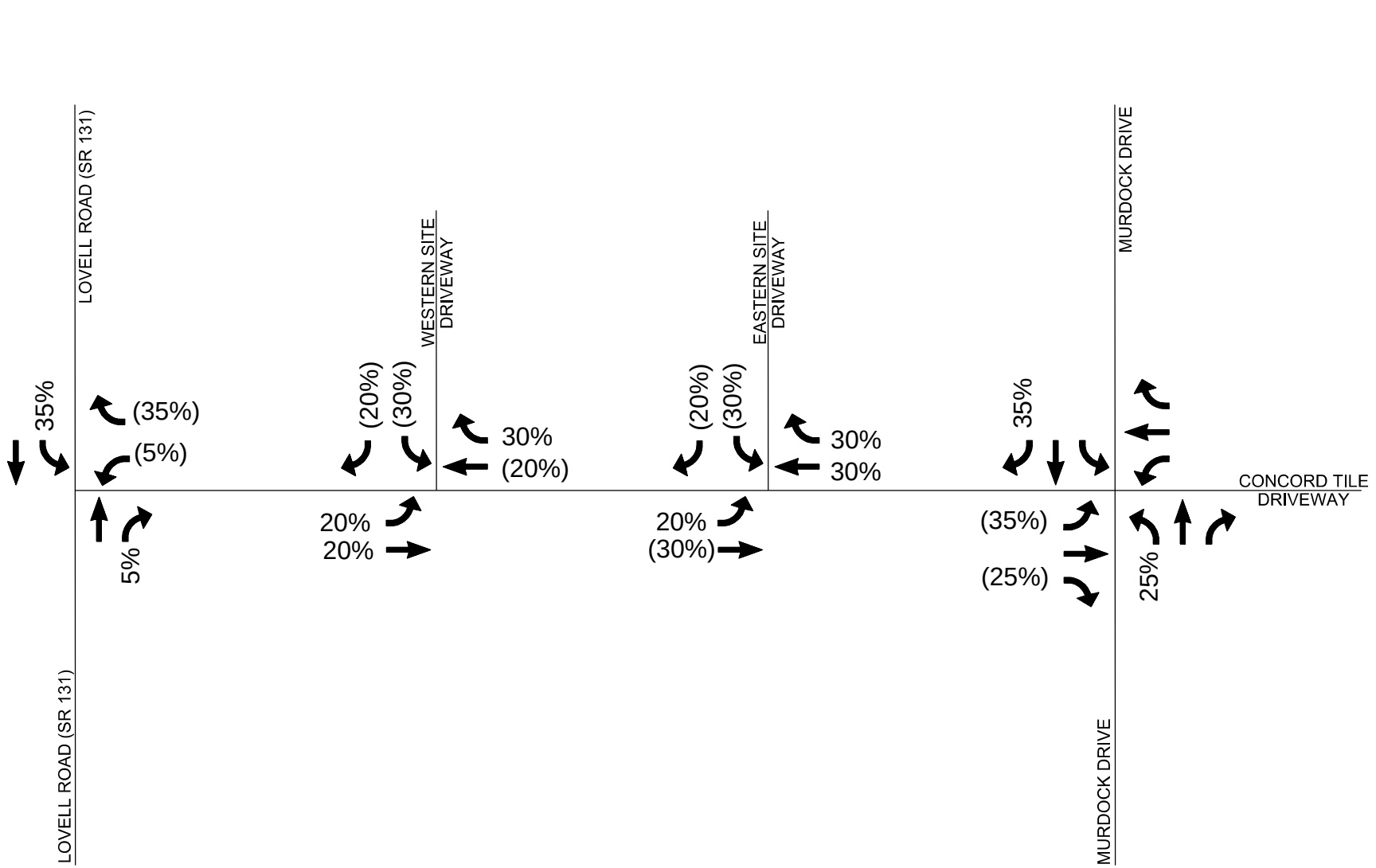
CORNERSTONE RESIDENTIAL DEVELOPMENT
TRAFFIC IMPACT STUDY
KNOX COUNTY, TENNESSEE

FORECASTED 2024 NO-BUILD (BASE)
PEAK HOUR TRAFFIC VOLUMES

DRAWN BY:	ANL	CHECKED BY:	CAD	APPROVED BY:	CAD	FIGURE NO.: 6
DATE:	NOVEMBER 2022	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	325-727	



LEGEND

12% ARRIVAL DISTRIBUTION PERCENTAGE

(12%) DEPARTURE DISTRIBUTION PERCENTAGE

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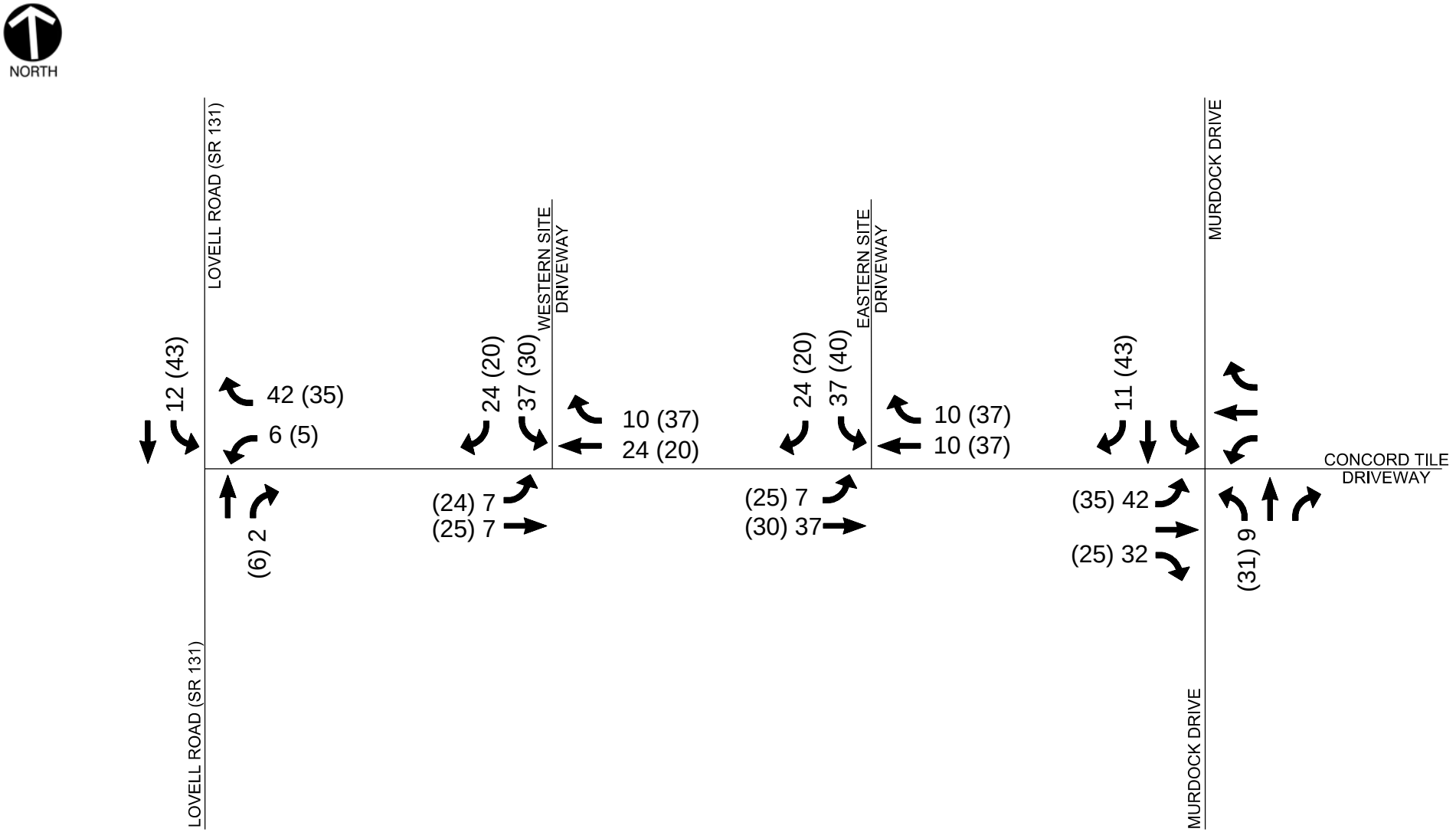
FORECASTED TRIP DISTRIBUTION

DRAWN BY:	ANL	CHECKED BY:	CAD	APPROVED BY:	CAD	FIGURE NO.: 7
DATE:	NOVEMBER 2022	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	325-727	



LEGEND

123 AM PEAK HOUR TRAFFIC VOLUMES

(123) PM PEAK HOUR TRAFFIC VOLUMES

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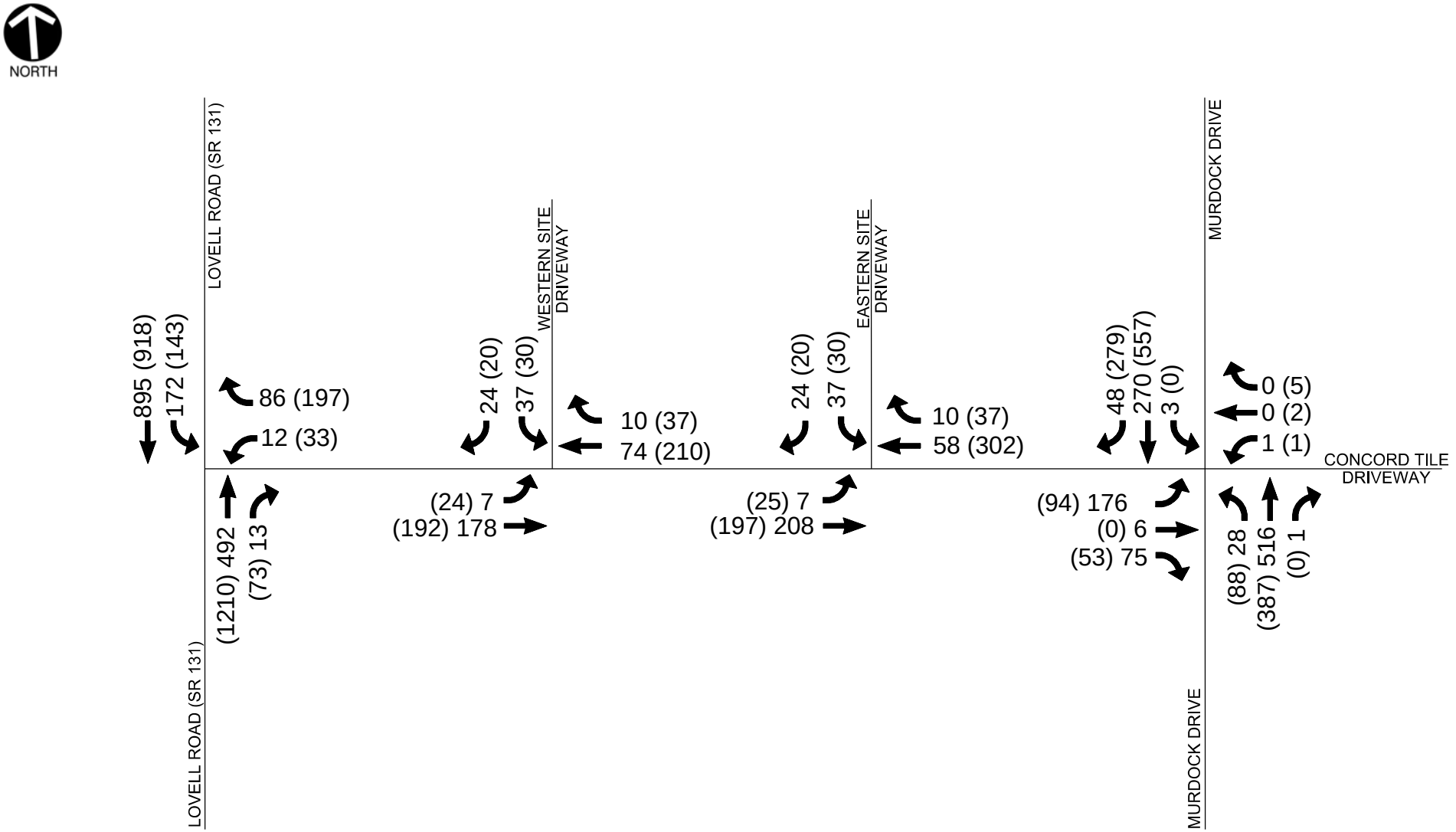
FORECASTED TRIP ADDITIONS

DRAWN BY:	ANL	CHECKED BY:	CAD	APPROVED BY:	CAD	FIGURE NO.: 9
DATE:	NOVEMBER 2022	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	325-727	



LEGEND

123 AM PEAK HOUR TRAFFIC VOLUMES

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CORNERSTONE RESIDENTIAL DEVELOPMENT
TRAFFIC IMPACT STUDY
KNOX COUNTY, TENNESSEE

FORECASTED 2024 BUILD (WITH DEVELOPMENT)
PEAK HOUR TRAFFIC VOLUMES

DRAWN BY:	ANL	CHECKED BY:	CAD	APPROVED BY:	CAD
DATE:	NOVEMBER 2022	DWG SCALE:	NOT TO SCALE	PROJECT NUMBER:	325-727

FIGURE NO.: 9

APPENDIX A

TURNING MOVEMENT COUNT SUMMARIES

Quality Counts - Tennessee Operations
855 Springfield Hwy, Ste 108 | Goodlettsville, TN 37072

File Name : Lovell w Cornerstone - AM
Site Code : 325-727
Start Date : 9/22/2022
Page No : 1

Groups Printed- Cars - Heavy Vehicles

	Cornerstone Drive Westbound			Lovell Road Northbound			Lovell Road Southtbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
07:00 AM	1	1	2	83	3	86	11	138	149	237
07:15 AM	2	4	6	90	5	95	28	166	194	295
07:30 AM	1	6	7	99	4	103	33	204	237	347
07:45 AM	3	13	16	132	1	133	45	246	291	440
Total	7	24	31	404	13	417	117	754	871	1319
08:00 AM	1	11	12	120	0	120	36	221	257	389
08:15 AM	1	8	9	118	5	123	37	181	218	350
08:30 AM	4	9	13	104	3	107	31	208	239	359
08:45 AM	1	9	10	114	0	114	22	139	161	285
Total	7	37	44	456	8	464	126	749	875	1383
Grand Total	14	61	75	860	21	881	243	1503	1746	2702
Apprch %	18.7	81.3		97.6	2.4		13.9	86.1		
Total %	0.5	2.3	2.8	31.8	0.8	32.6	9	55.6	64.6	
Cars	10	50	60	785	14	799	234	1416	1650	2509
% Cars	71.4	82	80	91.3	66.7	90.7	96.3	94.2	94.5	92.9
Heavy Vehicles	4	11	15	75	7	82	9	87	96	193
% Heavy Vehicles	28.6	18	20	8.7	33.3	9.3	3.7	5.8	5.5	7.1

	Cornerstone Drive Westbound			Lovell Road Northbound			Lovell Road Southtbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	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	6	7	99	4	103	33	204	237	347
07:45 AM	3	13	16	132	1	133	45	246	291	440
08:00 AM	1	11	12	120	0	120	36	221	257	389
08:15 AM	1	8	9	118	5	123	37	181	218	350
Total Volume	6	38	44	469	10	479	151	852	1003	1526
% App. Total	13.6	86.4		97.9	2.1		15.1	84.9		
PHF	.500	.731	.688	.888	.500	.900	.839	.866	.862	.867
Cars	4	33	37	425	7	432	149	797	946	1415
% Cars	66.7	86.8	84.1	90.6	70.0	90.2	98.7	93.5	94.3	92.7
Heavy Vehicles	2	5	7	44	3	47	2	55	57	111
% Heavy Vehicles	33.3	13.2	15.9	9.4	30.0	9.8	1.3	6.5	5.7	7.3

Quality Counts - Tennessee Operations
855 Springfield Hwy, Ste 108 | Goodlettsville, TN 37072

File Name : Lovell w Cornerstone - PM
Site Code : 325-727
Start Date : 9/22/2022
Page No : 1

Groups Printed- Cars - Heavy Vehicles

	Cornerstone Drive Westbound			Lovell Road Northbound			Lovell Road Southtbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
04:00 PM	0	26	26	194	1	195	15	210	225	446
04:15 PM	1	32	33	260	4	264	10	178	188	485
04:30 PM	0	35	35	247	3	250	10	210	220	505
04:45 PM	3	35	38	237	4	241	9	207	216	495
Total	4	128	132	938	12	950	44	805	849	1931
05:00 PM	3	55	58	288	9	297	27	230	257	612
05:15 PM	10	43	53	285	23	308	25	198	223	584
05:30 PM	9	35	44	305	17	322	18	218	236	602
05:45 PM	5	17	22	274	15	289	21	228	249	560
Total	27	150	177	1152	64	1216	91	874	965	2358
Grand Total	31	278	309	2090	76	2166	135	1679	1814	4289
Apprch %	10	90		96.5	3.5		7.4	92.6		
Total %	0.7	6.5	7.2	48.7	1.8	50.5	3.1	39.1	42.3	
Cars	31	266	297	2013	76	2089	127	1632	1759	4145
% Cars	100	95.7	96.1	96.3	100	96.4	94.1	97.2	97	96.6
Heavy Vehicles	0	12	12	77	0	77	8	47	55	144
% Heavy Vehicles	0	4.3	3.9	3.7	0	3.6	5.9	2.8	3	3.4

	Cornerstone Drive Westbound			Lovell Road Northbound			Lovell Road Southtbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 05:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 05:00 PM										
05:00 PM	3	55	58	288	9	297	27	230	257	612
05:15 PM	10	43	53	285	23	308	25	198	223	584
05:30 PM	9	35	44	305	17	322	18	218	236	602
05:45 PM	5	17	22	274	15	289	21	228	249	560
Total Volume	27	150	177	1152	64	1216	91	874	965	2358
% App. Total	15.3	84.7		94.7	5.3		9.4	90.6		
PHF	.675	.682	.763	.944	.696	.944	.843	.950	.939	.963
Cars	27	149	176	1113	64	1177	89	855	944	2297
% Cars	100	99.3	99.4	96.6	100	96.8	97.8	97.8	97.8	97.4
Heavy Vehicles	0	1	1	39	0	39	2	19	21	61
% Heavy Vehicles	0	0.7	0.6	3.4	0	3.2	2.2	2.2	2.2	2.6

Quality Counts - Tennessee Operations
855 Springfield Hwy, Ste 108 | Goodlettsville, TN 37072

File Name : Murdock w Cornerstone AM
Site Code : 325-727
Start Date : 9/22/2022
Page No : 1

Groups Printed- Cars - Heavy Vehicles

	Cornerstone Drive Eastbound				Concord Tile Drive Westbound				Murdock Drive Northbound				Murdock Drive Southtbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	10	0	2	12	0	0	0	0	0	40	1	41	0	28	4	32	85
07:15 AM	26	1	3	30	0	0	0	0	2	76	0	78	0	29	5	34	142
07:30 AM	26	0	8	34	0	0	0	0	4	113	0	117	0	52	6	58	209
07:45 AM	36	1	6	43	0	0	0	0	4	138	1	143	0	66	10	76	262
Total	98	2	19	119	0	0	0	0	10	367	2	379	0	175	25	200	698
08:00 AM	26	2	4	32	0	0	0	0	3	138	0	141	0	79	8	87	260
08:15 AM	24	3	11	38	1	0	0	1	4	99	0	103	3	48	6	57	199
08:30 AM	26	1	5	32	0	0	2	2	1	68	1	70	3	50	12	65	169
08:45 AM	18	1	3	22	0	0	0	0	1	70	5	76	2	45	9	56	154
Total	94	7	23	124	1	0	2	3	9	375	6	390	8	222	35	265	782
Grand Total	192	9	42	243	1	0	2	3	19	742	8	769	8	397	60	465	1480
Apprch %	79	3.7	17.3		33.3	0	66.7		2.5	96.5	1		1.7	85.4	12.9		
Total %	13	0.6	2.8	16.4	0.1	0	0.1	0.2	1.3	50.1	0.5	52	0.5	26.8	4.1	31.4	
Cars	184	8	38	230	1	0	1	2	16	699	8	723	8	364	48	420	1375
% Cars	95.8	88.9	90.5	94.7	100	0	50	66.7	84.2	94.2	100	94	100	91.7	80	90.3	92.9
Heavy Vehicles	8	1	4	13	0	0	1	1	3	43	0	46	0	33	12	45	105
% Heavy Vehicles	4.2	11.1	9.5	5.3	0	0	50	33.3	15.8	5.8	0	6	0	8.3	20	9.7	7.1

	Cornerstone Drive Eastbound				Concord Tile Drive Westbound				Murdock Drive Northbound				Murdock Drive Southtbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	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	26	0	8	34	0	0	0	0	4	113	0	117	0	52	6	58	209
07:45 AM	36	1	6	43	0	0	0	0	4	138	1	143	0	66	10	76	262
08:00 AM	26	2	4	32	0	0	0	0	3	138	0	141	0	79	8	87	260
08:15 AM	24	3	11	38	1	0	0	1	4	99	0	103	3	48	6	57	199
Total Volume	112	6	29	147	1	0	0	1	15	488	1	504	3	245	30	278	930
% App. Total	76.2	4.1	19.7		100	0	0		3	96.8	0.2		1.1	88.1	10.8		
PHF	.778	.500	.659	.855	.250	.000	.000	.250	.938	.884	.250	.881	.250	.775	.750	.799	.887
Cars	111	5	27	143	1	0	0	1	13	470	1	484	3	227	25	255	883
% Cars	99.1	83.3	93.1	97.3	100	0	0	100	86.7	96.3	100	96.0	100	92.7	83.3	91.7	94.9
Heavy Vehicles	1	1	2	4	0	0	0	0	2	18	0	20	0	18	5	23	47
% Heavy Vehicles	0.9	16.7	6.9	2.7	0	0	0	0	13.3	3.7	0	4.0	0	7.3	16.7	8.3	5.1

Quality Counts - Tennessee Operations
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File Name : Murdock w Cornerstone PM
Site Code : 325-727
Start Date : 9/22/2022
Page No : 1

Groups Printed- Cars - Heavy Vehicles

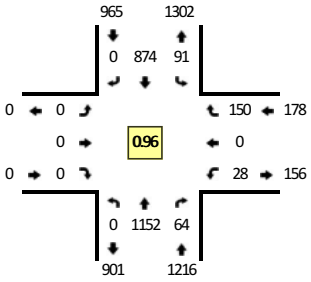
	Cornerstone Drive Eastbound				Concord Tile Drive Westbound				Murdock Drive Northbound				Murdock Drive Southtbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	17	0	3	20	0	0	0	0	9	85	0	94	0	58	15	73	187
04:15 PM	11	0	2	13	1	1	0	2	6	68	1	75	1	68	25	94	184
04:30 PM	11	0	1	12	0	1	3	4	6	91	1	98	0	81	29	110	224
04:45 PM	10	0	0	10	1	0	1	2	5	58	0	63	1	116	43	160	235
Total	49	0	6	55	2	2	4	8	26	302	2	330	2	323	112	437	830
05:00 PM	13	0	5	18	0	2	4	6	21	100	0	121	0	140	49	189	334
05:15 PM	12	0	2	14	1	0	0	1	4	95	0	99	0	164	76	240	354
05:30 PM	10	0	7	17	0	0	1	1	9	94	0	103	0	116	51	167	288
05:45 PM	8	0	2	10	0	0	0	0	8	67	0	75	0	100	33	133	218
Total	43	0	16	59	1	2	5	8	42	356	0	398	0	520	209	729	1194
Grand Total	92	0	22	114	3	4	9	16	68	658	2	728	2	843	321	1166	2024
Apprch %	80.7	0	19.3		18.8	25	56.2		9.3	90.4	0.3		0.2	72.3	27.5		
Total %	4.5	0	1.1	5.6	0.1	0.2	0.4	0.8	3.4	32.5	0.1	36	0.1	41.7	15.9	57.6	
Cars	84	0	22	106	3	4	9	16	67	638	2	707	2	830	311	1143	1972
% Cars	91.3	0	100	93	100	100	100	100	98.5	97	100	97.1	100	98.5	96.9	98	97.4
Heavy Vehicles	8	0	0	8	0	0	0	0	1	20	0	21	0	13	10	23	52
% Heavy Vehicles	8.7	0	0	7	0	0	0	0	1.5	3	0	2.9	0	1.5	3.1	2	2.6

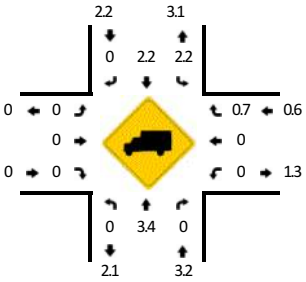
	Cornerstone Drive Eastbound				Concord Tile Drive Westbound				Murdock Drive Northbound				Murdock Drive Southtbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 05:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	13	0	5	18	0	2	4	6	21	100	0	121	0	140	49	189	334
05:15 PM	12	0	2	14	1	0	0	1	4	95	0	99	0	164	76	240	354
05:30 PM	10	0	7	17	0	0	1	1	9	94	0	103	0	116	51	167	288
05:45 PM	8	0	2	10	0	0	0	0	8	67	0	75	0	100	33	133	218
Total Volume	43	0	16	59	1	2	5	8	42	356	0	398	0	520	209	729	1194
% App. Total	72.9	0	27.1		12.5	25	62.5		10.6	89.4	0		0	71.3	28.7		
PHF	.827	.000	.571	.819	.250	.250	.313	.333	.500	.890	.000	.822	.000	.793	.688	.759	.843
Cars	41	0	16	57	1	2	5	8	42	347	0	389	0	516	208	724	1178
% Cars	95.3	0	100	96.6	100	100	100	100	100	97.5	0	97.7	0	99.2	99.5	99.3	98.7
Heavy Vehicles	2	0	0	2	0	0	0	0	0	9	0	9	0	4	1	5	16
% Heavy Vehicles	4.7	0	0	3.4	0	0	0	0	0	2.5	0	2.3	0	0.8	0.5	0.7	1.3

Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

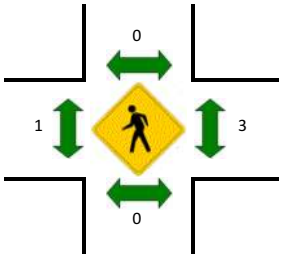
LOCATION: Lovell Rd -- Cornerstone Dr | **QC JOB #:** 15944302
CITY/STATE: Knoxville, TN | **DATE:** Thu, Sep 22 2022

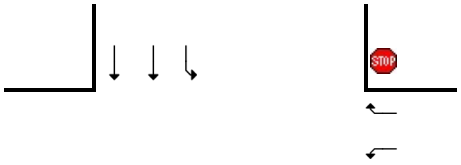
Peak-Hour: 5:00 PM -- 6:00 PM
Peak 15-Min: 5:00 PM -- 5:15 PM

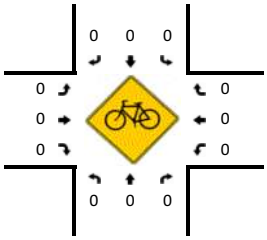


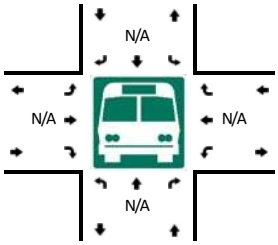


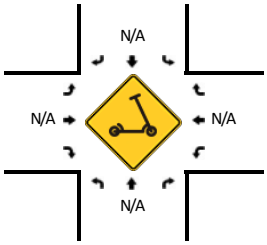
Quality Counts
DATA THAT DRIVES COMMUNITIES











15-Min Count Period Beginning At	Lovell Rd (Northbound)				Lovell Rd (Southbound)				Cornerstone Dr (Eastbound)				Cornerstone 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	194	1	0	15	210	0	0	0	0	0	0	0	0	26	0	446	
4:15 PM	0	260	4	0	10	178	0	0	0	0	0	0	1	0	32	0	485	
4:30 PM	0	247	3	0	10	210	0	0	0	0	0	0	0	0	35	0	505	
4:45 PM	0	237	4	0	9	207	0	0	0	0	0	0	3	0	35	0	495	1931
5:00 PM	0	288	9	0	27	230	0	0	0	0	0	0	3	0	55	0	612	2097
5:15 PM	0	285	23	0	25	198	0	0	0	0	0	0	10	0	43	0	584	2196
5:30 PM	0	305	17	0	18	218	0	0	0	0	0	0	9	0	35	0	602	2293
5:45 PM	0	274	15	0	21	228	0	0	0	0	0	0	5	0	17	1	561	2359

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	1152	36	0	108	920	0	0	0	0	0	0	12	0	220	0	2448
Heavy Trucks	0	32	0		0	12	0		0	0	0		0	0	0		44
Buses																	
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

Comments:

Report generated on 9/28/2022 7:38 AM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

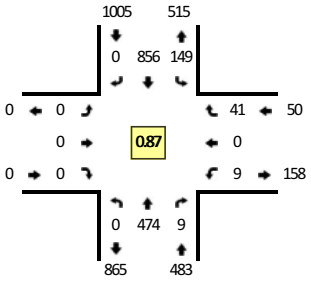
Type of peak hour being reported: Intersection Peak

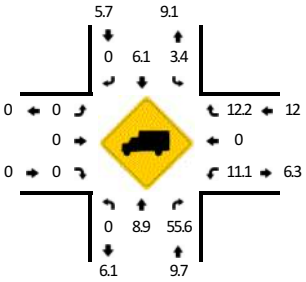
Method for determining peak hour: Total Entering Volume

LOCATION: Lovell Rd -- Cornerstone Dr
CITY/STATE: Knoxville, TN

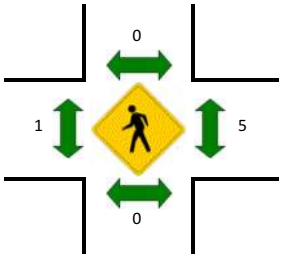
QC JOB #: 15944301
DATE: Thu, Sep 22 2022

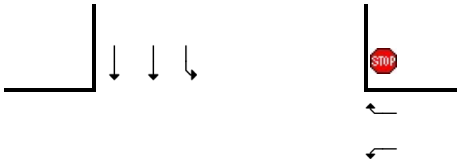
Peak-Hour: 7:45 AM -- 8:45 AM
Peak 15-Min: 7:45 AM -- 8:00 AM

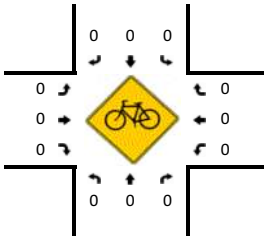


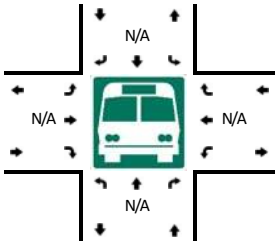


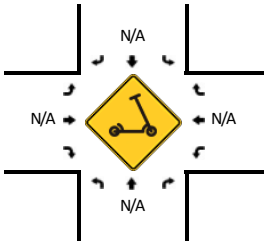
Quality Counts
DATA THAT DRIVES COMMUNITIES











15-Min Count Period Beginning At	Lovell Rd (Northbound)				Lovell Rd (Southbound)				Cornerstone Dr (Eastbound)				Cornerstone 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	83	3	0	11	138	0	0	0	0	0	0	1	0	1	0	237	
7:15 AM	0	90	5	0	28	166	0	0	0	0	0	0	2	0	4	0	295	
7:30 AM	0	99	4	0	33	204	0	0	0	0	0	0	1	0	6	0	347	
7:45 AM	0	132	1	0	45	246	0	0	0	0	0	0	3	0	13	0	440	1319
8:00 AM	0	120	0	0	36	221	0	0	0	0	0	0	1	0	11	0	389	1471
8:15 AM	0	118	5	0	37	181	0	0	0	0	0	0	1	0	8	0	350	1526
8:30 AM	0	104	3	0	31	208	0	0	0	0	0	0	4	0	9	0	359	1538
8:45 AM	0	114	0	0	22	139	0	0	0	0	0	0	1	0	9	0	285	1383

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	528	4	0	180	984	0	0	0	0	0	0	12	0	52	0	1760
Heavy Trucks	0	32	0		4	48	0		0	0	0		0	0	4		88
Buses																	
Pedestrians		0				0				0				12			12
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

Comments:

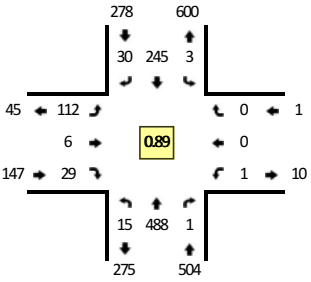
Report generated on 9/28/2022 7:38 AM

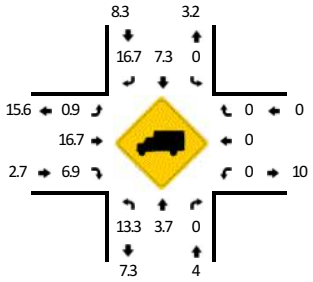
SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

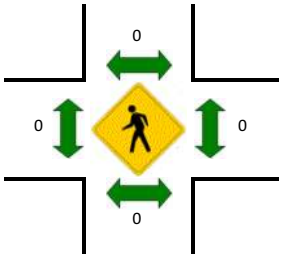
LOCATION: Murdock Dr -- Cornerstone Dr/Concord Title Dwy | **QC JOB #:** 15944303
CITY/STATE: Knoxville, TN | **DATE:** Thu, Sep 22 2022

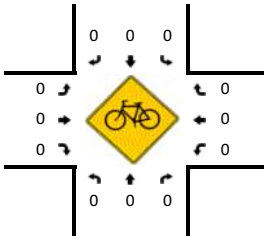
Peak-Hour: 7:30 AM -- 8:30 AM
Peak 15-Min: 7:45 AM -- 8:00 AM

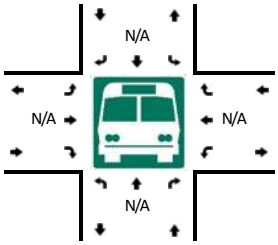


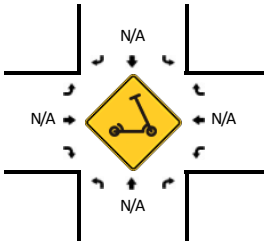


Quality Counts
DATA THAT DRIVES COMMUNITIES









15-Min Count Period Beginning At	Murdock Dr (Northbound)				Murdock Dr (Southbound)				Cornerstone Dr/Concord Title Dwy (Eastbound)				Cornerstone Dr/Concord Title Dwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	40	1	0	0	28	4	0	10	0	2	0	0	0	0	0	85	
7:15 AM	2	76	0	0	0	29	5	0	26	1	3	0	0	0	0	0	142	
7:30 AM	4	113	0	0	0	52	6	0	26	0	8	0	0	0	0	0	209	
7:45 AM	4	138	1	0	0	66	10	0	36	1	6	0	0	0	0	0	262	698
8:00 AM	3	138	0	0	0	79	8	0	26	2	4	0	0	0	0	0	260	873
8:15 AM	4	99	0	0	3	48	6	0	24	3	11	0	1	0	0	0	199	930
8:30 AM	1	68	1	0	3	50	12	0	26	1	5	0	0	0	2	0	169	890
8:45 AM	1	70	5	0	2	45	9	0	18	1	3	0	0	0	0	0	154	782

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	16	552	4	0	0	264	40	0	144	4	24	0	0	0	0	0	1048
Heavy Trucks	0	12	0		0	20	4		0	4	0		0	0	0		40
Buses																	
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

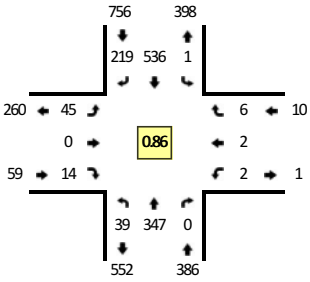
Comments:

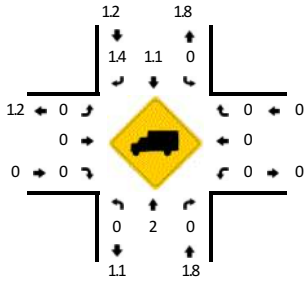
Report generated on 9/28/2022 7:38 AM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

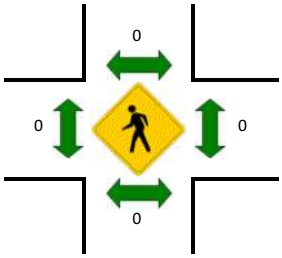
LOCATION: Murdock Dr -- Cornerstone Dr/Concord Title Dwy | **QC JOB #:** 15944304
CITY/STATE: Knoxville, TN | **DATE:** Thu, Sep 22 2022

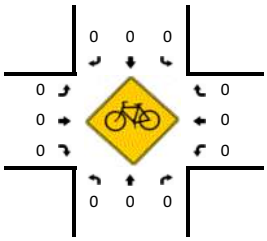
Peak-Hour: 4:45 PM -- 5:45 PM
Peak 15-Min: 5:15 PM -- 5:30 PM

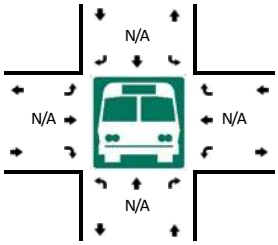


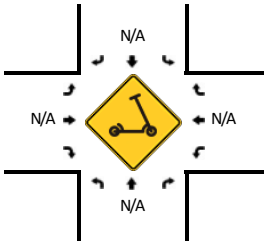


Quality Counts
DATA THAT DRIVES COMMUNITIES









15-Min Count Period Beginning At	Murdock Dr (Northbound)				Murdock Dr (Southbound)				Cornerstone Dr/Concord Title Dwy (Eastbound)				Cornerstone Dr/Concord Title Dwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	9	85	0	0	0	58	15	0	17	0	3	0	0	0	0	0	187	
4:15 PM	6	68	1	0	1	68	25	0	11	0	2	0	1	1	0	0	184	
4:30 PM	6	91	1	0	0	81	29	0	11	0	1	0	0	1	3	0	224	
4:45 PM	5	58	0	0	1	116	43	0	10	0	0	0	1	0	1	0	235	830
5:00 PM	21	100	0	0	0	140	49	0	13	0	5	0	0	2	4	0	334	977
5:15 PM	4	95	0	0	0	164	76	0	12	0	2	0	1	0	0	0	354	1147
5:30 PM	9	94	0	0	0	116	51	0	10	0	7	0	0	0	1	0	288	1211
5:45 PM	8	67	0	0	0	100	33	0	8	0	2	0	0	0	0	0	218	1194

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	16	380	0	0	0	656	304	0	48	0	8	0	4	0	0	0	1416
Heavy Trucks	0	8	0		0	4	0		0	0	0		0	0	0		12
Buses																	
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

Comments:

Report generated on 9/28/2022 7:38 AM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Heavy Vehicle Adjustments

Cornerstone Drive with Lovell Road

	Movement	2022 Existing				New Trips				Adjusted HV%			
		cars	trucks	total	HV%	cars	trucks	total	HV%	cars	trucks	total	HV%
AM Peak Hour	WBL	4	2	6	33.3%	6	0	6	2.0%	10	2	12	17%
	WBR	33	5	38	13.2%	41	1	42	2.0%	74	6	80	8%
	NBT	425	44	469	9.4%	0	0	0	2.0%	425	44	469	9%
	NBR	7	3	10	30.0%	2	0	2	2.0%	9	3	12	25%
	SBL	149	2	151	1.3%	12	0	12	2.0%	161	2	163	1%
	SBT	797	55	852	6.5%	0	0	0	2.0%	797	55	852	6%
	Movement	2022 Existing				New Trips				Adjusted HV%			
		cars	trucks	total	HV%	cars	trucks	total	HV%	cars	trucks	total	HV%
PM Peak Hour	WBL	27	0	27	0.0%	5	0	5	2.0%	32	0	32	0%
	WBR	149	1	150	0.7%	34	1	35	2.0%	183	2	185	1%
	NBT	1113	39	1152	3.4%	0	0	0	2.0%	1113	39	1152	3%
	NBR	64	0	64	0.0%	6	0	6	2.0%	70	0	70	0%
	SBL	89	2	91	2.2%	42	1	43	2.0%	131	3	134	2%
	SBT	855	19	874	2.2%	2	0	2	2.0%	857	19	876	2%

Cornerstone Drive with Murdock Drive

	Movement	2022 Existing				New Trips				Adjusted HV%			
		cars	trucks	total	HV%	cars	trucks	total	HV%	cars	trucks	total	HV%
AM Peak Hour	EBL	111	1	112	0.9%	41	1	42	2.0%	152	2	154	1%
	EBT	5	1	6	16.7%	0	0	0	2.0%	5	1	6	17%
	EBR	27	2	29	6.9%	31	1	32	2.0%	58	3	61	5%
	WBL	1	0	1	0.0%	0	0	0	2.0%	1	0	1	0%
	WBT	0	0	0	#DIV/0!	0	0	0	2.0%	0	0	0	#DIV/0!
	WBR	0	0	0	#DIV/0!	0	0	0	2.0%	0	0	0	#DIV/0!
	NBL	13	2	15	13.3%	9	0	9	2.0%	22	2	24	8%
	NBT	470	18	488	3.7%	0	0	0	2.0%	470	18	488	4%
	NBR	1	0	1	0.0%	0	0	0	2.0%	1	0	1	0%
	SBL	3	0	3	0.0%	0	0	0	2.0%	3	0	3	0%
	SBT	227	18	245	7.3%	0	0	0	2.0%	227	18	245	7%
	SBR	25	5	30	16.7%	11	0	11	2.0%	36	5	41	12%
	Movement	2022 Existing				New Trips				Adjusted HV%			
		cars	trucks	total	HV%	cars	trucks	total	HV%	cars	trucks	total	HV%
PM Peak Hour	EBL	41	2	43	4.7%	34	1	35	2.0%	75	3	78	4%
	EBT	0	0	0	#DIV/0!	0	0	0	2.0%	0	0	0	#DIV/0!
	EBR	16	0	16	0.0%	24	1	25	2.0%	40	1	41	2%
	WBL	1	0	1	0.0%	0	0	0	2.0%	1	0	1	0%
	WBT	2	0	2	0.0%	0	0	0	2.0%	2	0	2	0%
	WBR	5	0	5	0.0%	0	0	0	2.0%	5	0	5	0%
	NBL	42	0	42	0.0%	30	1	31	2.0%	72	1	73	1%
	NBT	347	9	356	2.5%	0	0	0	2.0%	347	9	356	3%
	NBR	0	0	0	#DIV/0!	0	0	0	2.0%	0	0	0	#DIV/0!
	SBL	0	0	0	#DIV/0!	0	0	0	2.0%	0	0	0	#DIV/0!
	SBT	516	4	520	0.8%	0	0	0	2.0%	516	4	520	1%
	SBR	208	1	209	0.5%	42	1	43	2.0%	250	2	252	1%

(1) HV% determined from turning movment counts performed in October 2022.

(2) New site traffic for the proposed residential devleopment is assumed to be 98 passenger sized vehicles and 2% heavy vehicles.

APPENDIX B

LEVEL OF SERVICE DEFINITIONS

LEVELS OF SERVICE

Intersection levels of service (LOS) were determined through implementation of the methodology presented in the *Highway Capacity Manual 6th Edition*, published by the Transportation Research Board.

i. Signalized Intersections

An explanation of level of service at signalized intersections is as follows:

This subsection describes the LOS criteria for the motorized vehicle mode. The criteria for the motorized vehicle mode are different from those for other modes. Specifically, the motorized vehicle mode criteria are based on performance measures that are field measurable and perceivable by travelers. The criteria for other modes are based on scores reported by travelers indicating their perception of service quality.

LOS can be characterized for the entire intersection, each intersection approach, and each lane group. Control delay alone is used to characterize LOS for the entire intersection of an approach. Control delay and volume-to-capacity ratio are used to characterize LOS for a lane group. Delay quantifies the increase in travel time due to traffic signal control. It is also a surrogate measure of driver discomfort and fuel consumption. The volume-to-capacity ratio quantifies the degree to which a phases's capacity is utilized by a lane group. The following paragraphs describe each LOS.

LOS A describes operations with a control delay of 10 s/veh or less and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is exceptionally favorable or the cycle length is very short. If it is due to favorable progression, most vehicles arrive during the green indication and travel through the intersection without stopping.

LOS B describes operations with control delay between 10 and 20 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is highly favorable or the cycle length is short. More vehicles stop than with LOS A.

LOS C describes operations with control delay between 20 and 35 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when progression is favorable or the cycle length is moderate. Individual *cycle failures* (i.e., one or more queued vehicles are not able to depart as a result of insufficient capacity during the cycle) may begin to appear at this level. The number of vehicles stopping is significant, although many vehicles still pass through the intersection without stopping.

LOS D describes operations with control delay between 35 and 55 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high and either progression is ineffective or the cycle length is long. Many vehicles stop and individual cycle failures are noticeable.

LOS E describes operations with control delay between 55 and 80 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high, progression is unfavorable, and the cycle length is long. Individual cycle failures are frequent.

LOS F describes operations with control delay exceeding 80 s/veh or a volume-to-capacity ratio greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is very high, progression is very poor, and the cycle length is long. Most cycles fail to clear the queue.

A lane group can incur a delay less than 80 s/veh when the volume-to-capacity ratio exceeds 1.0. This condition typically occurs when the cycle length is short, the signal progression is favorable, or both. As a result, both the delay and volume-to-capacity ratio are considered when lane group LOS is established. A ratio of 1.0 or more indicates that cycle capacity is fully utilized and represents failure from a capacity perspective (just as delay in excess of 80 s/veh represents failure from a delay perspective).

Exhibit 19-8 lists the LOS thresholds established for the motor vehicle mode at a signalized intersection.

Exhibit 19-8
LOS Criteria: Signalized Intersection

Control Delay (s/veh)	LOS by Volume-to-Capacity (v/c) Ratio[1]	
	v/c ≤ 1.0	v/c > 1.0
≤ 10	A	F
> 10 – 20	B	F
> 20 – 35	C	F
> 35 – 55	D	F
> 55 – 80	E	F
> 80	F	F

(1) For approach-based and intersectionwide assessments, LOS is defined solely by control delay.

ii. Unsignalized Intersections

The following level-of-service criteria for two-way stop-controlled and all-way stop-controlled intersections differ from the criteria for signalized intersections. The primary reason for this difference is that drivers expect different levels of performance from various kinds of transportation facilities. The expectation is that a signalized intersection is designed to carry higher traffic volumes than an unsignalized intersection. Thus, a higher level of control delay is acceptable at a signalized intersection for the same level of service.

Level of service for two-way stop-controlled (TWSC) intersections and an all-way stop control intersections is determined by the computed or measured control delay. For motor vehicles, LOS is determined for each minor-street movement (or shared movement), as well as the major-street left turns, by using the criteria given in Exhibit 20-2 and Exhibit 21-8. For TWSC intersections, LOS is not defined for the intersection as a whole or for major –street approaches for three primary reasons: (a) major-street through vehicles are assumed to experience zero delay; (b) the disproportionate number of major-street through vehicles a typical TWSC intersection skews the weighted average of all movements, resulting in a very low overall average delay for all vehicles; and (c) the resulting low delay can mask LOS deficiencies for minor movements. Level of service for two-way stop control is not defined for the intersection as a whole, while level of service for all-way stop control is defined for the intersection as a whole. Level of service criteria are given in Exhibit 20-2 (two-way stop-controlled intersections) and Exhibit 21-8 (all-way stop controlled intersections).

Exhibit 20-2 and Exhibit 21-8
LOS Criteria: Two-Way and All-Way Stop Controlled Intersections

Control Delay (s/veh)	LOS by Volume-to-Capacity (v/c) Ratio (1)(2)	
	v/c ≤ 1.0	v/c > 1.0
0 – 10	A	F
> 10 – 15	B	F
> 15 – 25	C	F
> 25 – 35	D	F
> 35 – 50	E	F
> 50	F	F

(1) TWSC: The LOS criteria apply to each lane on a given approach and to each approach on the minor street. LOS is not calculated for major-street approaches or for the intersection as a whole.
(2) AWSC: For approaches and intersectionwide assessment, LOS is defined solely by control delay.

APPENDIX C

EXISTING 2022 PEAK HOUR CAPACITY CALCULATIONS

HCS Two-Way Stop-Control Report

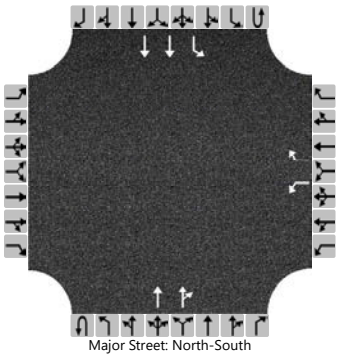
General Information

Analyst	ANL
Agency/Co.	CEC
Date Performed	10/18/2022
Analysis Year	2024
Time Analyzed	Build A.M. Peak Hour
Intersection Orientation	North-South
Project Description	Dominion Cornerstone Residential Development

Site Information

Intersection	Lovell Road with Cornerstone Drive
Jurisdiction	Knox County, TN
East/West Street	Cornerstone Drive
North/South Street	Lovell Road
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	2	0	0	1	2	0
Configuration						L		R			T	TR		L	T	
Volume (veh/h)						12		86			492	13	0	172	895	
Percent Heavy Vehicles (%)						17		8					0	1		
Proportion Time Blocked																
Percent Grade (%)						2										
Right Turn Channelized						No										
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						7.54		7.26						4.12		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.67		3.38						2.21		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						14		99						198		
Capacity, c (veh/h)						166		666						984		
v/c Ratio						0.08		0.15						0.20		
95% Queue Length, Q_{95} (veh)						0.3		0.5						0.7		
Control Delay (s/veh)						28.7		11.3						9.6		
Level of Service (LOS)						D		B						A		
Approach Delay (s/veh)						13.5								1.5		
Approach LOS						B								A		

HCS Two-Way Stop-Control Report

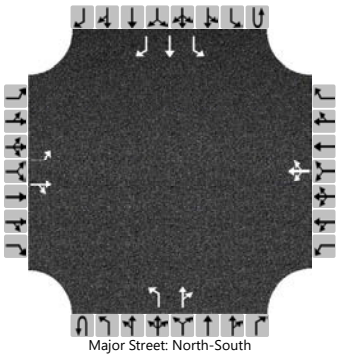
General Information

Analyst	ANL
Agency/Co.	CEC
Date Performed	10/18/2022
Analysis Year	2024
Time Analyzed	Build A.M. Peak Hour
Intersection Orientation	North-South
Project Description	Dominion Cornerstone Residential Development

Site Information

Intersection	Murdock Drive with Cornerstone Drive
Jurisdiction	Knox County, TN
East/West Street	Cornerstone Drive
North/South Street	Murdock Drive
Peak Hour Factor	0.89
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	1	0	0	1	1	0	0	1	1	1
Configuration		L		TR			LTR			L		TR		L	T	R
Volume (veh/h)		176	6	75		1	0	0		28	516	1		3	270	48
Percent Heavy Vehicles (%)		1	17	5		0	0	0		8				0		
Proportion Time Blocked																
Percent Grade (%)	-2				0											
Right Turn Channelized													No			
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		6.71	6.27	6.05		7.10	6.50	6.20		4.18				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.15	3.35		3.50	4.00	3.30		2.27				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		198		91			1			31				3		
Capacity, c (veh/h)		374		654			320			1169				1003		
v/c Ratio		0.53		0.14			0.00			0.03				0.00		
95% Queue Length, Q_{95} (veh)		3.0		0.5			0.0			0.1				0.0		
Control Delay (s/veh)		25.0		11.4			16.3			8.2				8.6		
Level of Service (LOS)		C		B			C			A				A		
Approach Delay (s/veh)	20.7				16.3				0.4				0.1			
Approach LOS	C				C				A				A			

HCS Two-Way Stop-Control Report

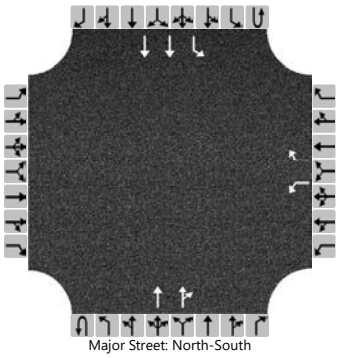
General Information

Analyst	ANL
Agency/Co.	CEC
Date Performed	10/6/2022
Analysis Year	2024
Time Analyzed	No Build P.M. Peak Hour
Intersection Orientation	North-South
Project Description	Dominion Cornerstone Residential Development

Site Information

Intersection	Lovell Road with Cornerstone Drive
Jurisdiction	Knox County, TN
East/West Street	Cornerstone Drive
North/South Street	Lovell Road
Peak Hour Factor	0.96
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	2	0	0	1	2	0
Configuration						L		R			T	TR		L	T	
Volume (veh/h)						28		162			1210	67	0	100	918	
Percent Heavy Vehicles (%)						0		1					0	2		
Proportion Time Blocked																
Percent Grade (%)						2										
Right Turn Channelized						No										
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						7.20		7.12						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.50		3.31						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						29		169						104		
Capacity, c (veh/h)						127		387						512		
v/c Ratio						0.23		0.44						0.20		
95% Queue Length, Q_{95} (veh)						0.8		2.1						0.8		
Control Delay (s/veh)						41.5		21.3						13.8		
Level of Service (LOS)						E		C						B		
Approach Delay (s/veh)						24.3								1.4		
Approach LOS						C								A		

HCS Two-Way Stop-Control Report

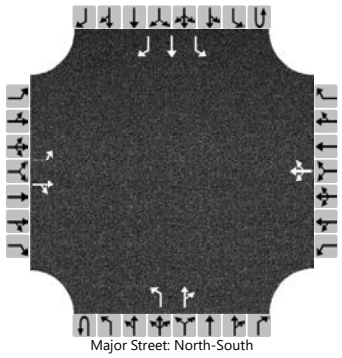
General Information

Analyst	ANL
Agency/Co.	CEC
Date Performed	10/18/2022
Analysis Year	2024
Time Analyzed	Existing P.M. Peak Hour
Intersection Orientation	North-South
Project Description	Dominion Cornerstone Residential Development

Site Information

Intersection	Murdock Drive with Cornerstone Drive
Jurisdiction	Knox County, TN
East/West Street	Cornerstone Drive
North/South Street	Murdock Drive
Peak Hour Factor	0.84
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	1	0	0	1	1	0	0	1	1	1
Configuration		L		TR			LTR			L		TR		L	T	R
Volume (veh/h)		94	0	53		1	2	5		88	387	0		0	557	279
Percent Heavy Vehicles (%)		4	0	2		0	0	0		1				0		
Proportion Time Blocked																
Percent Grade (%)	-2				0											
Right Turn Channelized													No			
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		6.74	6.10	6.02		7.10	6.50	6.20		4.11				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.54	4.00	3.32		3.50	4.00	3.30		2.21				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		112		63			10			105				0		
Capacity, c (veh/h)		252		478			213			699				1109		
v/c Ratio		0.44		0.13			0.04			0.15				0.00		
95% Queue Length, Q_{95} (veh)		2.1		0.5			0.1			0.5				0.0		
Control Delay (s/veh)		30.3		13.7			22.7			11.1				8.2		
Level of Service (LOS)		D		B			C			B				A		
Approach Delay (s/veh)	24.3				22.7				2.0				0.0			
Approach LOS	C				C				A				A			

APPENDIX D

BACKGROUND TRAFFIC GROWTH RATE CALCULATION

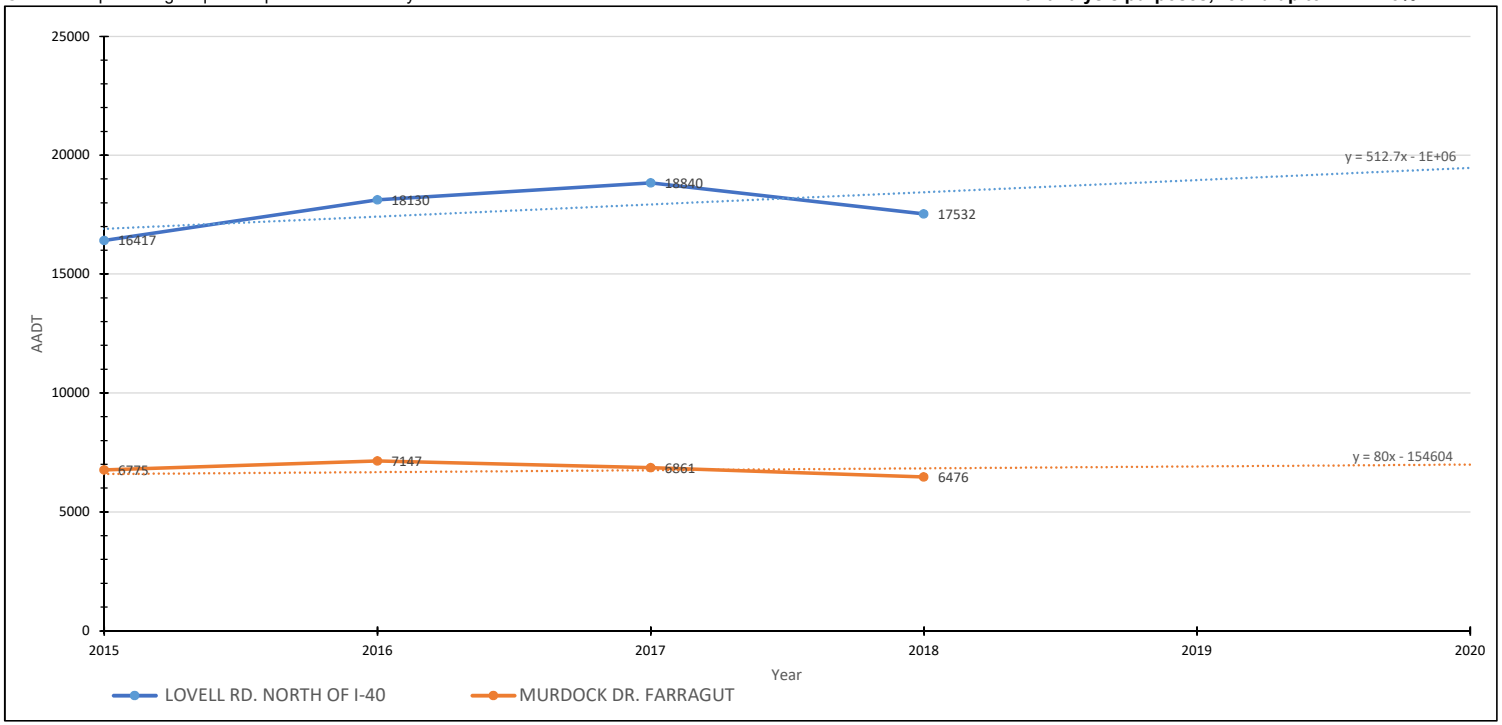
TABLE A1
BACKGROUND TRAFFIC GROWTH RATE CALCULATIONS

Station ID #	Location	AADT Traffic Counts (1)							Statistics						
		2014	2015	2016	2017	2018	2019	2020	Slope	Y-Intercept	Number of Data Points	R Squared	Linear Growth Rate (2)	Weight	Weighted Growth
47,000,285	LOVELL RD. NORTH OF I-40	16180	16417	18130	18840	17532			512.7000	-1016183.4	5	0.518	2.90%	0.73	2.12%
47,000,464	MURDOCK DR. FARRAGUT	6119	6775	7147	6861	6476			80.0000	-154604.4	5	0.104	1.20%	0.27	0.32%
						Total	24,008							1.00	2.44%

(1) Traffic count data obtained form the Tennesee Department of Transportation TDMS (Transportation data management system)

(2) Growth rate percentage equals slope of line divided by most recent count.

Average Weighted Linear Growth Rate **2.44%**
For analysis purposes, round up to: **2.5%**



APPENDIX E

APPROVED BACKGROUND PROJECT TRIP ADDITIONS

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 were utilized. The proposed development will include 216 multi-family residential apartment units. Local trip generation rates developed by the Knoxville-Knox County Metropolitan Planning Commission for multi-family apartment type developments within the region were utilized to generate the estimated trips. 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 APPENDIX B.

TABLE 2: TRIP GENERATION SUMMARY

LAND USE	ITE CODE	SIZE	WEEKDAY (TRIPS/DAY)	AM PEAK HOUR (TRIPS/HOUR)	PM PEAK HOUR (TRIPS/HOUR)
Multi-Family Residential	n/a	216 Dwelling Units	1,906	109	155
Entering Trips Exiting Trips			953 (50%) 953 (50%)	24 (22%) 85 (78%)	85 (55%) 70 (45%)

A.M. Peak Hour trip generation is based on Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m.
P.M. Peak Hour trip generation is based on Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m.

TRIP DISTRIBUTION AND ASSIGNMENT

The proposed trip distribution for this development was determined through a review of existing travel patterns, local knowledge of the study area, proposed site location in relation to surrounding roadway network, and engineering judgement. FIGURE 7 provides a summary of how the above site generated trips would be assigned to the study intersection. FIGURE 8 provides the proposed trip assignment volumes to the studied intersections.

FUTURE TRAFFIC VOLUMES

Future projected traffic volumes for the study intersection were developed by adding the generated and assigned trips shown in FIGURE 8 to the 2022 background traffic volumes developed in the previous section and shown in FIGURE 6. These combined 2022 volumes reflect the existing traffic, the background traffic growth, and the generated traffic from the proposed development. These future volumes are shown on FIGURE 9 and are the combined volumes used in the analyses of future conditions with the proposed development.

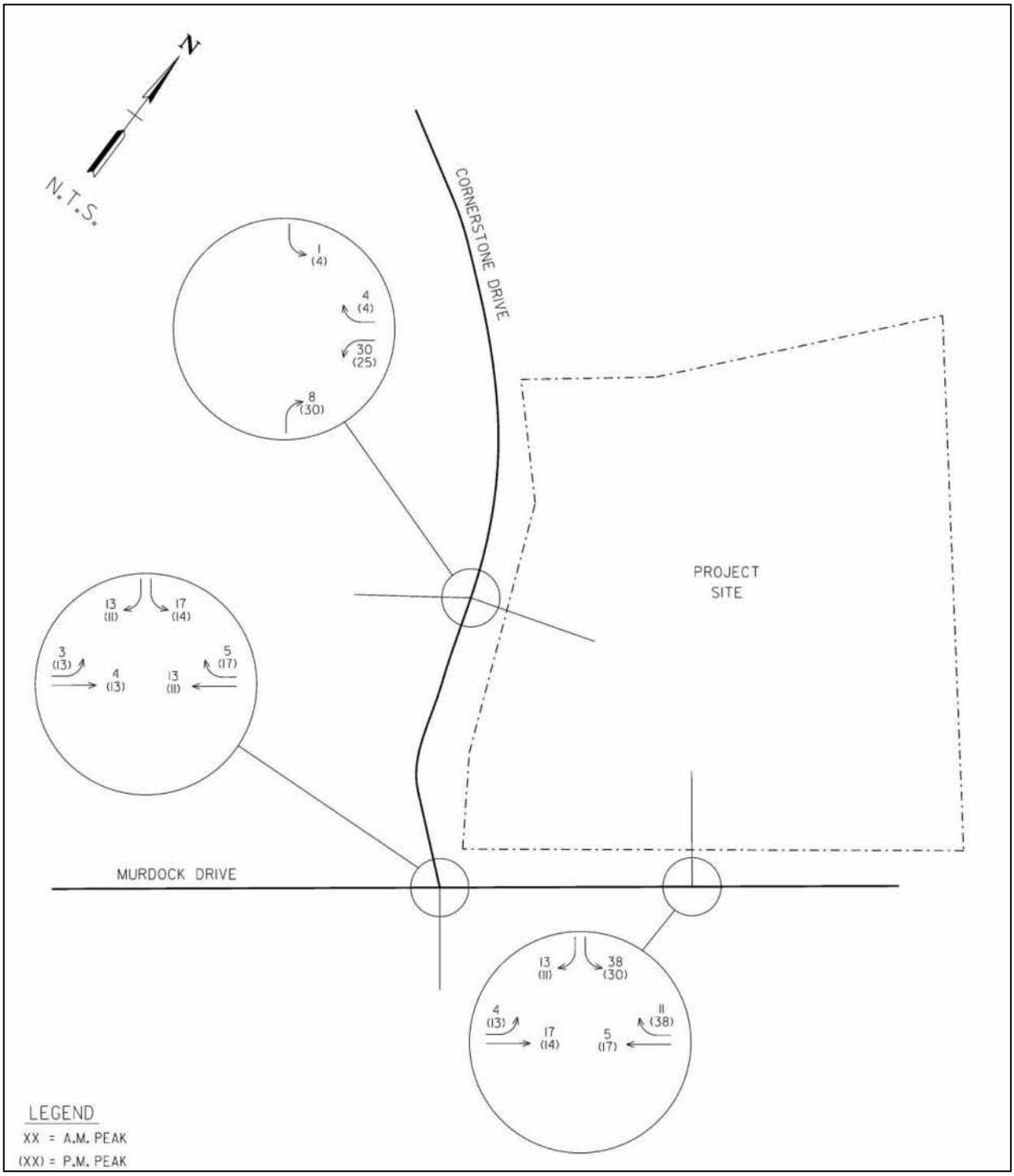


FIGURE 8
TRIP ASSIGNMENT

APPENDIX F

FORECASTED OPENING YEAR 2024 NO-BUILD (BASE) PEAK HOUR CAPACITY CALCULATIONS

HCS Two-Way Stop-Control Report

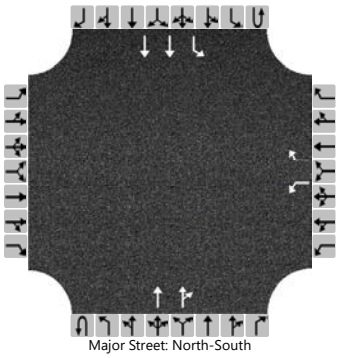
General Information

Analyst	ANL
Agency/Co.	CEC
Date Performed	10/18/2022
Analysis Year	2024
Time Analyzed	Build A.M. Peak Hour
Intersection Orientation	North-South
Project Description	Dominion Cornerstone Residential Development

Site Information

Intersection	Lovell Road with Cornerstone Drive
Jurisdiction	Knox County, TN
East/West Street	Cornerstone Drive
North/South Street	Lovell Road
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	2	0	0	1	2	0
Configuration						L		R			T	TR		L	T	
Volume (veh/h)						12		86			492	13	0	172	895	
Percent Heavy Vehicles (%)						17		8					0	1		
Proportion Time Blocked																
Percent Grade (%)						2										
Right Turn Channelized						No										
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						7.54		7.26						4.12		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.67		3.38						2.21		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						14		99						198		
Capacity, c (veh/h)						166		666						984		
v/c Ratio						0.08		0.15						0.20		
95% Queue Length, Q_{95} (veh)						0.3		0.5						0.7		
Control Delay (s/veh)						28.7		11.3						9.6		
Level of Service (LOS)						D		B						A		
Approach Delay (s/veh)						13.5								1.5		
Approach LOS						B								A		

HCS Two-Way Stop-Control Report

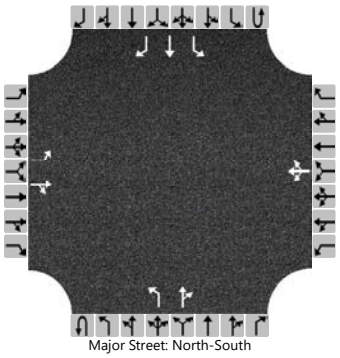
General Information

Analyst	ANL
Agency/Co.	CEC
Date Performed	10/18/2022
Analysis Year	2024
Time Analyzed	Build A.M. Peak Hour
Intersection Orientation	North-South
Project Description	Dominion Cornerstone Residential Development

Site Information

Intersection	Murdock Drive with Cornerstone Drive
Jurisdiction	Knox County, TN
East/West Street	Cornerstone Drive
North/South Street	Murdock Drive
Peak Hour Factor	0.89
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	1	0	0	1	1	0	0	1	1	1
Configuration		L		TR			LTR			L		TR		L	T	R
Volume (veh/h)		176	6	75		1	0	0		28	516	1		3	270	48
Percent Heavy Vehicles (%)		1	17	5		0	0	0		8				0		
Proportion Time Blocked																
Percent Grade (%)	-2				0											
Right Turn Channelized													No			
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		6.71	6.27	6.05		7.10	6.50	6.20		4.18				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.15	3.35		3.50	4.00	3.30		2.27				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		198		91			1			31				3		
Capacity, c (veh/h)		374		654			320			1169				1003		
v/c Ratio		0.53		0.14			0.00			0.03				0.00		
95% Queue Length, Q_{95} (veh)		3.0		0.5			0.0			0.1				0.0		
Control Delay (s/veh)		25.0		11.4			16.3			8.2				8.6		
Level of Service (LOS)		C		B			C			A				A		
Approach Delay (s/veh)	20.7				16.3				0.4				0.1			
Approach LOS	C				C				A				A			

HCS Two-Way Stop-Control Report

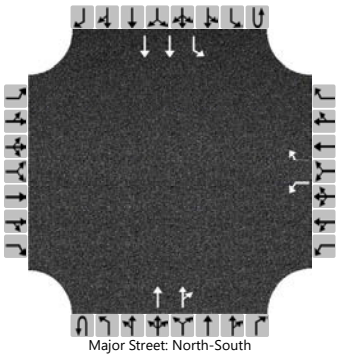
General Information

Analyst	ANL
Agency/Co.	CEC
Date Performed	10/6/2022
Analysis Year	2024
Time Analyzed	No Build P.M. Peak Hour
Intersection Orientation	North-South
Project Description	Dominion Cornerstone Residential Development

Site Information

Intersection	Lovell Road with Cornerstone Drive
Jurisdiction	Knox County, TN
East/West Street	Cornerstone Drive
North/South Street	Lovell Road
Peak Hour Factor	0.96
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	2	0	0	1	2	0
Configuration						L		R			T	TR		L	T	
Volume (veh/h)						28		162			1210	67	0	100	918	
Percent Heavy Vehicles (%)						0		1					0	2		
Proportion Time Blocked																
Percent Grade (%)						2										
Right Turn Channelized						No										
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						7.20		7.12						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.50		3.31						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						29		169						104		
Capacity, c (veh/h)						127		387						512		
v/c Ratio						0.23		0.44						0.20		
95% Queue Length, Q_{95} (veh)						0.8		2.1						0.8		
Control Delay (s/veh)						41.5		21.3						13.8		
Level of Service (LOS)						E		C						B		
Approach Delay (s/veh)						24.3								1.4		
Approach LOS						C								A		

HCS Two-Way Stop-Control Report

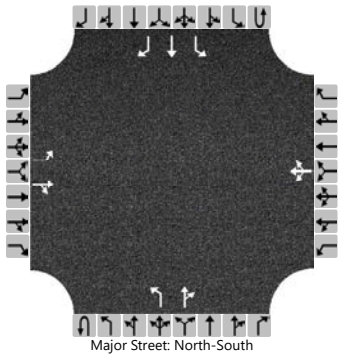
General Information

Analyst	ANL
Agency/Co.	CEC
Date Performed	10/18/2022
Analysis Year	2024
Time Analyzed	Existing P.M. Peak Hour
Intersection Orientation	North-South
Project Description	Dominion Cornerstone Residential Development

Site Information

Intersection	Murdock Drive with Cornerstone Drive
Jurisdiction	Knox County, TN
East/West Street	Cornerstone Drive
North/South Street	Murdock Drive
Peak Hour Factor	0.84
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	1	0	0	1	1	0	0	1	1	1
Configuration		L		TR			LTR			L		TR		L	T	R
Volume (veh/h)		94	0	53		1	2	5		88	387	0		0	557	279
Percent Heavy Vehicles (%)		4	0	2		0	0	0		1				0		
Proportion Time Blocked																
Percent Grade (%)	-2				0											
Right Turn Channelized													No			
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		6.74	6.10	6.02		7.10	6.50	6.20		4.11				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.54	4.00	3.32		3.50	4.00	3.30		2.21				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		112		63			10			105				0		
Capacity, c (veh/h)		252		478			213			699				1109		
v/c Ratio		0.44		0.13			0.04			0.15				0.00		
95% Queue Length, Q_{95} (veh)		2.1		0.5			0.1			0.5				0.0		
Control Delay (s/veh)		30.3		13.7			22.7			11.1				8.2		
Level of Service (LOS)		D		B			C			B				A		
Approach Delay (s/veh)	24.3				22.7				2.0				0.0			
Approach LOS	C				C				A				A			

APPENDIX G

TRIP GENERATION CALCULATIONS

KNOX COUNTY
LOCAL APARTMENT TRIP GENERATION STUDY

PURPOSE

A Traffic Impact Study (TIS) is currently required in Knox County when a proposed development is projected to generate in excess of 750 trips per day. The determinations of when the threshold is met as well as all subsequent analyses in the TIS are performed using the rates and equations given in the Institute of Transportation Engineers (ITE) Trip Generation Manual. Local governmental agencies rely heavily on the accuracy of these trip generation rates in order to correctly predict the impacts of a proposed development on the transportation system. Therefore, in certain instances, it is logical to verify whether the "national" rates and equations given in the ITE Trip Generation Manual are appropriate for use in a specific local area or region.

The decision was made to study the local trip-making characteristics of apartments because of the discrepancy between the trip generation rates for apartments and single family residential land uses as given in the ITE Trip Generation Manual. While these two land uses are similar in nature, the Trip Generation Manual predicts about three less trips per dwelling unit generated by apartments for the average weekday. Additionally the Trip Generation Manual points out that due to the age of their database, which dates back to the 1960's, "the rates for apartments probably had changed over time". It is also assumed that some of the ITE data had come from larger metropolitan areas with denser development and greater transit use than Knox County, which would contribute to lower trip generation rates. Therefore, this study will be used to either verify the rates given in the Trip Generation Manual or generate new ones that can be applied to locally proposed apartment developments.

PROCEDURE

The procedures recommended by ITE in conducting local trip generation studies were generally followed for this study, along with some important assumptions that have made. ITE has published a proposed recommended practice entitled "Trip Generation Handbook" which specifically outlines procedures for conducting local trip generation studies and establishing new rates and equations.

The first step in the study was to define the number and location of the sites to be studied, as well as the counting methodology. Initially 14 sites were selected, although one apartment complex – the College Park Apartments – was later omitted due to uncharacteristically high traffic generation numbers. The number of sites used in this study far exceeds the recommended minimum amount suggested by ITE, which is five sites. Traffic counts were taken for week-long periods at 15-minute intervals between July 22, 1996 and August 9, 1996 at the access points to the apartment complexes. A Technical Appendix to this report contains the traffic count data collected at each apartment complex.

RESULTS

The traffic count data was analyzed using spreadsheets in order to determine the weighted average rates and regression equations. In order to be considered valid, the local rates and equations for each time period of analysis that were generated must meet certain statistical criteria. First, the standard deviation of the independent variable (dwelling units) should be no more than 110 percent of the weighted average rate; and secondly, the regression equations require a computed coefficient of determination (R^2) value of at least 0.75 before good data fit is indicated. This statistical criteria is met by the local data results, and in fact it often exceeds the level of data fit given by their counterparts in the ITE Trip Generation Manual. Finally, in order to simplify the use of the local data, plots were generated that appear identical to the actual ones in the ITE Trip Generation Manual.

The resulting rates and equations calculated from the local data indicate that the average weekday trip generation of apartments in this area is well above the national rates reported in the ITE manual. For example, the locally computed average rate for number of trips generated during a weekday is 35% higher than the rate given by ITE (increase from 6.63 trips per dwelling unit to 9.03 trips per dwelling unit). The trip generation rates do not increase as much for the AM and PM peak hours however. The local rate is roughly 8% higher for the AM peak, and 16% higher for the PM peak. The plots from the ITE Trip Generation Manual are included in the Technical Appendix for comparison purposes.

ASSUMPTIONS MADE

Some important assumptions have been made which may affect the results of the local data that was collected:

- It is important to note that the local trip generation rates were computed for the *total* number of dwelling units in the apartment complex, and not necessarily for the number of *occupied* dwelling units. There are several reasons why this was done, chiefly because of the need for comparability with the rates given in ITE Trip Generation Manual, as it does not specify whether the dwelling units are occupied. According to ITE procedures the selected sites must only be of "reasonably full occupancy (i.e. at least 85%)". The Apartment Association of Greater Knoxville (AAGK) publishes quarterly reports on occupancy levels of apartment complexes, and the report covering the period of the data collection was reviewed to determine occupancy levels. According to the AAGK report from July 1, 1996 – September 30, 1996 all of the apartment complexes surveyed in this study met the minimum 85% occupancy level, with an average occupancy rate for all sites studied of 94%.

- The count data that was collected at each apartment complex was used "raw" meaning that it was not factored for possible daily or seasonal variations. Once again, according to an ITE representative it is not known whether the data used in the Trip Generation Manual was factored or not, so therefore in order to be able to compare

local rates to those in the manual you must assume that count data should not be factored. Additionally, it was felt that apartment complexes would generally not be as susceptible to major seasonal fluctuations as other land uses might be. The local rates were also developed using count data that was collected and averaged over an entire week, which should limit some of the daily variations. Finally, reliable local daily and seasonal variation factors do not truly exist.

CONCLUSION

The local apartment study methodology and results were distributed for comment to a group of local transportation professionals who are directly responsible for either preparing or reviewing traffic impact studies. A meeting was held between this group on February 16, 2000 in order to gather comments and discuss the study in greater detail. The following conclusions are based on the discussion and consensus reached at this meeting:

1. The trip generation rates and equations meet statistical requirements and resulted from a study that followed accepted procedures; therefore they should be adopted for future use. Furthermore, the rates and equations are recommended for use in reviewing the traffic impact of any development termed as "multi-family", such as townhouse and condominium developments due to their similarity to apartment complexes.

2. The Traffic Access and Impact Study Guidelines and Procedures adopted by MPC should be amended with the language that local data should be used when available, which will allow the implementation of these new multi-family trip generation rates.

3. The following suggestions were made for future consideration:
   - This study should be updated with data collected from local townhouse and condominium developments in order to further justify the use of the new trip generation rates.
   - A statistical comparison should be made between any newly developed rates and the ITE single family trip generation rates to determine if there is a significant difference. If there is no difference then perhaps ITE single-family rates could be used for any residential development proposed in Knox County.

Local Apartment
Trip Generation Study

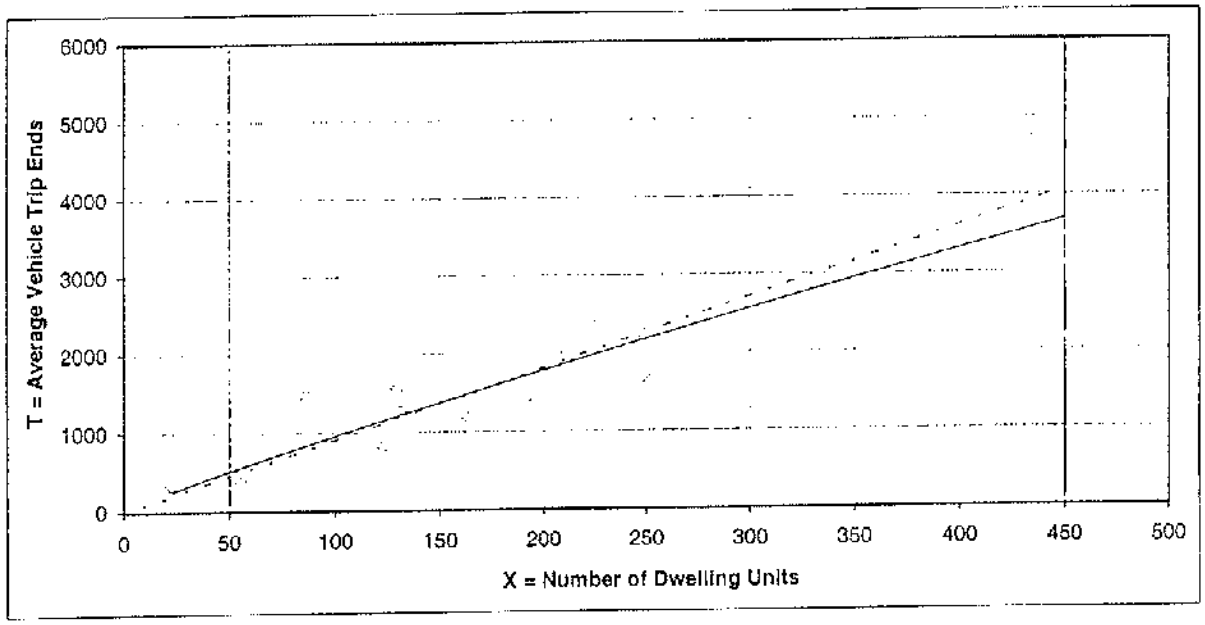
Average Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday**

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

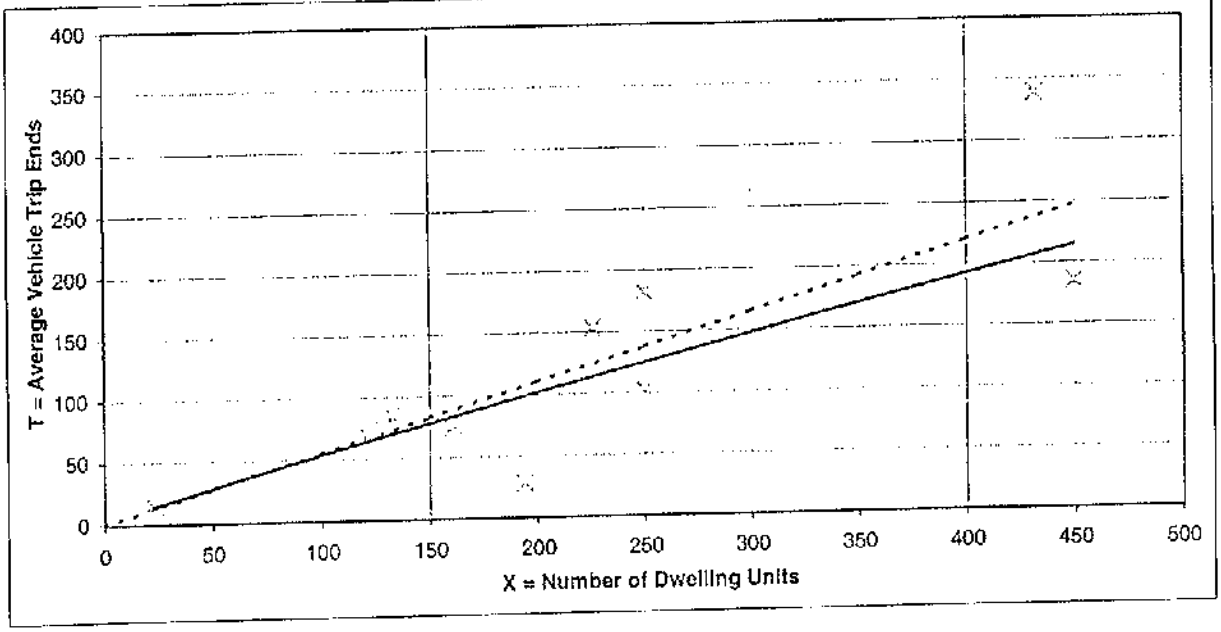
Local Apartment
Trip Generation Study

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



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

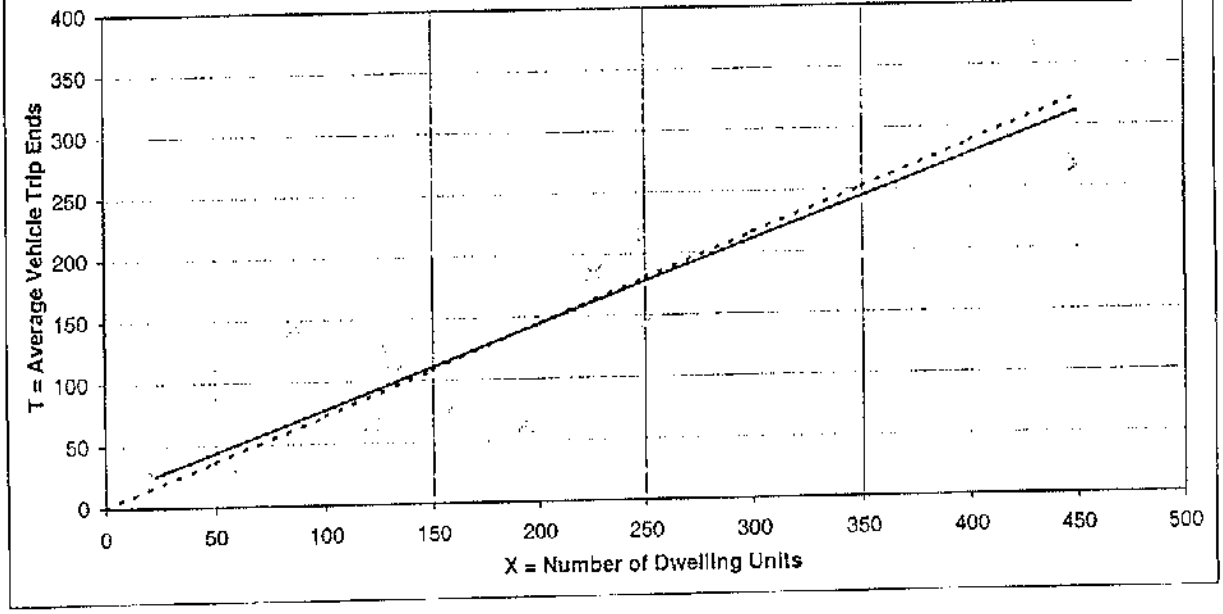
Local Apartment
Trip Generation Study

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



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

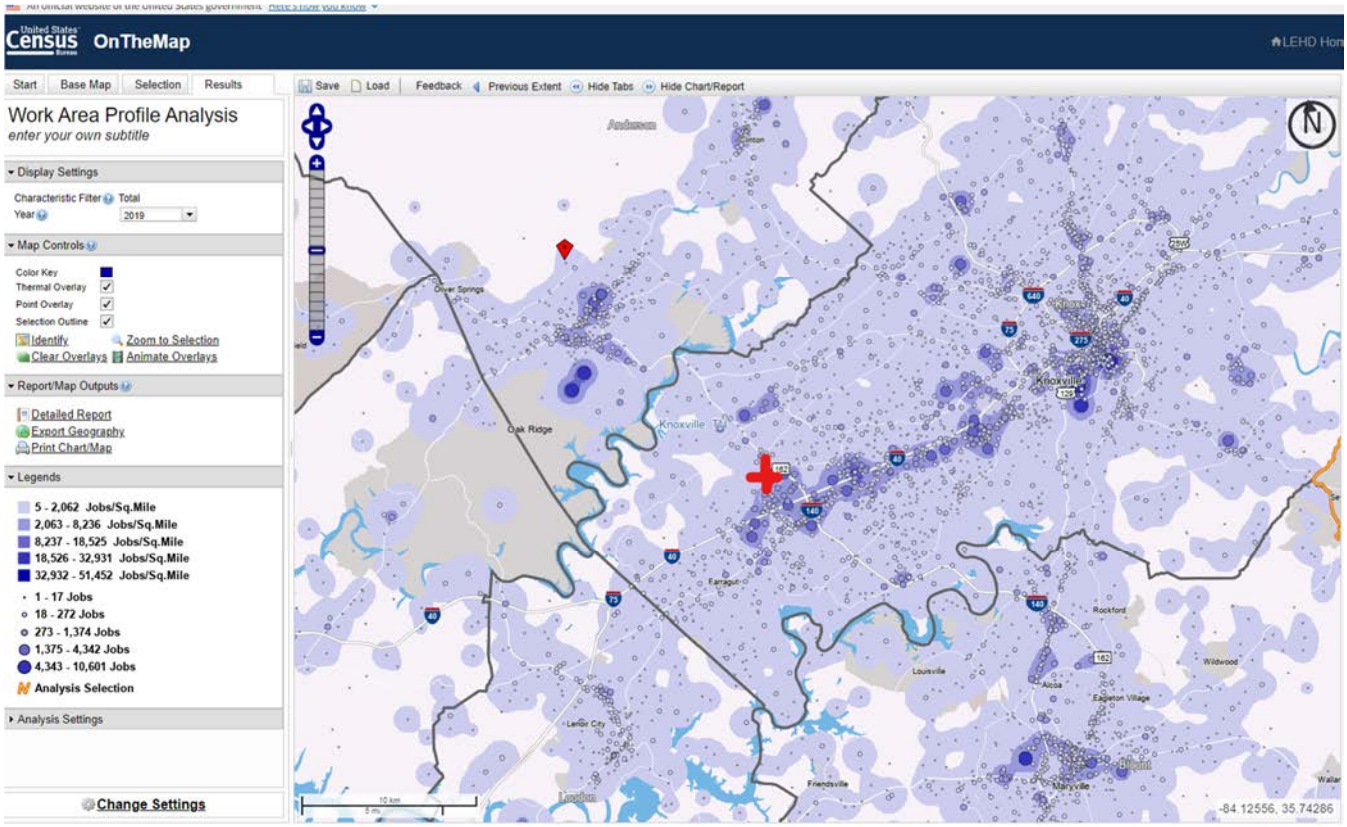
Fitted Curve Equation: T = 0.669(X) + 10.069 $R^2 = 0.79$

Trip Generation Calculations(1)
Dominion Cornerstone Residential Development
Knoxville, Knox County, TN

Calculated ANL Checked CAD

318	Dwelling Units	ITE Land Use Code		N/A					Local Apartment - Trip Generation Study						
	Weekday 24-Hour	=======>	T =	15.19	(	X	)	' ^0.899			(	50	% Entering/	50	% Exiting)
			T =	15.19	(	318.00	)	^0.899							
			T =			2699.762239									
			T =			2700					(	1350	Entering/	1350	Exiting)
	A.M. Peak Hour	=======>	T =	0.758	(	X	)	' ^0.924			(	22	% Entering/	78	% Exiting)
			T =	0.758	(	318.00	)	^0.924							
			T =			155.5649897									
			T =			156					(	34	Entering/	122	Exiting)
	P.M. Peak Hour	=======>	T =	0.669	(	X	)	+	10.069		(	55	% Entering/	45	% Exiting)
			T =	0.669	(	318.00	)	+	10.069						
			T =			222.811									
			T =			223					(	123	Entering/	100	Exiting)

(1) Trip generation consistent with Knoxville Knox Planning Comission TIA Guidelines on residential trip generation through the use of their Local Apartment Trip Generation Study.


United States Census Bureau
OnTheMap
LEHD Hom
Start
Base Map
Selection
Results
Work Area Profile Analysis
enter your own subtitle
Display Settings
Characteristic Filter
Total
Year
2019
Map Controls
Color Key
Thermal Overlay
Point Overlay
Selection Outline
Identify
Zoom to Selection
Clear Overlays
Animate Overlays
Report/Map Outputs
Detailed Report
Export Geography
Print Chart/Map
Legends
5 - 2,062 Jobs/Sq.Mile
2,063 - 8,236 Jobs/Sq.Mile
8,237 - 18,525 Jobs/Sq.Mile
18,526 - 32,931 Jobs/Sq.Mile
32,932 - 51,452 Jobs/Sq.Mile
1 - 17 Jobs
18 - 272 Jobs
273 - 1,374 Jobs
1,375 - 4,342 Jobs
4,343 - 10,601 Jobs
Analysis Selection
Analysis Settings
Change Settings
Save
Load
Feedback
Previous Extent
Hide Tabs
Hide Chart/Report
Knoxville
Oak Ridge
Farragut
Louisville
Rockford
Alcoa
Maryville
Friendsville
Lenoir City
-84.12556, 35.74286

APPENDIX H

FORECASTED OPENING YEAR 2024 BUILD (WITH DEVELOPMENT) PEAK HOUR CAPACITY CALCULATIONS

HCS Two-Way Stop-Control Report

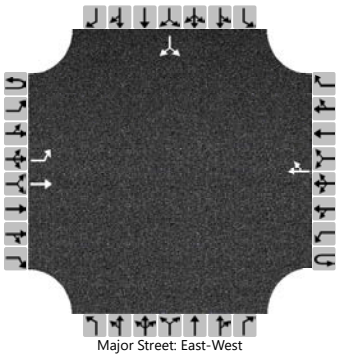
General Information

Analyst	ANL
Agency/Co.	CEC
Date Performed	10/18/2022
Analysis Year	2024
Time Analyzed	Build A.M. Peak Hour
Intersection Orientation	East-West
Project Description	Dominion Cornerstone Residential Development

Site Information

Intersection	Cornerstone Drive with Eastern Site Driveway
Jurisdiction	Knox County, TN
East/West Street	Cornerstone Drive
North/South Street	Eastern Site Driveway
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



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	1	0
Configuration		L	T					TR							LR	
Volume (veh/h)		7	208				58	10						37		30
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)														-6		
Right Turn Channelized																
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.12												5.22		5.62
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.22												3.52		3.32

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		8													74	
Capacity, c (veh/h)		1524													846	
v/c Ratio		0.01													0.09	
95% Queue Length, Q_{95} (veh)		0.0													0.3	
Control Delay (s/veh)		7.4													9.7	
Level of Service (LOS)		A													A	
Approach Delay (s/veh)	0.2												9.7			
Approach LOS	A												A			

HCS Two-Way Stop-Control Report

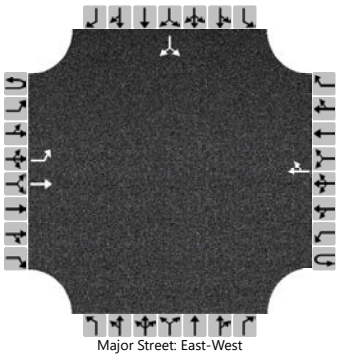
General Information

Analyst	ANL
Agency/Co.	CEC
Date Performed	10/18/2022
Analysis Year	2024
Time Analyzed	Build A.M. Peak Hour
Intersection Orientation	East-West
Project Description	Dominion Cornerstone Residential Development

Site Information

Intersection	Cornerstone Drive with Western Site Driveway
Jurisdiction	Knox County, TN
East/West Street	Cornerstone Drive
North/South Street	Western Site Driveway
Peak Hour Factor	0.90
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	1	0
Configuration		L	T					TR							LR	
Volume (veh/h)		7	178				74	10						37		24
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)														-6		
Right Turn Channelized																
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.12												5.22		5.62
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.22												3.52		3.32

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		8													68	
Capacity, c (veh/h)		1501													836	
v/c Ratio		0.01													0.08	
95% Queue Length, Q_{95} (veh)		0.0													0.3	
Control Delay (s/veh)		7.4													9.7	
Level of Service (LOS)		A													A	
Approach Delay (s/veh)	0.3												9.7			
Approach LOS	A												A			

HCS Two-Way Stop-Control Report

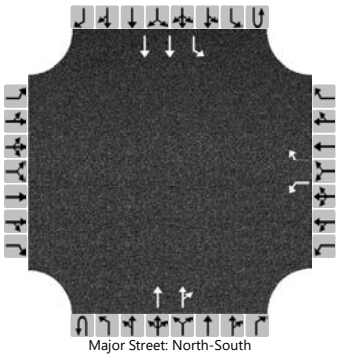
General Information

Analyst	ANL
Agency/Co.	CEC
Date Performed	10/18/2022
Analysis Year	2024
Time Analyzed	Build A.M. Peak Hour
Intersection Orientation	North-South
Project Description	Dominion Cornerstone Residential Development

Site Information

Intersection	Lovell Road with Cornerstone Drive
Jurisdiction	Knox County, TN
East/West Street	Cornerstone Drive
North/South Street	Lovell Road
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	2	0	0	1	2	0
Configuration						L		R			T	TR		L	T	
Volume (veh/h)						12		86			492	13	0	172	895	
Percent Heavy Vehicles (%)						17		8					0	1		
Proportion Time Blocked																
Percent Grade (%)						2										
Right Turn Channelized						No										
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						7.54		7.26						4.12		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.67		3.38						2.21		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						14		99						198		
Capacity, c (veh/h)						166		666						984		
v/c Ratio						0.08		0.15						0.20		
95% Queue Length, Q_{95} (veh)						0.3		0.5						0.7		
Control Delay (s/veh)						28.7		11.3						9.6		
Level of Service (LOS)						D		B						A		
Approach Delay (s/veh)						13.5								1.5		
Approach LOS						B								A		

HCS Two-Way Stop-Control Report

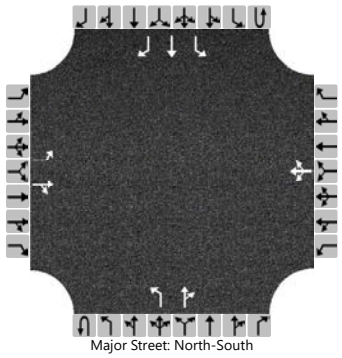
General Information

Analyst	ANL
Agency/Co.	CEC
Date Performed	10/18/2022
Analysis Year	2024
Time Analyzed	Build A.M. Peak Hour
Intersection Orientation	North-South
Project Description	Dominion Cornerstone Residential Development

Site Information

Intersection	Murdock Drive with Cornerstone Drive
Jurisdiction	Knox County, TN
East/West Street	Cornerstone Drive
North/South Street	Murdock Drive
Peak Hour Factor	0.89
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	1	0	0	1	1	0	0	1	1	1
Configuration		L		TR			LTR			L		TR		L	T	R
Volume (veh/h)		176	6	75		1	0	0		28	516	1		3	270	48
Percent Heavy Vehicles (%)		1	17	5		0	0	0		8				0		
Proportion Time Blocked																
Percent Grade (%)	-2				0											
Right Turn Channelized													No			
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		6.71	6.27	6.05		7.10	6.50	6.20		4.18				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.15	3.35		3.50	4.00	3.30		2.27				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		198		91			1			31				3		
Capacity, c (veh/h)		374		654			320			1169				1003		
v/c Ratio		0.53		0.14			0.00			0.03				0.00		
95% Queue Length, Q_{95} (veh)		3.0		0.5			0.0			0.1				0.0		
Control Delay (s/veh)		25.0		11.4			16.3			8.2				8.6		
Level of Service (LOS)		C		B			C			A				A		
Approach Delay (s/veh)	20.7				16.3				0.4				0.1			
Approach LOS	C				C				A				A			

HCS Two-Way Stop-Control Report

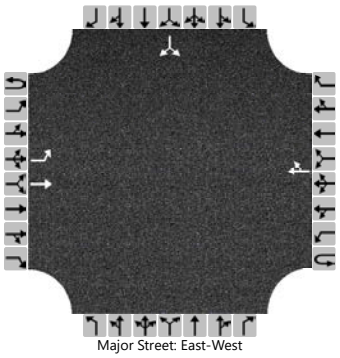
General Information

Analyst	ANL
Agency/Co.	CEC
Date Performed	10/18/2022
Analysis Year	2024
Time Analyzed	Build P.M. Peak Hour
Intersection Orientation	East-West
Project Description	Dominion Cornerstone Residential Development

Site Information

Intersection	Cornerstone Drive with Eastern Site Driveway
Jurisdiction	Knox County, TN
East/West Street	Cornerstone Drive
North/South Street	Eastern Site Driveway
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



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	1	0
Configuration		L	T					TR							LR	
Volume (veh/h)		25	197				302	37						30		20
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)														-6		
Right Turn Channelized																
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.12												5.22		5.62
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.22												3.52		3.32

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		28													56	
Capacity, c (veh/h)		1182													656	
v/c Ratio		0.02													0.08	
95% Queue Length, Q_{95} (veh)		0.1													0.3	
Control Delay (s/veh)		8.1													11.0	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	0.9												11.0			
Approach LOS	A												B			

HCS Two-Way Stop-Control Report

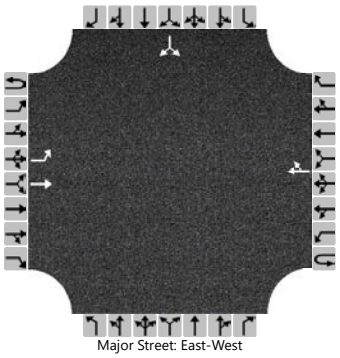
General Information

Analyst	ANL
Agency/Co.	CEC
Date Performed	10/18/2022
Analysis Year	2024
Time Analyzed	Build P.M. Peak Hour
Intersection Orientation	East-West
Project Description	Dominion Cornerstone Residential Development

Site Information

Intersection	Cornerstone Drive with Western Site Driveway
Jurisdiction	Knox County, TN
East/West Street	Cornerstone Drive
North/South Street	Western Site Driveway
Peak Hour Factor	0.90
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	1	0
Configuration		L	T					TR							LR	
Volume (veh/h)		24	192				210	37						30		20
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)														-6		
Right Turn Channelized																
Median Type | Storage	Left Only								1							

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.12												5.22		5.62
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.22												3.52		3.32

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		27													56	
Capacity, c (veh/h)		1289													715	
v/c Ratio		0.02													0.08	
95% Queue Length, Q_{95} (veh)		0.1													0.3	
Control Delay (s/veh)		7.9													10.5	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	0.9												10.5			
Approach LOS	A												B			

HCS Two-Way Stop-Control Report

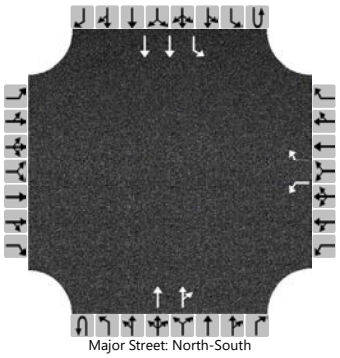
General Information

Analyst	ANL
Agency/Co.	CEC
Date Performed	10/18/2022
Analysis Year	2024
Time Analyzed	Build P.M. Peak Hour
Intersection Orientation	North-South
Project Description	Dominion Cornerstone Residential Development

Site Information

Intersection	Lovell Road with Cornerstone Drive
Jurisdiction	Knox County, TN
East/West Street	Cornerstone Drive
North/South Street	Lovell Road
Peak Hour Factor	0.96
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		1	0	1	0	0	2	0	0	1	2	0
Configuration						L		R			T	TR		L	T	
Volume (veh/h)						33		197			1210	73	0	143	918	
Percent Heavy Vehicles (%)						0		1					0	2		
Proportion Time Blocked																
Percent Grade (%)						2										
Right Turn Channelized						No										
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)						7.5		6.9						4.1		
Critical Headway (sec)						7.20		7.12						4.14		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.50		3.31						2.22		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						34		205						149		
Capacity, c (veh/h)						115		385						509		
v/c Ratio						0.30		0.53						0.29		
95% Queue Length, Q_{95} (veh)						1.2		3.0						1.2		
Control Delay (s/veh)						49.4		24.5						15.0		
Level of Service (LOS)						E		C						B		
Approach Delay (s/veh)						28.1								2.0		
Approach LOS						D								A		

HCS Two-Way Stop-Control Report

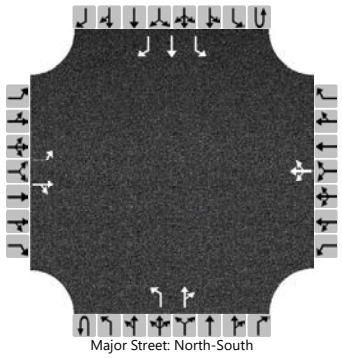
General Information

Analyst	ANL
Agency/Co.	CEC
Date Performed	10/18/2022
Analysis Year	2024
Time Analyzed	Existing P.M. Peak Hour
Intersection Orientation	North-South
Project Description	Dominion Cornerstone Residential Development

Site Information

Intersection	Murdock Drive with Cornerstone Drive
Jurisdiction	Knox County, TN
East/West Street	Cornerstone Drive
North/South Street	Murdock Drive
Peak Hour Factor	0.84
Analysis Time Period (hrs)	0.25

Lanes


Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		1	1	0		0	1	0	0	1	1	0	0	1	1	1
Configuration		L		TR			LTR			L		TR		L	T	R
Volume (veh/h)		94	0	53		1	2	5		88	387	0		0	557	279
Percent Heavy Vehicles (%)		4	0	2		0	0	0		1				0		
Proportion Time Blocked																
Percent Grade (%)		-2				0										
Right Turn Channelized														No		
Median Type | Storage		Left Only								1						

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		6.74	6.10	6.02		7.10	6.50	6.20		4.11				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.54	4.00	3.32		3.50	4.00	3.30		2.21				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		112		63			10			105				0		
Capacity, c (veh/h)		252		478			213			699				1109		
v/c Ratio		0.44		0.13			0.04			0.15				0.00		
95% Queue Length, Q_{95} (veh)		2.1		0.5			0.1			0.5				0.0		
Control Delay (s/veh)		30.3		13.7			22.7			11.1				8.2		
Level of Service (LOS)		D		B			C			B				A		
Approach Delay (s/veh)		24.3				22.7				2.0				0.0		
Approach LOS		C				C				A				A		

APPENDIX I

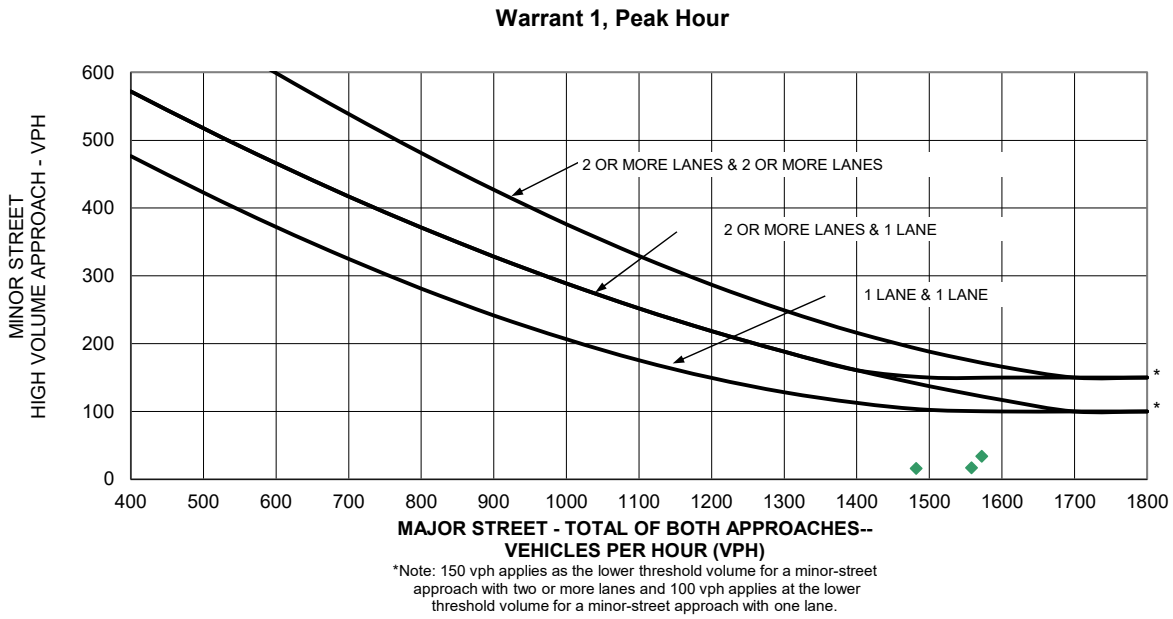
TRAFFIC SIGNAL WARRANTS EVALUATION

Project:		Dominion Cornerstone Residential-Knox County, TN	**Calculations:**	ANL
Major Street	**Name:**	Lovell Road	**Date:**	11/15/2022
	Speed Limit (mph):	45	**Checked by:**	CAD
	Approach Lanes:	2	**Date:**	11/15/2022
Minor Street	**Name:**	Cornerstone Drive		
	Speed Limit (mph):	30		
	Approach Lanes:	1		
Population < 10000?		No		

Civil & Environmental Consultants, Inc.

Warrant 1 - Peak Hour

Signal Warrant Satisfied? [ ] Yes [X] No



Scenario	Major Street (vph)	Minor Street (vph)	Warrant Volume Minor Street	Warrant Satisfied?
2022 Existing, AM Peak	1482	16	141	NO
2022 Existing PM Peak	2181	65	100	NO
2024 No-Build, AM Peak	1558	17	125	NO
2024 No-Build, PM Peak	2295	69	100	NO
2024 Build, AM Peak	1572	34	122	NO
2024 Build, PM Peak	2344	82	100	NO

Signal warrant satisfied if hourly threshold satisfied for any 1 hour of an average day.

As peer the MUTCD, The study should consider the effects of the right-turn vehicles from the minor-street approaches. Engineering judgment should be used to determine what, if any, portion of the right-turn traffic is subtracted from the minor-street traffic count when evaluating the count against the signal warrants.

(1) Using pagones theorem, minor street volumes in an exclusive right turn lane are reduced by 75% when peroforming signal warrant analysis

Project:		Dominion Cornerstone Residential-Knox County, TN	**Calculations:**	ANL
Major Street	**Name:**	Lovell Road	**Date:**	11/15/2022
	Speed Limit (mph):	45	**Checked by:**	CAD
	Approach Lanes:	2	**Date:**	11/15/2022
Minor Street	**Name:**	Cornerstone Drive		
	Speed Limit (mph):	30		
	Approach Lanes:	1		
Population < 10000?		No		

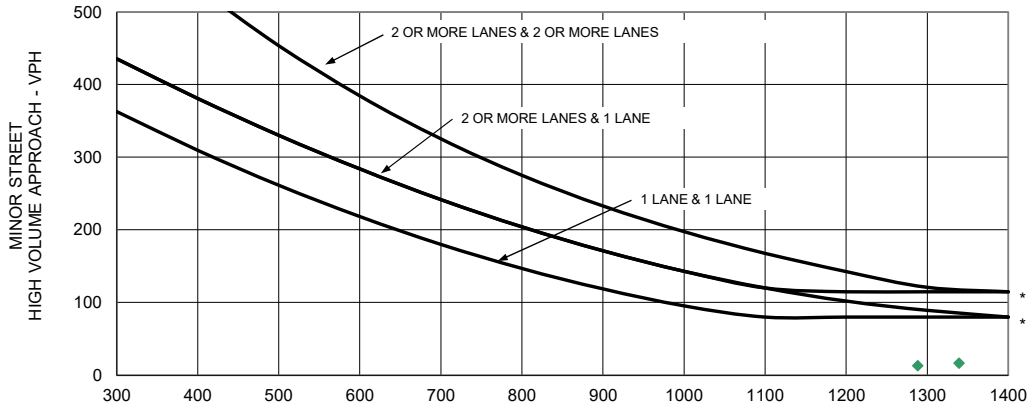
Civil & Environmental Consultants, Inc.

Warrant 2 - Four Hour Vehicular Volume

2022 Existing Conditions

Signal Warrant Satisfied? [ ] Yes [X] No

Warrant 2, Four Hour Vehicular Volume



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

Hour	Major Street (vph)	Minor Street (vph)	Hourly Threshold Minor Street	Hourly Threshold Satisfied?
0:00			622	NO
1:00			622	NO
2:00			622	NO
3:00			622	NO
4:00			622	NO
5:00			622	NO
6:00			622	NO
7:00	1288	13	90	NO
8:00	1339	16	86	NO
9:00			622	NO
10:00			622	NO
11:00			622	NO
12:00			622	NO
13:00			622	NO
14:00			622	NO
15:00			622	NO
16:00	1799	36	80	NO
17:00	2181	65	80	NO
18:00			622	NO
19:00			622	NO
20:00			622	NO
21:00			622	NO
22:00			622	NO
23:00			622	NO
Signal warrant satisfied?				**NO**

Signal warrant satisfied if hourly threshold satisfied for each of any 4 hours of an average day.

(1) Using pagones theorem, minor street volumes in an exclusive right turn lane are reduced by 75% when peroforming signal warrant analysis

Project:		Dominion Cornerstone Residential-Knox County, TN	**Calculations:**	ANL
Major Street	**Name:**	Lovell Road	**Date:**	11/15/2022
	Speed Limit (mph):	45	**Checked by:**	CAD
	Approach Lanes:	2	**Date:**	11/15/2022
Minor Street	**Name:**	Cornerstone Drive		
	Speed Limit (mph):	30		
	Approach Lanes:	1		
Population < 10000?		No		

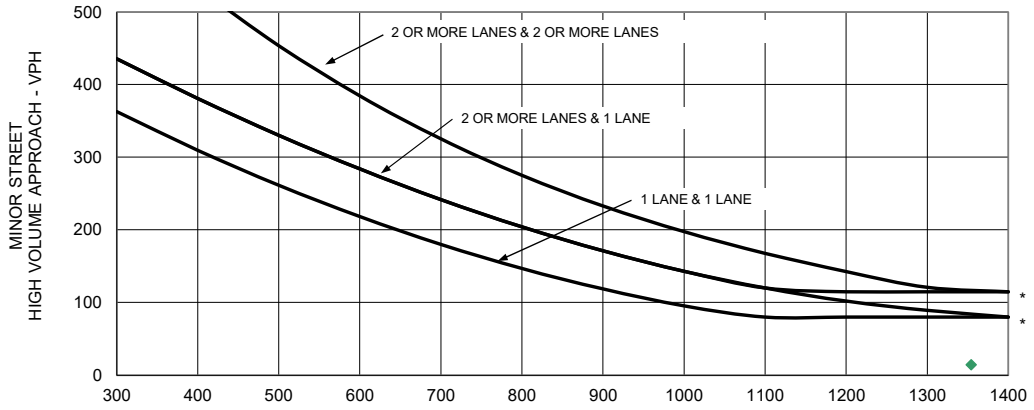
Civil & Environmental Consultants, Inc.

Warrant 2 - Four Hour Vehicular Volume

2024 No-Build Conditions

Signal Warrant Satisfied? [ ] Yes [X] No

Warrant 2, Four Hour Vehicular Volume



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

Hour	Major Street (vph)	Minor Street (vph)	Hourly Threshold Minor Street	Hourly Threshold Satisfied?
0:00			622	NO
1:00			622	NO
2:00			622	NO
3:00			622	NO
4:00			622	NO
5:00			622	NO
6:00			622	NO
7:00	1354	14	85	NO
8:00	1407	18	80	NO
9:00			622	NO
10:00			622	NO
11:00			622	NO
12:00			622	NO
13:00			622	NO
14:00			622	NO
15:00			622	NO
16:00	1893	39	80	NO
17:00	2294	69	80	NO
18:00			622	NO
19:00			622	NO
20:00			622	NO
21:00			622	NO
22:00			622	NO
23:00			622	NO
Signal warrant satisfied?				**NO**

Signal warrant satisfied if hourly threshold satisfied for each of any 4 hours of an average day.

(1) Using pagones theorem, minor street volumes in an exclusive right turn lane are reduced by 75% when peroforming signal warrant analysis

Project:		Dominion Cornerstone Residential-Knox County, TN	**Calculations:**	ANL
Major Street	**Name:**	Lovell Road	**Date:**	11/15/2022
	Speed Limit (mph):	45	**Checked by:**	CAD
	Approach Lanes:	2	**Date:**	11/15/2022
Minor Street	**Name:**	Cornerstone Drive		
	Speed Limit (mph):	30		
	Approach Lanes:	1		
Population < 10000?		No		

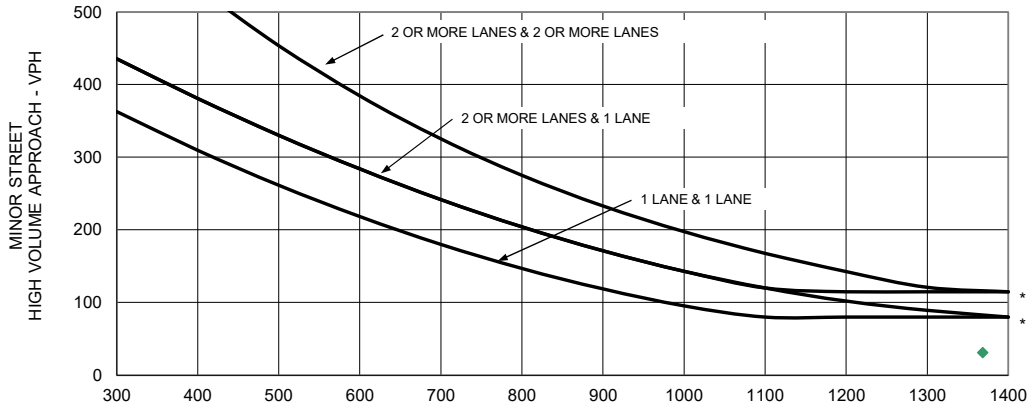
Civil & Environmental Consultants, Inc.

Warrant 2 - Four Hour Vehicular Volume

2024 Build Conditions

Signal Warrant Satisfied? [ ] Yes [X] No

Warrant 2, Four Hour Vehicular Volume



MAJOR STREET - TOTAL OF BOTH APPROACHES--
VEHICLES PER HOUR (VPH)

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

Hour	Major Street (vph)	Minor Street (vph)	Hourly Threshold Minor Street	Hourly Threshold Satisfied?
0:00			622	NO
1:00			622	NO
2:00			622	NO
3:00			622	NO
4:00			622	NO
5:00			622	NO
6:00			622	NO
7:00	1368	31	84	NO
8:00	1421	35	80	NO
9:00			622	NO
10:00			622	NO
11:00			622	NO
12:00			622	NO
13:00			622	NO
14:00			622	NO
15:00			622	NO
16:00	1942	43	80	NO
17:00	2343	49	80	NO
18:00			622	NO
19:00			622	NO
20:00			622	NO
21:00			622	NO
22:00			622	NO
23:00			622	NO
Signal warrant satisfied?				**NO**

Signal warrant satisfied if hourly threshold satisfied for each of any 4 hours of an average day.

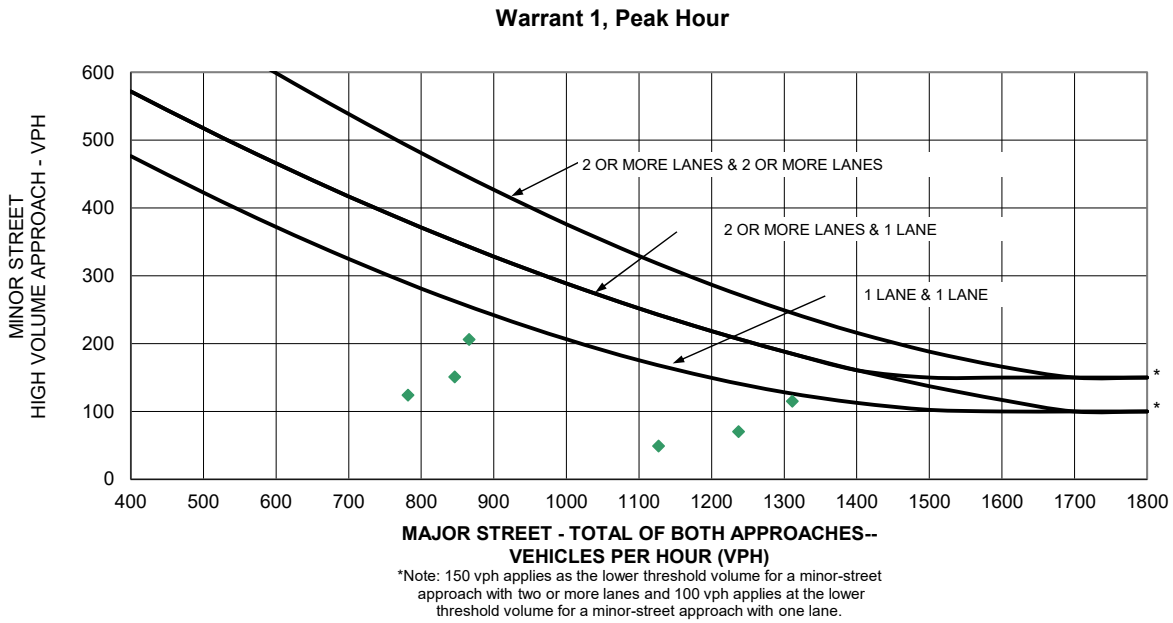
(1) Using pagones theorem, minor street volumes in an exclusive right turn lane are reduced by 75% when peroforming signal warrant analysis

Project:		Dominion Cornerstone Residential-Knox County, TN	**Calculations:**	ANL
Major Street	**Name:**	Murdock Drive	**Date:**	11/15/2022
	Speed Limit (mph):	40	**Checked by:**	CAD
	Approach Lanes:	1	**Date:**	11/15/2022
Minor Street	**Name:**	Cornerstone Drive		
	Speed Limit (mph):	30		
	Approach Lanes:	1		
Population < 10000?		No		

Civil & Environmental Consultants, Inc.

Warrant 1 - Peak Hour

Signal Warrant Satisfied? [ ] Yes [X] No



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies at the lower threshold volume for a minor-street approach with one lane.

Scenario	Major Street (vph)	Minor Street (vph) [1]	Warrant Volume Minor Street	Warrant Satisfied?
Existing 2021 AM Peak	782	124	289	NO
Existing 2021 PM Peak	1127	49	168	NO
2024 No-Build AM Peak	846	151	263	NO
2024 No-Build PM Peak	1237	70	141	NO
2024 Build, AM Peak	866	206	255	NO
2024 Build PM Peak	1311	115	126	NO

Signal warrant satisfied if hourly threshold satisfied for any 1 hour of an average day.

As peer the MUTCD, The study should consider the effects of the right-turn vehicles from the minor-street approaches. Engineering judgment should be used to determine what, if any, portion of the right-turn traffic is subtracted from the minor-street traffic count when evaluating the count against the signal warrants.

(1) Using pagones theorem, minor street volumes in a shared through/right turn lane are reduced by 60% when right turn volume is greater than 3xthrough volume for signal warrant analysis

Project:		Dominion Cornerstone Residential-Knox County, TN	**Calculations:**	ANL
Major Street	**Name:**	Murdock Drive	**Date:**	11/15/2022
	Speed Limit (mph):	40	**Checked by:**	CAD
	Approach Lanes:	1	**Date:**	11/15/2022
Minor Street	**Name:**	Cornerstone Drive		
	Speed Limit (mph):	30		
	Approach Lanes:	1		
Population < 10000?		No		

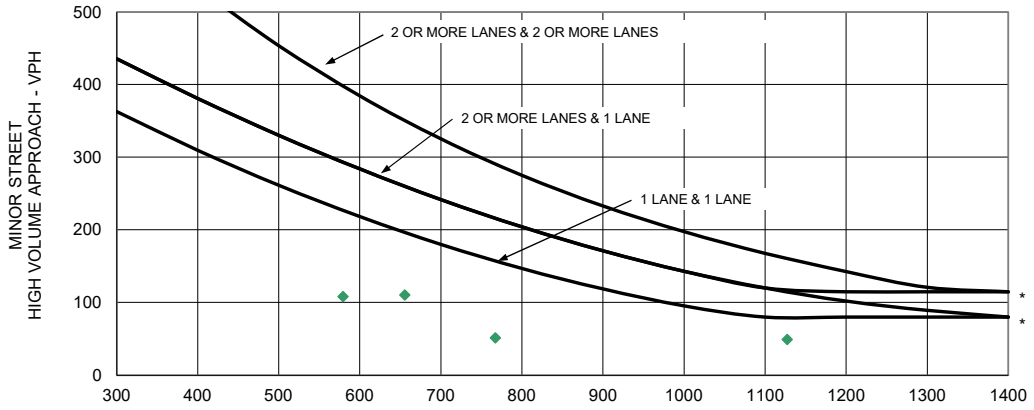
Civil & Environmental Consultants, Inc.

Warrant 2 - Four Hour Vehicular Volume

2022 Conditions

Signal Warrant Satisfied? [ ] Yes [X] No

Warrant 2, Four Hour Vehicular Volume



MAJOR STREET - TOTAL OF BOTH APPROACHES--
VEHICLES PER HOUR (VPH)

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

Hour	Major Street (vph)	Minor Street (vph)	Hourly Threshold Minor Street	Hourly Threshold Satisfied?
0:00			552	NO
1:00			552	NO
2:00			552	NO
3:00			552	NO
4:00			552	NO
5:00			552	NO
6:00			552	NO
7:00	579	108	227	NO
8:00	655	110	197	NO
9:00			552	NO
10:00			552	NO
11:00			552	NO
12:00			552	NO
13:00			552	NO
14:00			552	NO
15:00			552	NO
16:00	767	51	157	NO
17:00	1127	49	80	NO
18:00			552	NO
19:00			552	NO
20:00			552	NO
21:00			552	NO
22:00			552	NO
23:00			552	NO
Signal warrant satisfied?				**NO**

Signal warrant satisfied if hourly threshold satisfied for each of any 4 hours of an average day.

(1) Using pagones theorem, minor street volumes in a shared through/right turn lane are reduced by 60% when right turn volume is greater than 3xthrough volume for signal warrant analysis

Project:		Dominion Cornerstone Residential-Knox County, TN	**Calculations:**	ANL
Major Street	**Name:**	Murdock Drive	**Date:**	11/15/2022
	Speed Limit (mph):	40	**Checked by:**	CAD
	Approach Lanes:	1	**Date:**	11/15/2022
Minor Street	**Name:**	Cornerstone Drive		
	Speed Limit (mph):	30		
	Approach Lanes:	1		
Population < 10000?		No		

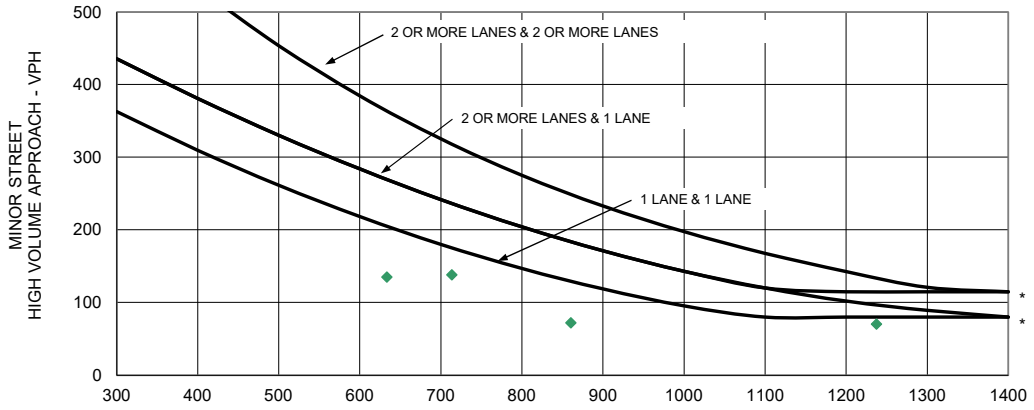
Civil & Environmental Consultants, Inc.

Warrant 2 - Four Hour Vehicular Volume

2024 No-Build Conditions

Signal Warrant Satisfied? [ ] Yes [X] No

Warrant 2, Four Hour Vehicular Volume



MAJOR STREET - TOTAL OF BOTH APPROACHES--
VEHICLES PER HOUR (VPH)

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

Hour	Major Street (vph)	Minor Street (vph)	Hourly Threshold Minor Street	Hourly Threshold Satisfied?
0:00			552	NO
1:00			552	NO
2:00			552	NO
3:00			552	NO
4:00			552	NO
5:00			552	NO
6:00			552	NO
7:00	633	135	205	NO
8:00	713	138	175	NO
9:00			552	NO
10:00			552	NO
11:00			552	NO
12:00			552	NO
13:00			552	NO
14:00			552	NO
15:00			552	NO
16:00	860	72	129	NO
17:00	1237	70	80	NO
18:00			552	NO
19:00			552	NO
20:00			552	NO
21:00			552	NO
22:00			552	NO
23:00			552	NO
Signal warrant satisfied?				**NO**

Signal warrant satisfied if hourly threshold satisfied for each of any 4 hours of an average day.

(1) Using pagones theorem, minor street volumes in a shared through/right turn lane are reduced by 60% when right turn volume is greater than 3xthrough volume for signal warrant analysis

Project:		Dominion Cornerstone Residential-Knox County, TN	**Calculations:**	ANL
Major Street	**Name:**	Murdock Drive	**Date:**	11/15/2022
	Speed Limit (mph):	40	**Checked by:**	CAD
	Approach Lanes:	1	**Date:**	11/15/2022
Minor Street	**Name:**	Cornerstone Drive		
	Speed Limit (mph):	30		
	Approach Lanes:	1		
Population < 10000?		No		

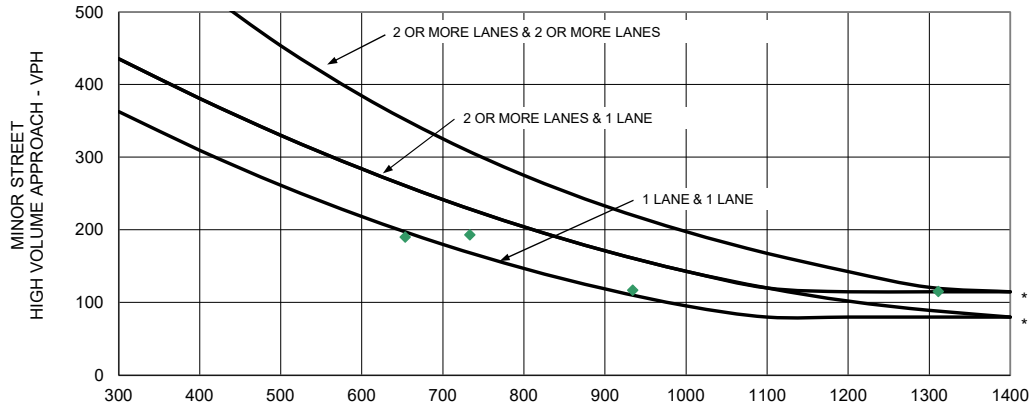
Civil & Environmental Consultants, Inc.

Warrant 2 - Four Hour Vehicular Volume

2024 Build Conditions

Signal Warrant Satisfied? [ ] Yes [X] No

Warrant 2, Four Hour Vehicular Volume



MAJOR STREET - TOTAL OF BOTH APPROACHES--
VEHICLES PER HOUR (VPH)

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

Hour	Major Street (vph)	Minor Street (vph)	Hourly Threshold Minor Street	Hourly Threshold Satisfied?
0:00			552	NO
1:00			552	NO
2:00			552	NO
3:00			552	NO
4:00			552	NO
5:00			552	NO
6:00			552	NO
7:00	653	190	197	NO
8:00	733	193	168	YES
9:00			552	NO
10:00			552	NO
11:00			552	NO
12:00			552	NO
13:00			552	NO
14:00			552	NO
15:00			552	NO
16:00	934	117	110	YES
17:00	1311	115	80	YES
18:00			552	NO
19:00			552	NO
20:00			552	NO
21:00			552	NO
22:00			552	NO
23:00			552	NO
Signal warrant satisfied?				**NO**

Signal warrant satisfied if hourly threshold satisfied for each of any 4 hours of an average day.

(1) Using pagones theorem, minor street volumes in a shared through/right turn lane are reduced by 60% when right turn volume is greater than 3xthrough volume for signal warrant analysis

Signal Warrant Evaluation Traffic Volumes
Intersection: Cornerstone with Murdock

EXISTING 2022 TRAFFIC VOLUMES (WITHOUT ADJUSTMENTS)

Hour Interval	Major Street - Murdock			Minor Street - Cornerstone				
Beginning At	Northbound	Southbound	Combined	Eastbound				
				Left	Through	Right	Reduced Right Turn Vol for Warrant [1]	Total
7:00 AM	379	200	579	98	2	19	8	108
8:00 AM	390	265	655	94	7	23	9	110
4:00 PM	330	437	767	49	0	6	2	51
5:00 PM	398	729	1127	43	0	16	6	49

(1) Using pagones theorem, minor street volumes in a shared through/right turn lane are reduced by 60% when right turn volume is greater than 3xthrough volume for signal warrant
(2) Additional volumes obtained from the 875 Cornerstone Drive TIS. As detailed in that report, volumes were adjustd by a factor of 1.2 to account for COVID traffic conditions.

2024 BACKGROUND TRAFFIC VOLUMES - Grown from 2022 to 2024 GROWTH RATE FACTOR: 1.05

Hour Interval	Major Street - Murdock			Minor Street - Cornerstone/private dwy				
Beginning At	Northbound	Southbound	Combined	Eastbound				
				Left	Through	Right	Reduced Right Turn Vol for Warrant [1]	Total
7:00 AM	398	210	608	103	2	20	8	113
8:00 AM	410	278	688	99	7	24	10	116
4:00 PM	347	459	806	51	0	6	2	53
5:00 PM	418	765	1183	45	0	17	7	52

Note: In order to provide a conservative analysis, the AM and PM peak hour site traffic were assumed to occur equally during each peak period study hour.

BACKGROUND PROJECTS SITE TRAFFIC - 875 Cornerstone

Hour Interval	Major Street - Murdock			Minor Street - Cornerstone/private dwy				
Beginning At	Northbound	Southbound	Combined	Eastbound				
				Left	Through	Right	Reduced Right Turn Vol for Warrant [1]	Total
7:00 AM	7	18	25	17	0	13	5	22
8:00 AM	7	18	25	17	0	13	5	22
4:00 PM	26	28	54	14	0	11	4	18
5:00 PM	26	28	54	14	0	11	4	18

2024 NO-BUILD TRAFFIC VOLUMES

Hour Interval	Major Street - Murdock			Minor Street - Cornerstone/private dwy				
Beginning At	Northbound	Southbound	Combined	Eastbound				
				Left	Through	Right	Reduced Right Turn Vol for Warrant [1]	Total
7:00 AM	405	228	633	120	2	33	13	135
8:00 AM	417	296	713	116	7	37	15	138
4:00 PM	373	487	860	65	0	17	7	72
5:00 PM	444	793	1237	59	0	28	11	70

PROPOSED NEW TRIPS

Hour Interval	Major Street - Murdock			Minor Street - Cornerstone/private dwy				
Beginning At	Northbound	Southbound	Combined	Eastbound				
				Left	Through	Right	Reduced Right Turn Vol for Warrant [1]	Total
7:00 AM	9	11	20	42	0	32	13	55
8:00 AM	9	11	20	42	0	32	13	55
4:00 PM	31	43	74	35	0	25	10	45
5:00 PM	31	43	74	35	0	25	10	45

2024 BUILD TRAFFIC VOLUMES

Hour Interval	Major Street - Murdock			Minor Street - Cornerstone/private dwy				
Beginning At	Northbound	Southbound	Combined	Eastbound				
				Left	Through	Right	Reduced Right Turn Vol for Warrant [1]	Total
7:00 AM	414	239	653	162	2	65	26	190
8:00 AM	426	307	733	158	7	69	28	193
4:00 PM	404	530	934	100	0	42	17	117
5:00 PM	475	836	1311	94	0	53	21	115

Signal Warrant Evaluation Traffic Volumes
Intersection: Cornerstone with Lovell

EXISTING 2022 TRAFFIC VOLUMES (WITHOUT ADJUSTMENTS)

Hour Interval	Major Street - Lovell			Minor Street - Cornerstone				
Beginning At	Northbound	Southbound	Combined	Eastbound				
				Left	Through	Right	Reduced Right Turn Vol for Warrant [1]	Total
7:00 AM	417	871	1288	7	0	24	6	13
8:00 AM	464	875	1339	7	0	37	9	16
4:00 PM	950	849	1799	4	0	128	32	36
5:00 PM	1216	965	2181	27	0	150	38	65

(1) Using pagones theorem, minor street volumes in an exclusive right turn lane are reduced by 75% when peroforming signal warrant analysis

2024 BACKGROUND TRAFFIC VOLUMES - Grown from 2022 to 2024 GROWTH RATE FACTOR:

Hour Interval	Major Street - Lovell			Minor Street - Cornerstone/private dwy				
Beginning At	Northbound	Southbound	Combined	Eastbound				
				Left	Through	Right	Reduced Right Turn Vol for Warrant [1]	Total
7:00 AM	438	915	1353	7	0	25	6	13
8:00 AM	487	919	1406	7	0	39	10	17
4:00 PM	998	891	1889	4	0	134	34	38
5:00 PM	1277	1013	2290	28	0	158	40	68

Note: In order to provide a conservative analysis, the AM and PM peak hour site traffic were assumed to occur equally during each peak period study hour.

BACKGROUND PROJECTS SITE TRAFFIC - 875 Cornerstone

Hour Interval	Major Street - Lovell			Minor Street - Cornerstone/private dwy				
Beginning At	Northbound	Southbound	Combined	Eastbound				
				Left	Through	Right	Reduced Right Turn Vol for Warrant [1]	Total
7:00 AM	0	1	1	0	0	4	1	1
8:00 AM	0	1	1	0	0	4	1	1
4:00 PM	0	4	4	0	0	4	1	1
5:00 PM	0	4	4	0	0	4	1	1

2024 NO-BUILD TRAFFIC VOLUMES

Hour Interval	Major Street - Lovell			Minor Street - Cornerstone/private dwy				
Beginning At	Northbound	Southbound	Combined	Eastbound				
				Left	Through	Right	Reduced Right Turn Vol for Warrant [1]	Total
7:00 AM	438	916	1354	7	0	29	7	14
8:00 AM	487	920	1407	7	0	43	11	18
4:00 PM	998	895	1893	4	0	138	35	39
5:00 PM	1277	1017	2294	28	0	162	41	69

PROPOSED NEW TRIPS

Hour Interval	Major Street - Lovell			Minor Street - Cornerstone/private dwy				
Beginning At	Northbound	Southbound	Combined	Eastbound				
				Left	Through	Right	Reduced Right Turn Vol for Warrant [1]	Total
7:00 AM	2	12	14	6	0	42	11	17
8:00 AM	2	12	14	6	0	42	11	17
4:00 PM	6	43	49	5	0	35	9	14
5:00 PM	6	43	49	5	0	35	9	14

2024 BUILD TRAFFIC VOLUMES

Hour Interval	Major Street - Lovell			Minor Street - Cornerstone/private dwy				
Beginning At	Northbound	Southbound	Combined	Eastbound				
				Left	Through	Right	Reduced Right Turn Vol for Warrant [1]	Total
7:00 AM	440	928	1368	13	0	71	18	31
8:00 AM	489	932	1421	13	0	85	21	35
4:00 PM	1004	938	1942	9	0	173	43	53
5:00 PM	1283	1060	2343	33	0	197	49	83

Pagones Theorem*

First, determine which lane configuration represents the leg that is being studied. Then, based on the movements for each hour, find the percent reduction for each hour with Pagones Theorem.

Pagones Theorem

Situation	Approach configuration	Condition	Reduction of right turns
1	Shared Left/ Through/Right	$R > 0.7A$ $0.7A \geq R > 0.35A$ $R \leq 0.35A$	Reduce R by 60 percent Reduce R by 40 percent Reduce R by 20 percent
2	Exclusive Left, Shared Through/ Right	$R > 3T$ $3T \geq R > T/3$ $R \leq T/3$	Reduce R by 60 percent Reduce R by 40 percent Reduce R by 20 percent
3	Any configuration with an exclusive right turn lane		Reduce R by 75 percent in all cases
4	Shared Left/Through and Shared Through/Right	$R > (T + L)$ $L > (T + R)$ $L = T = R$ (±10 vehicles) $L = T > 3R$ $R = T > 3L$ All other cases	Reduce R by 65 percent Use Situation 2 Reduce R by 40 percent Reduce R by 20 percent Reduce R by 50 percent Reduce R by 30 percent
5	Exclusive Left, Exclusive Through and Shared Through/Right	$R > T$ $T \geq R > T/2$ $T/2 \geq R > T/4$ $R \leq T/4$	Reduce R by 75 percent Reduce R by 50 percent Reduce R by 30 percent Reduce R by 15 percent

Where: L = number of left turning vehicles in approach;
T = number of through vehicles in approach;
R = number of right turning vehicles in approach; and
$A = (L + T + R)$.

APPENDIX J

AUXILIARY TURN LANE WARRANTS EVALUATION

2024 Opening Year Build
Conerstone Drive with Western Site Driveway

TABLE 4B

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

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						
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

AM Peak 178, 10

PM Peak 192, 37

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.

2024 Opening Year Build
Conerstone Drive with Eastern Site Driveway

TABLE 4B

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

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						
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

PM Peak 208, 10

AM Peak 197, 37

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.

APPENDIX K

RESPONSE TO COMMENTS

November 21, 2022

Mr. Mike Conger, P.E.
Knoxville-Knox County Planning
400 Main Street, Suite 403
Knoxville, TN 37902

Dear Mr. Conger:

Subject: Response to Knoxville-Knox County Planning Review Comments
Traffic Impact Study for the proposed Cornerstone Residential Development
Knox County, Tennessee
CEC Project 325-727

Civil & Environmental Consultants, Inc. (CEC), is in receipt of review comments prepared by the Knoxville-Knox County Planning, provided via email dated November 15, 2022 and referencing our *Traffic Impact Study for the proposed Cornerstone Residential Development*, dated October 24, 2022.

On the following pages, each of the Knoxville-Knox County Planning review comments will be reiterated, followed immediately by our response to each comment.

(1) On page i and throughout the report the development study area is referenced as being in the "City of Knoxville" however the city limits are a significant distance away and it should instead be referenced as only "Knox County".

RESPONSE: The Traffic Impact Study has been revised to eliminate any reference to The City of Knoxville.

(2) Existing Conditions, an incorrect posted speed limit of 40-mph for Lovell Rd is referenced which instead should be listed as 45-mph at Cornerstone Drive, as confirmed by TDOT Region 1 Traffic Office staff. Please update this section and any analyses that utilize prevailing speed such as the traffic signal warrants.

RESPONSE: The Traffic Impact Study report, as well as all analyses have been revised to reflect a posted speed limit of 45-mph along Lovell Road.

(3) Page 2 – Existing Conditions, please also include documentation of multimodal accommodations such as bike lanes and sidewalks on adjacent roadways and their characteristics (width, composition, markings, etc). Also note if connections to greenway systems are being proposed and whether public transit service is available to the site.

RESPONSE: The Existing Conditions section of the Traffic Impact Study report has been revised to include information with respect to multimodal accommodations on adjacent roadways.

(4) Page 3 – Cornerstone Drive is assumed to have a 30-mph speed limit, which is the correct default speed limit in Knox County if not specifically posted however subsequent analyses in the report such as the sight distance evaluation appear to use an assumed 35-mph limit, please check and update as appropriate.

RESPONSE: Comment acknowledged. The Traffic Impact Study report, as well as all analyses have been revised to reflect a speed limit of 30-mph along Cornerstone Drive.

(5) Page 4 – there is a typo in the last paragraph where it states "156 trips exiting" instead of the correct amount of 100.

RESPONSE: Comment acknowledged. The text of the Revised Traffic Impact Study now accurately states 100 trips exiting in the last paragraph of page four (4).

(6) Page 5 – additional information/methodology should be provided to justify the assumed trip distribution percentages. The reviewing staff do not believe that a higher percentage of exiting trips will turn left from Cornerstone Drive to Lovell Road as assumed in the TIS since current traffic counts exhibit more in the range of 15/85 percent split turning left/right at this intersection. This TIS should rely more on actual data as well as the a review of the distribution assumptions utilized in the previous TIS for the project at 875 Cornerstone Drive for consistency purposes. Please revise and update all analyses accordingly.

RESPONSE: Comment acknowledged. As discussed, the trip distribution for the proposed development was adjusted to incorporate the anticipated regional employment centers obtained from the US Census Bureau's data as well as the expected fastest travel routes utilizing Google Maps. Additionally, consideration for the trip distribution utilized in the approved adjacent retail development, 875 Cornerstone Drive Apartments, was given. Additional details of the trip distribution are detailed on page 5 of the revised study. All analyses have been updated in the revised report to reflect this change.

(7) Page 7 – the sight distance analysis needs to include an evaluation of Intersection Sight Distance, which is the required standard in the Knoxville-Knox County Minimum Subdivision Regulations and specifically for projects in Knox County where the minimum ISD needed is based on a distance calculated by multiplying the posted speed limit by 10, i.e. 300 feet in the case of Cornerstone Drive.

RESPONSE: Comment acknowledged. Page 7 of the Traffic Impact Study report has been revised to reflect the minimum ISD standard required by Knoxville-Knox County Minimum Subdivision Regulations.

(8) Table 6 – this sight distance summary will need to be updated based on Comment #7 above, but wanted to call your attention to the fact that some listed measured sight distances are less than the required sight distances and both sections of the table reference the "western site driveway" instead of both eastern and western driveways.

RESPONSE: Comment acknowledged. The values of required sight distance in Table 6 have been reviewed and updated accordingly as per Comment #7. Furthermore, Table 6 now correctly references both eastern and western site driveways. Finally, a review of the available sight distances was clarified to more adequately reflect the distances available.

This completes CEC's response to the review comments prepared by the Knoxville-Knox County Planning, provided via email dated November 15, 2022 and referencing our *Traffic Impact Study for the proposed Cornerstone Residential Development*, dated October 24, 2022.

If you have any questions or require anything additional, please do not hesitate to contact us.

Very truly yours,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Chris A Droznek, II, P.E., PTP
Senior Project Manager

Austin N Lucas
Staff Consultant