DRAFT

MASONIC HOMES of KENTUCKY
LOUISVILLE CAMPUS

3701 Frankfort Avenue
Louisville, Kentucky

TRAFFIC IMPACT STUDY

JUNE 2014 REVISION

Prepared for:

MASONIC HOMES of KENTUCKY

3761 Johnson Hall Drive
Masonic Homes, Kentucky 40041

Prepared by:

QK4
Engineering Planning

Groundbreaking by Design.

1046 East Chestnut Street
Louisville, Kentucky 40204
Phone: 502-585-2222 • Fax: 502-566-3058

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1.0 INTRODUCTION

Masonic Homes of Kentucky retained Qk4 to revise the Traffic Impact Study (TIS) completed in November 2013 for their existing Louisville Campus located along Frankfort Avenue (US 60). Following the completion of the initial study, it was decided that the additional access points to Leland Road and Ormond Lane would be included; that all four access points would be opened at the same time; and that access would be limited to campus residents and staff, as well EMS vehicles and limousines that are currently allowed in Binding Element No. 3.

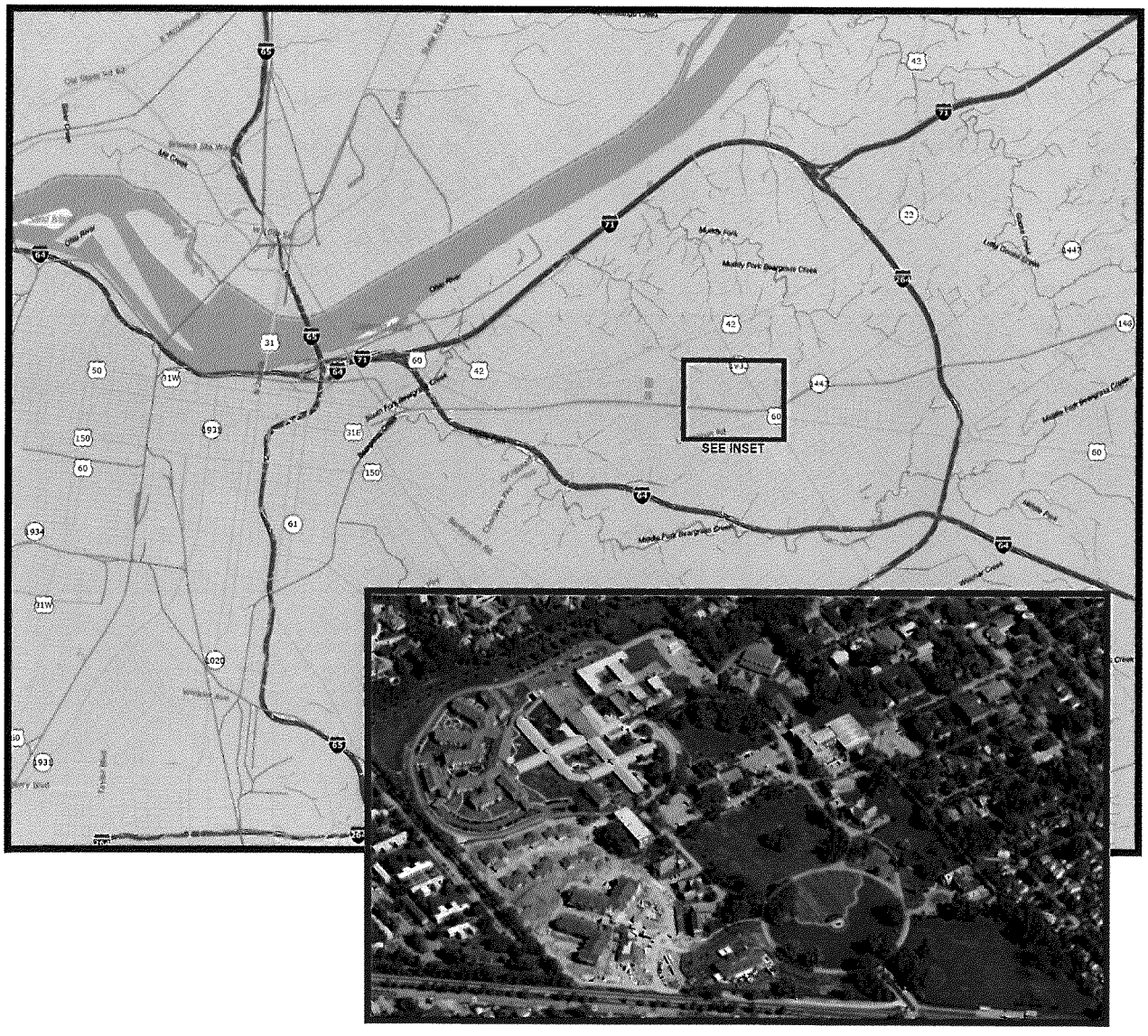


FIGURE 1: Location Map and Aerial View of Masonic Home Campus (October 2013)

2.0 EXISTING ACCESS TO MASONIC HOMES' LOUISVILLE CAMPUS

Currently the only access point provided to the Louisville Masonic Home's campus is via the signalized intersection of Masonic Home Drive/Bauer Avenue with Frankfort Avenue (US 60). Washington Square located between the eastern edge of the campus and Chenoweth Lane does extend onto campus property. This access is currently closed by gate to vehicular traffic, allowing pedestrian access only; however, this gate allows regular emergency access and limousine access for special events, which are both permitted per current binding elements.

FIGURE 2: Masonic Home Campus Access Points

3.0 PROPOSED CHANGES TO ROADWAY CONNECTIVITY AND FUTURE DEVELOPMENT PLANS

Louisville Masonic Homes is proposing to make connections to four neighborhood streets that connect to Chenoweth Lane: Washington Square and Leland Road would allow the one-way flow of traffic onto campus while Elmwood Avenue and Ormond Road would allow one-way flow of traffic off of campus.

All four points of access to the campus would be controlled by gates that would permit entry/exit by employees and residents, only. Other visitors to campus, including people accessing Sproutlings daycare, The Olmsted, post office, and other guests would still be required to use the Frankfort Avenue access point rather than any of the connections to Chenoweth Lane. Figure 3 below illustrates the proposed access points to Chenoweth Lane.

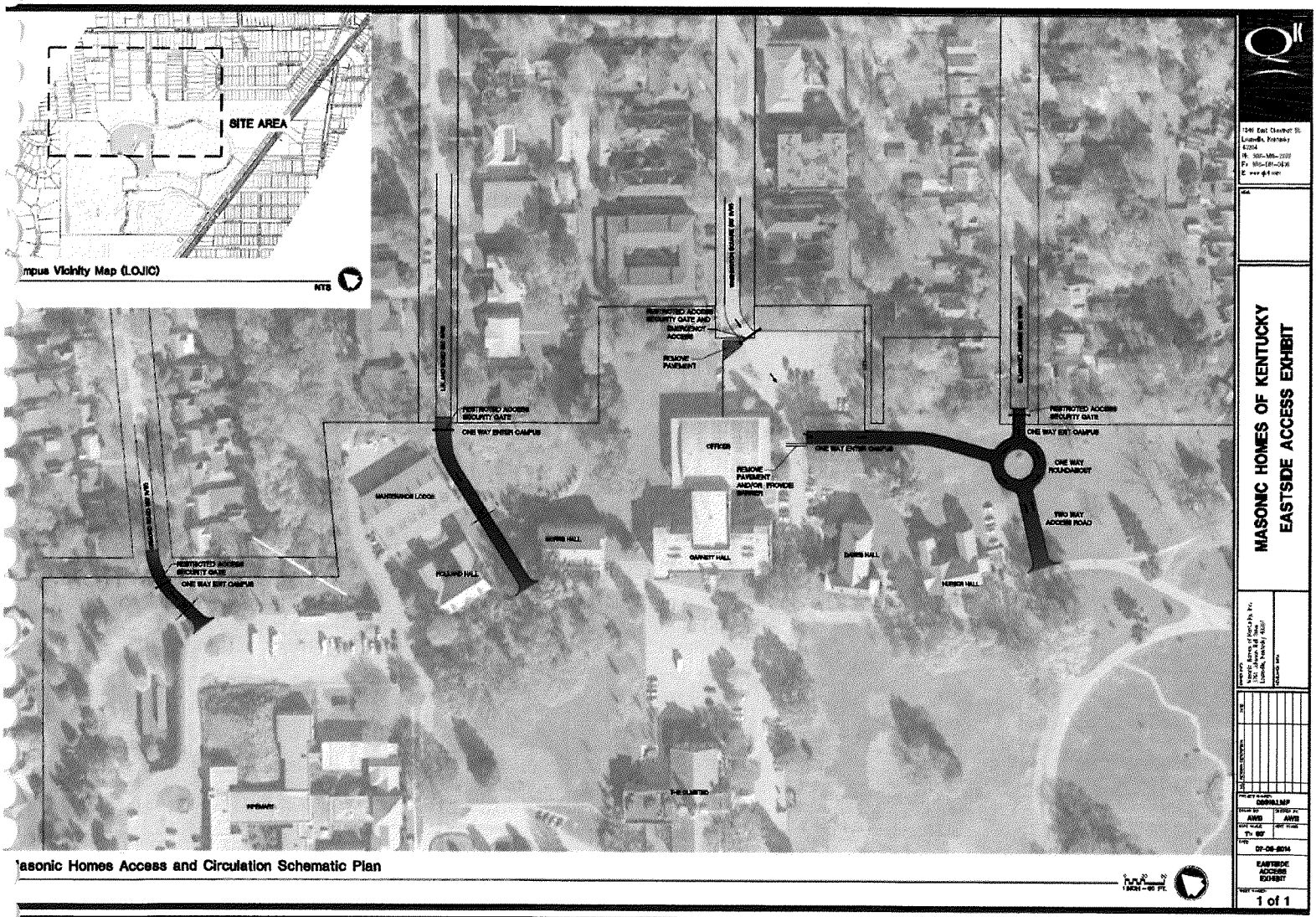


FIGURE 3: Proposed Connections from Campus to Chenoweth Lane

4.0 STUDY AREA

The study area for this traffic impact study includes the following existing intersections:

1. Masonic Home Drive/Bauer Avenue / Frankfort Avenue (US 60)
2. Elmwood Avenue & Chenoweth Lane
3. Washington Square & Chenoweth Lane
4. Leland Road & Chenoweth Lane
5. Ormond Road & Chenoweth Lane

Sections 4.1 through 4.5, below, address the results of each of these traffic impact study locations.

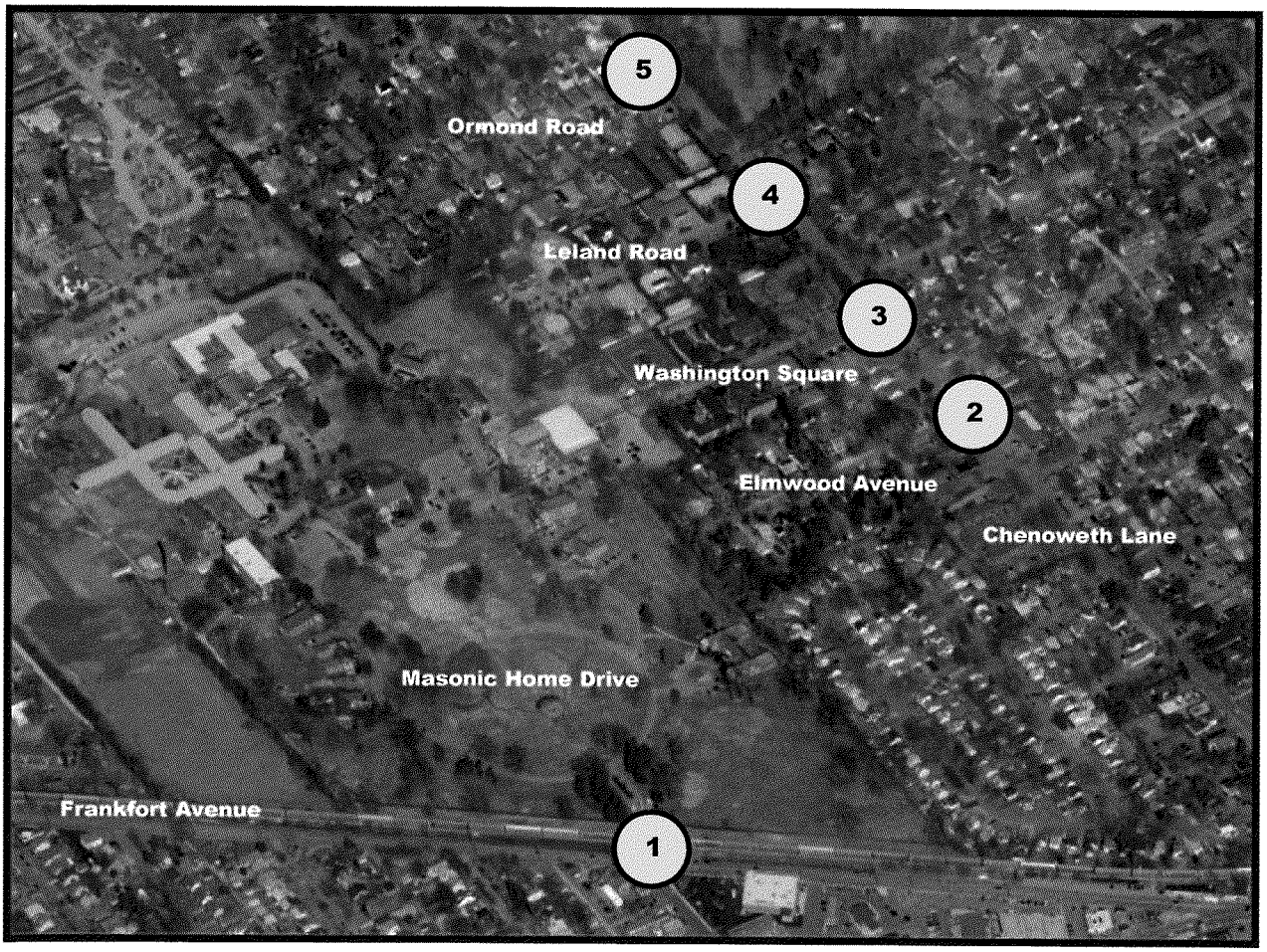


FIGURE 4: Study Area Intersections

4.1 MASONIC HOME DRIVE / BAUER AVENUE / FRANKFORT AVENUE

The existing intersection of Masonic Home Drive / Bauer Avenue / Frankfort Avenue is a signal controlled intersection. This signal operates independently: Frankfort Avenue has a signal system east of this location that includes Chenoweth Lane and runs east to the intersection with Hurstbourne Lane. A CSX railroad track runs between the stop bar for the southbound approach to the campus and Frankfort Avenue. When trains are moving through the area, the single access point to the campus is blocked. There are no exclusive turn lanes at this intersection, so the following lanes are blocked by traffic trying to enter the campus when a train is present: the eastbound left/through and westbound through/right movements on Frankfort Avenue and the northbound through/right movements on Bauer Avenue. The aerial photograph (Figure 5) depicts the way the intersection is currently configured. The lane geometry is also depicted below.

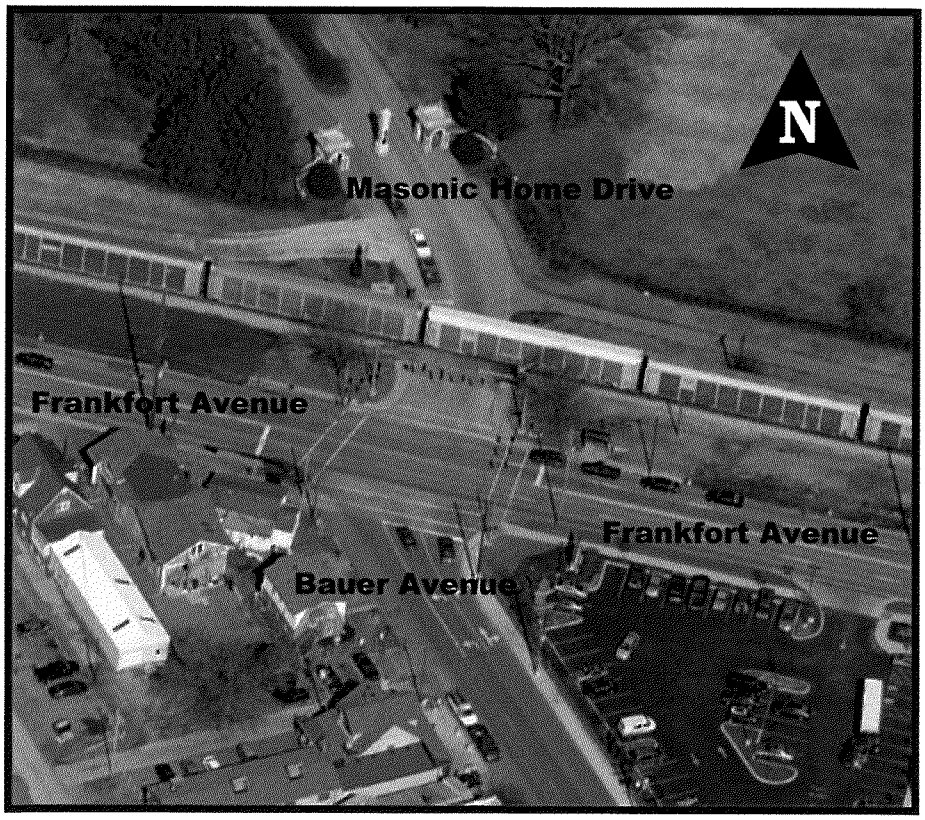
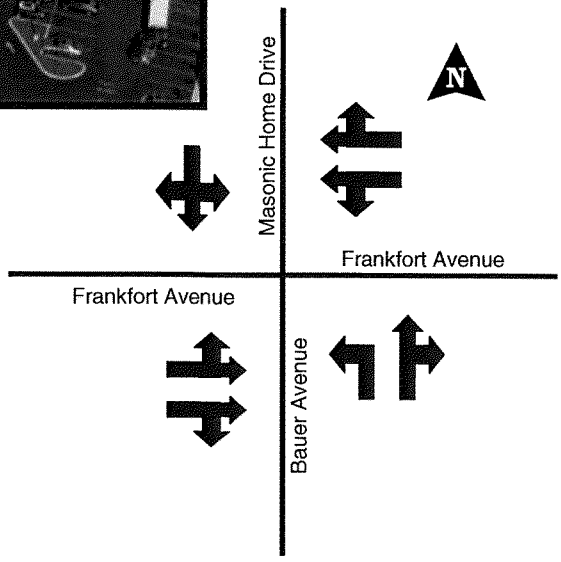


FIGURE 5

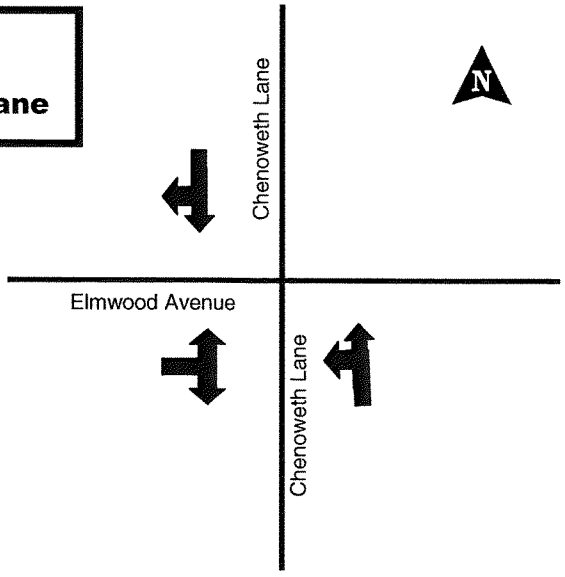
Masonic Home Drive / Bauer Avenue / Frankfort Avenue



4.2 ELMWOOD AVENUE AND CHENOWETH LANE

The existing intersection of Elmwood Avenue and Chenoweth Lane is a stop controlled intersection. The eastbound Elmwood Avenue approach to the intersection must stop while Chenoweth Lane remains free-flowing. The aerial photograph (Figure 6) depicts the way the intersection is currently configured. The lane geometry is also depicted below.

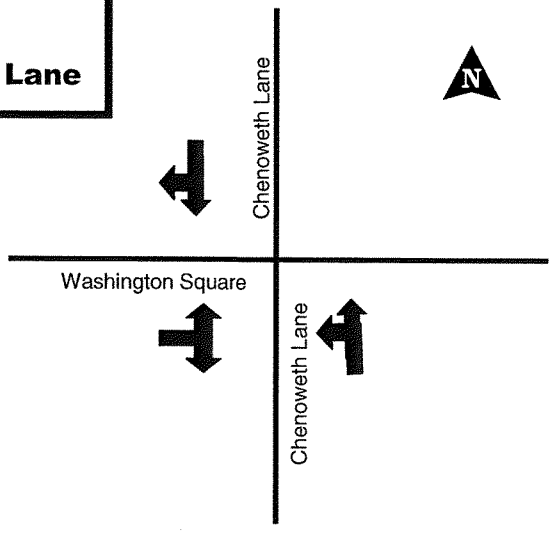
FIGURE 6
Elmwood Avenue / Chenoweth Lane



4.3 WASHINGTON SQUARE AND CHENOWETH LANE

The existing intersection of Washington Square and Chenoweth Lane is a stop controlled intersection. The eastbound Washington Square approach to the intersection must stop while Chenoweth Lane remains free-flowing. The aerial photograph (Figure 7) depicts the way the intersection is currently configured. The lane geometry is also depicted below.

FIGURE 7
Washington Square / Chenoweth Lane



4.4 LELAND ROAD AND CHENOWETH LANE

The existing intersection of Leland Road and Chenoweth Lane is a stop controlled intersection. The eastbound and westbound Leland Road approaches to the intersection must stop while Chenoweth Lane remains free-flowing. The aerial photograph (Figure 8) depicts the way the intersection is currently configured. The lane geometry is also depicted below.

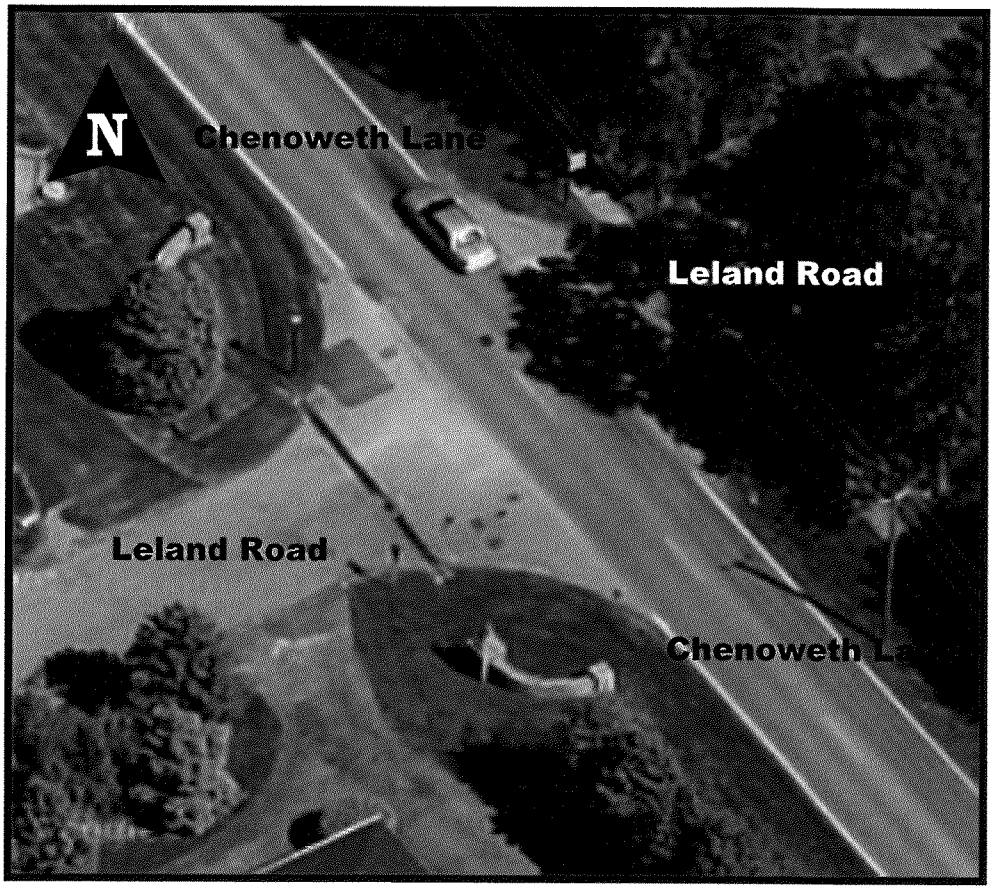
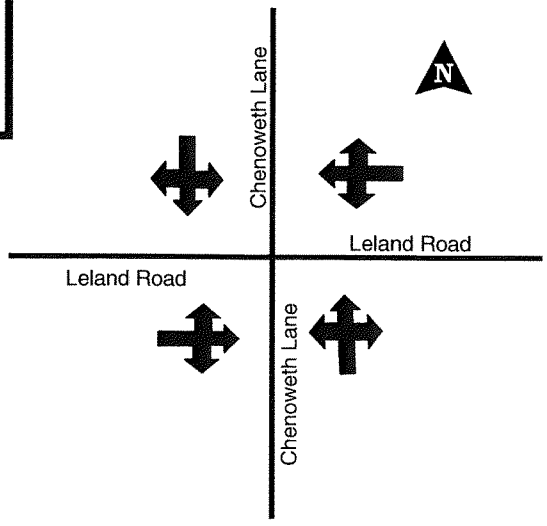


FIGURE 8

Chenoweth Lane / Leland Road



4.5 ORMOND ROAD AND CHENOWETH LANE

The existing intersection of Ormond Road and Chenoweth Lane is a stop controlled intersection. The eastbound Ormond approach to the intersection must stop while Chenoweth Lane remains free-flowing. The aerial photograph (Figure 9) depicts the way the intersection is currently configured. The lane geometry is also depicted below.

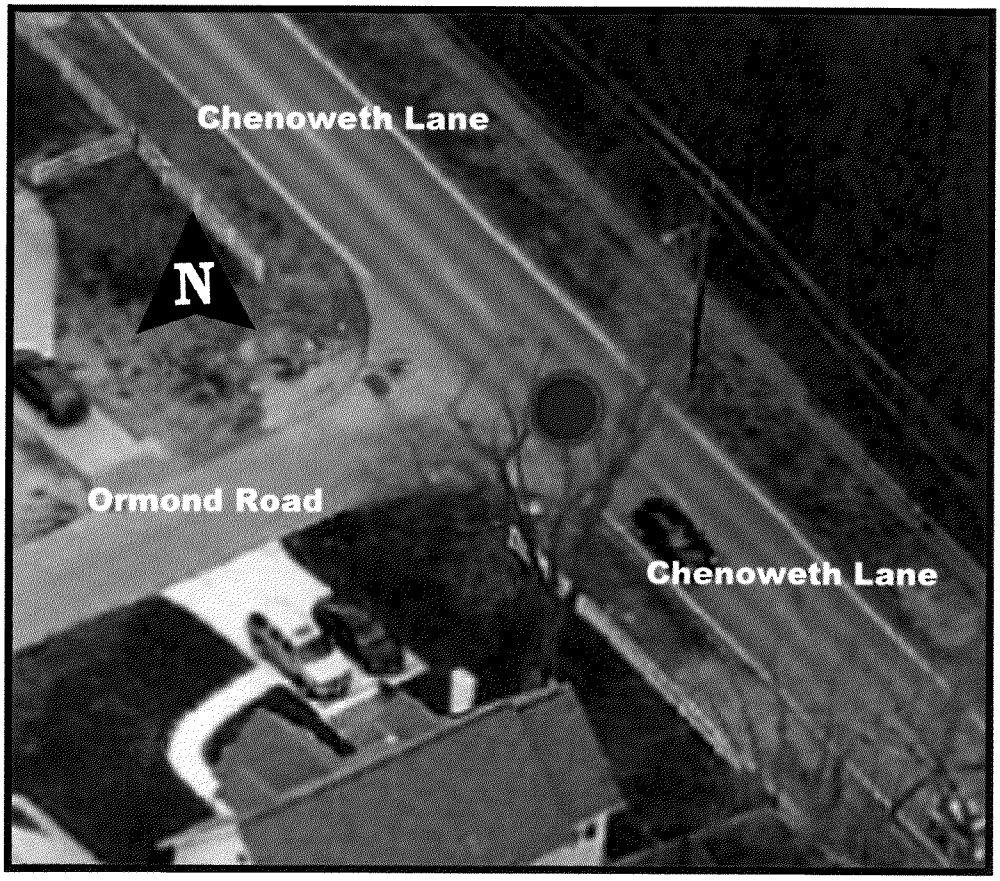
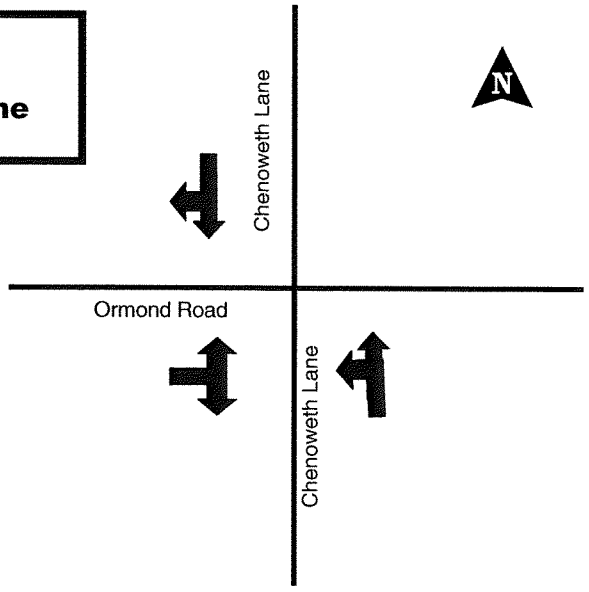


FIGURE 9

Ormand Road / Chenoweth Lane



5.0 TURNING MOVEMENT COUNTS

Turning movement data for this study was collected on August 27 and 28, 2013, and May 29, 2014. Turning movement counts were performed at the Masonic Home Drive / Bauer Avenue intersection of August 27 to coincide with a campus event and, thereby, record traffic on one of the campus's busiest days. Turning movements at these intersections were counted using Miovision cameras, which film the intersection from 25 feet above the ground (see Figure 10). The recorded data is then processed by computer to provide the most accurate count possible.

The four Chenoweth Lane/neighborhood streets intersections were counted for the peak hours of 7 a.m. to 9 a.m. and 4 p.m. to 6 p.m., and the intersection of Masonic Home Drive / Bauer Avenue / Frankfort Avenue was counted between the hours of 6 a.m. and 7 p.m. All intersections peaked between 7:15–8:15 a.m. and 5:00–6:00 p.m.

Figure 11 (p.11) summarizes current AM peak-hour turning movements and Figure 12 (p.12) summarizes PM peak-hour turning movements.

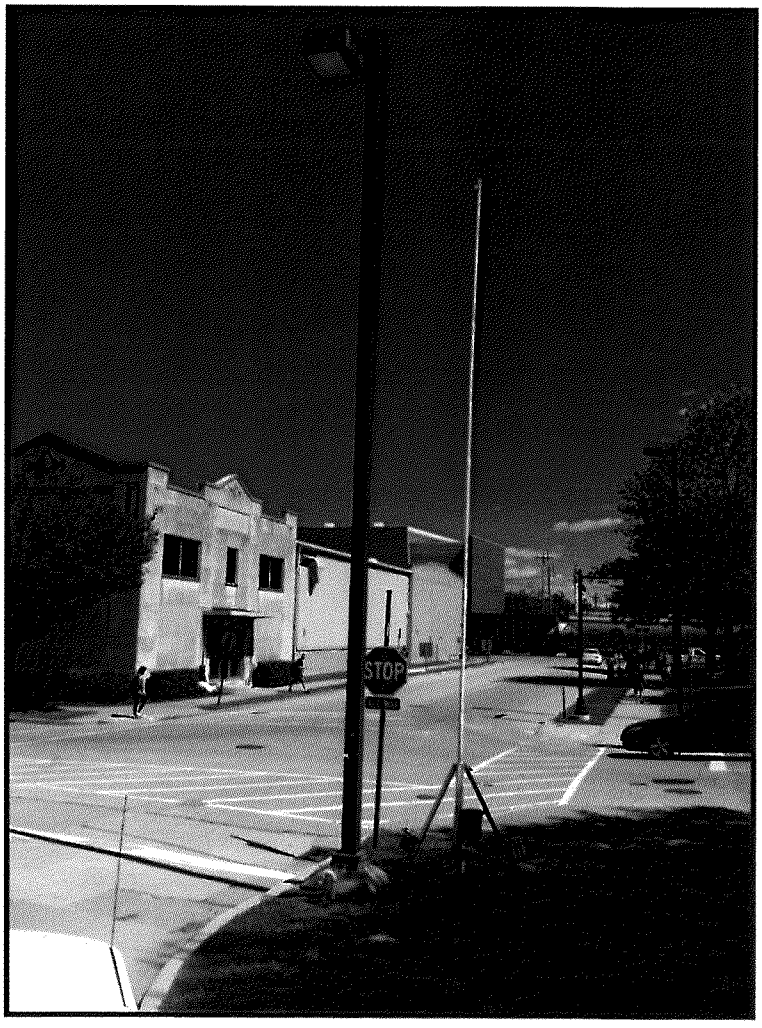


FIGURE 10: Example of Miovision Camera Setup

FIGURE 11: AM PEAK-HOUR TURNING MOVEMENT VOLUMES

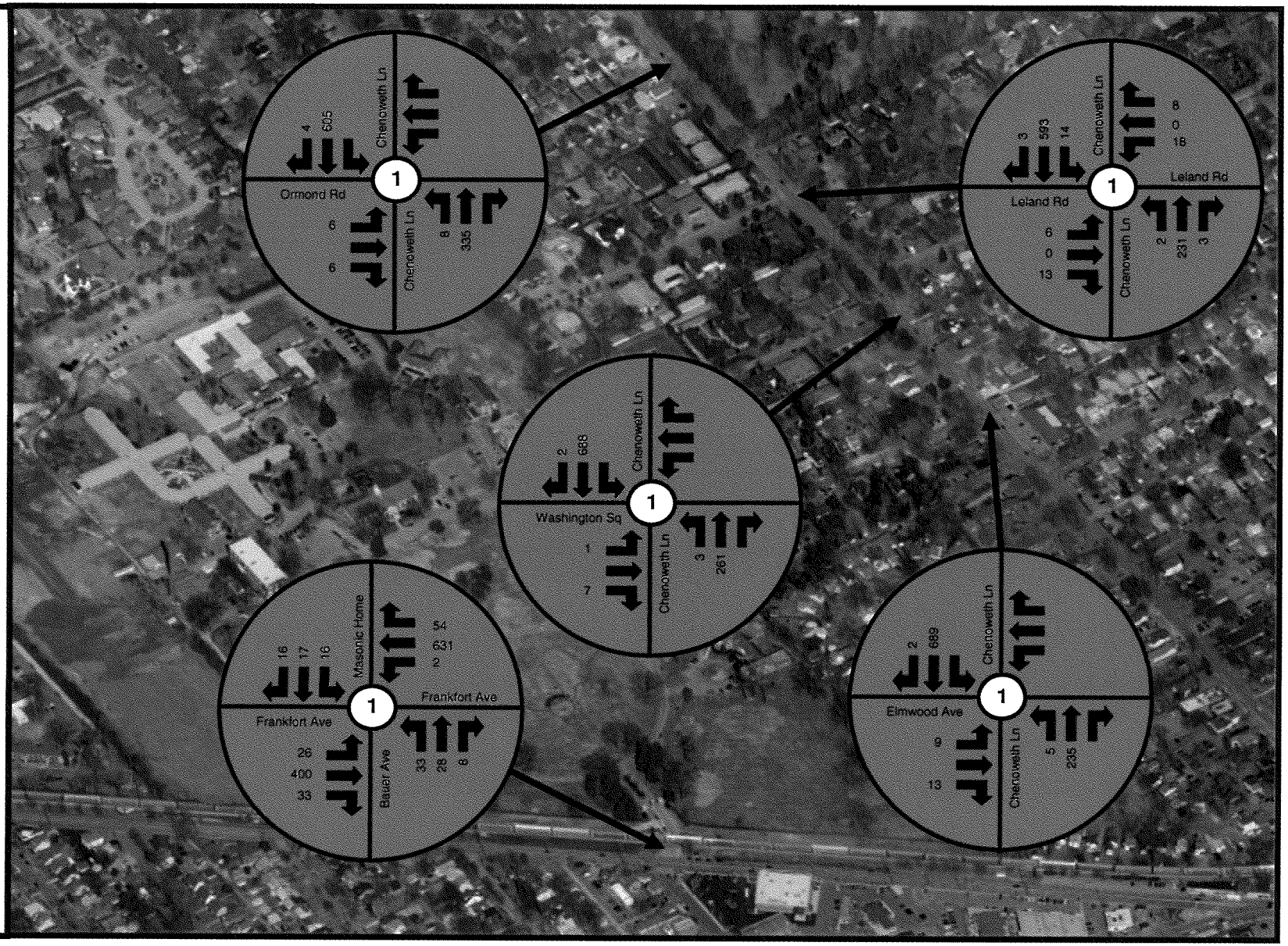
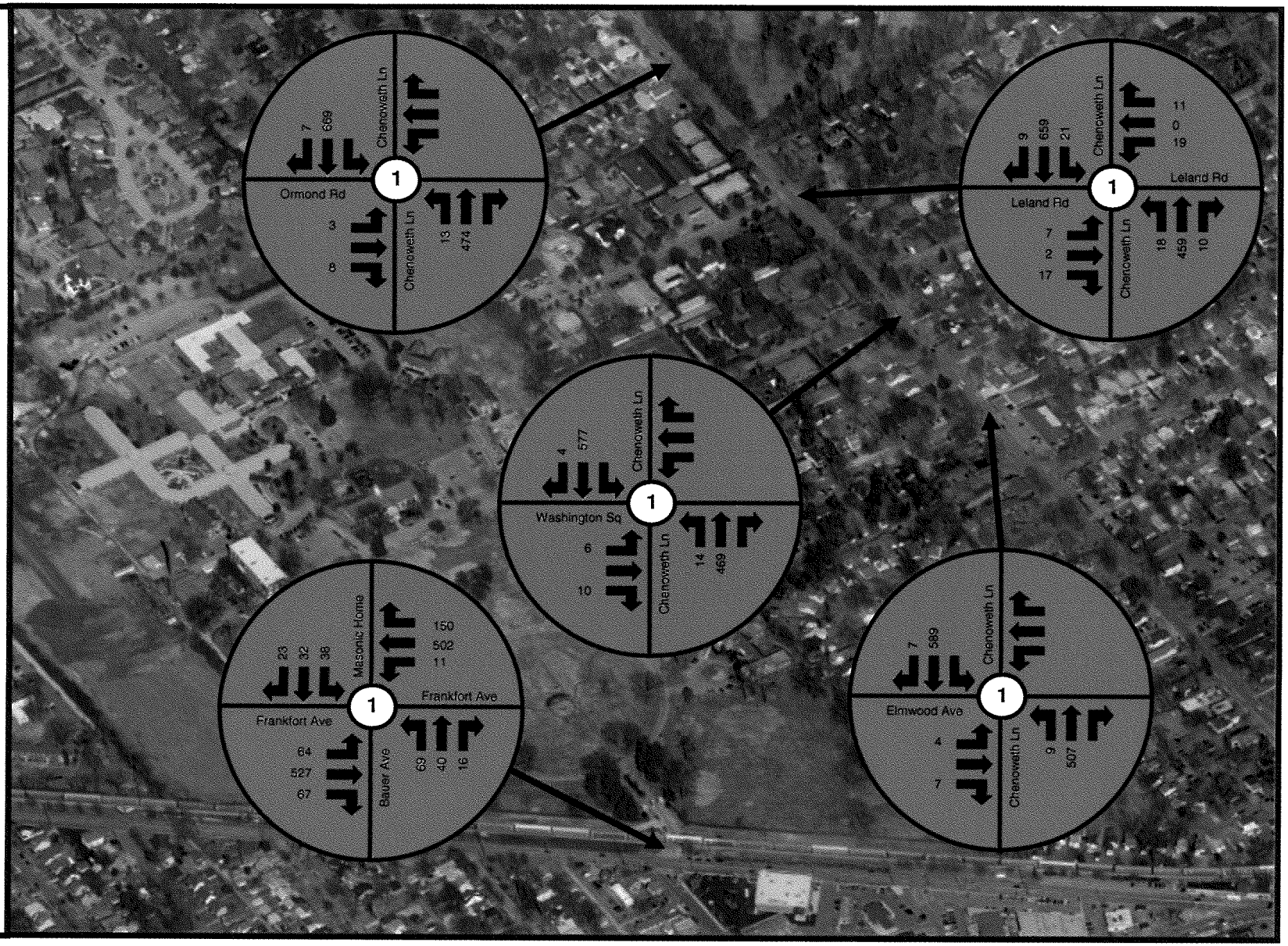


FIGURE 12: PM PEAK-HOUR TURNING MOVEMENT VOLUMES



6.0 PROJECTED TRAFFIC

6.1 BACKGROUND TRAFFIC

To calculate 2020 no-change traffic (i.e., traffic without the proposed four new campus access points), a one percent growth rate was applied to traffic on Frankfort Avenue and Chenoweth Lane. Historical counts on these two roadways show a general downward trend since the mid-1990s; however, for this study, a positive growth rate was used as a worst-case estimate. Historic traffic counts for Chenoweth Lane can be found in Appendix A.

Masonic Homes is currently constructing an additional 30 independent senior housing units that will be ready for occupancy by mid-2015. A build out year of 2020 was used for traffic analysis purposes in this study.

Trips were generated for the additional 30 housing units using Site Code 255 "Continuing Care Retirement Community" from the Institute of Transportation Engineers (ITE) *Trip Generation Manual, 9th Edition.* The following passage from the manual describes this land use.

> *Continuing care retirement communities (CCRCs) are land uses that provide multiple elements of senior adult living. CCRCs combine aspects of independent living with increased care, as lifestyle needs change with time. Housing options may include various combinations of senior adult (detached), senior adult (attached), congregate care, assisted living and skilled nursing care—aimed at allowing the residents to live in one community as their medical needs change. The communities may also contain special services such as medical, dining, recreational and some limited, supporting retail facilities. CCRCs are usual self-contained villages.*

Following is a summary of the trip generation calculations using equations from the Trip Generation Manual to calculate trips for the proposed 30 housing units.

T = trips

X = units

AM Peak Hour

$Ln(T) = 0.85\ Ln(X) - 0.82$

$T = e^{(0.85\ Ln(X) - 0.82)}$

$T = e^{(0.85\ Ln(30) - 0.82)}$

T = 8 trips (65% in, 35% out)

AM Peak Hour

$Ln(T) = 0.89\ Ln(X) - 0.99$

$T = e^{(0.89\ Ln(X) - 0.89)}$

$T = e^{(0.89\ Ln(30) - 0.89)}$

T = 8 trips (39% in, 61% out)

Figures 13 and 14 summarize future year no-change traffic conditions with added trips from the additional 30 units that are proposed. These additional trips were distributed based on the existing traffic pattern of vehicles entering and leaving the campus.

FIGURE13: AM FUTURE YEAR TURNING MOVEMENT VOLUMES

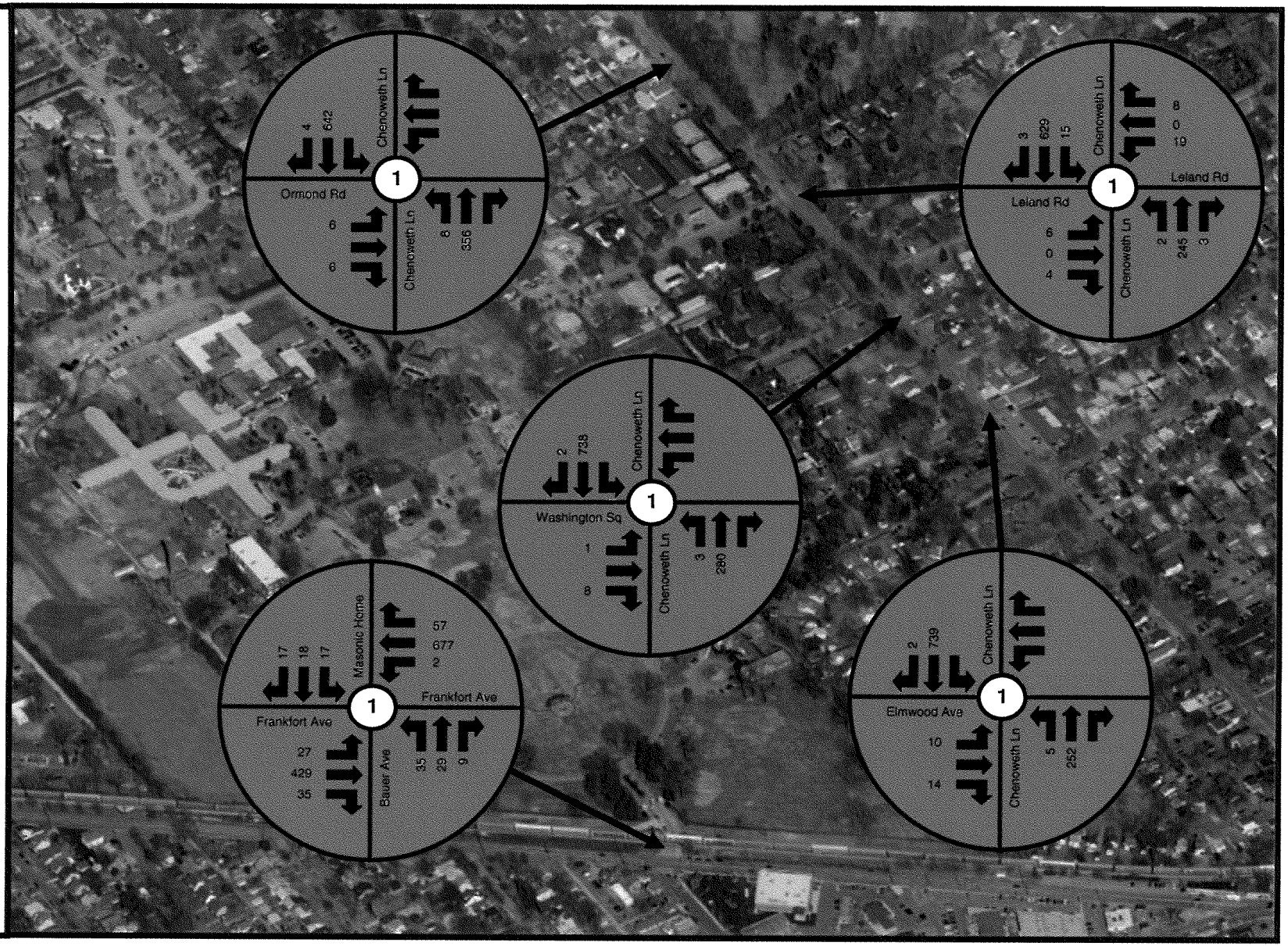
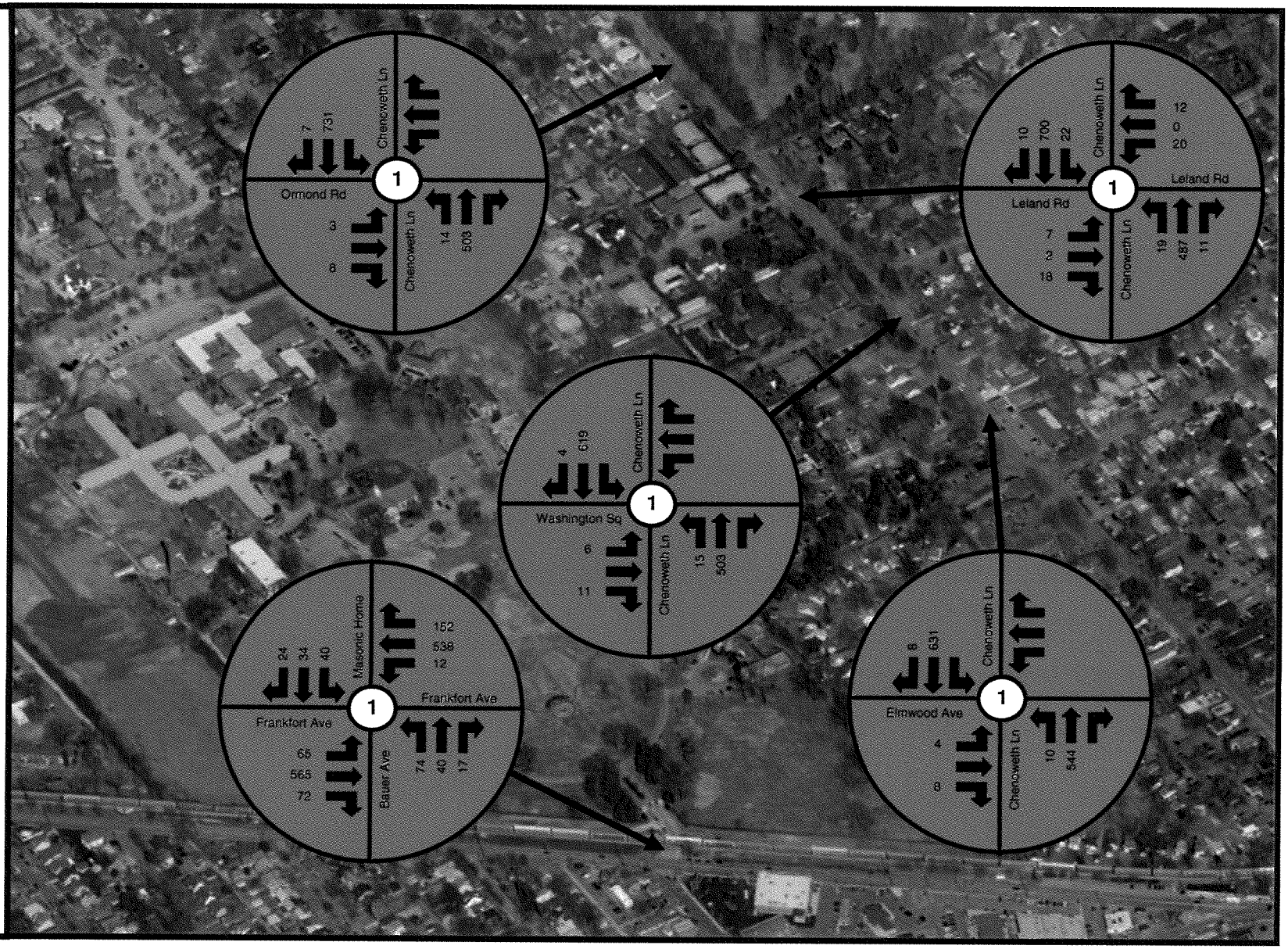


FIGURE 14: PM FUTURE YEAR TURNING MOVEMENT VOLUMES



6.2 DIVERTED TRAFFIC

Traffic diversions were based on responses received from a survey Louisville Masonic Home conducted with its employees and residents. The complete surveys are located in Apppendix D. Of 175 employees surveyed, 94 said they would use the new access points at least once a week and 32 said they would use these access points daily. Of 147 residents surveyed, 128 said they would use the new access points at least once a week and 56 said they would use them daily. Because there are three work shifts at Masonic Home, not all employee trips are made during peak hours. Likewise, residents at Masonic Home are not peak-hour oriented; their trips are spread throughout the day. With employees and residents combined, total usage of the proposed connectors is expected to range from 100 to 200 trips in each direction daily.

From the traffic data collected, there are a total of 113 trips entering the campus and 52 trips exiting the campus during the AM peak hour. During the PM peak hour there are a total of 257 trips entering the campus and 98 trips exiting the campus. These trips include people who access the day care center and the Olmsted, and who would not be allowed to use the proposed access points.

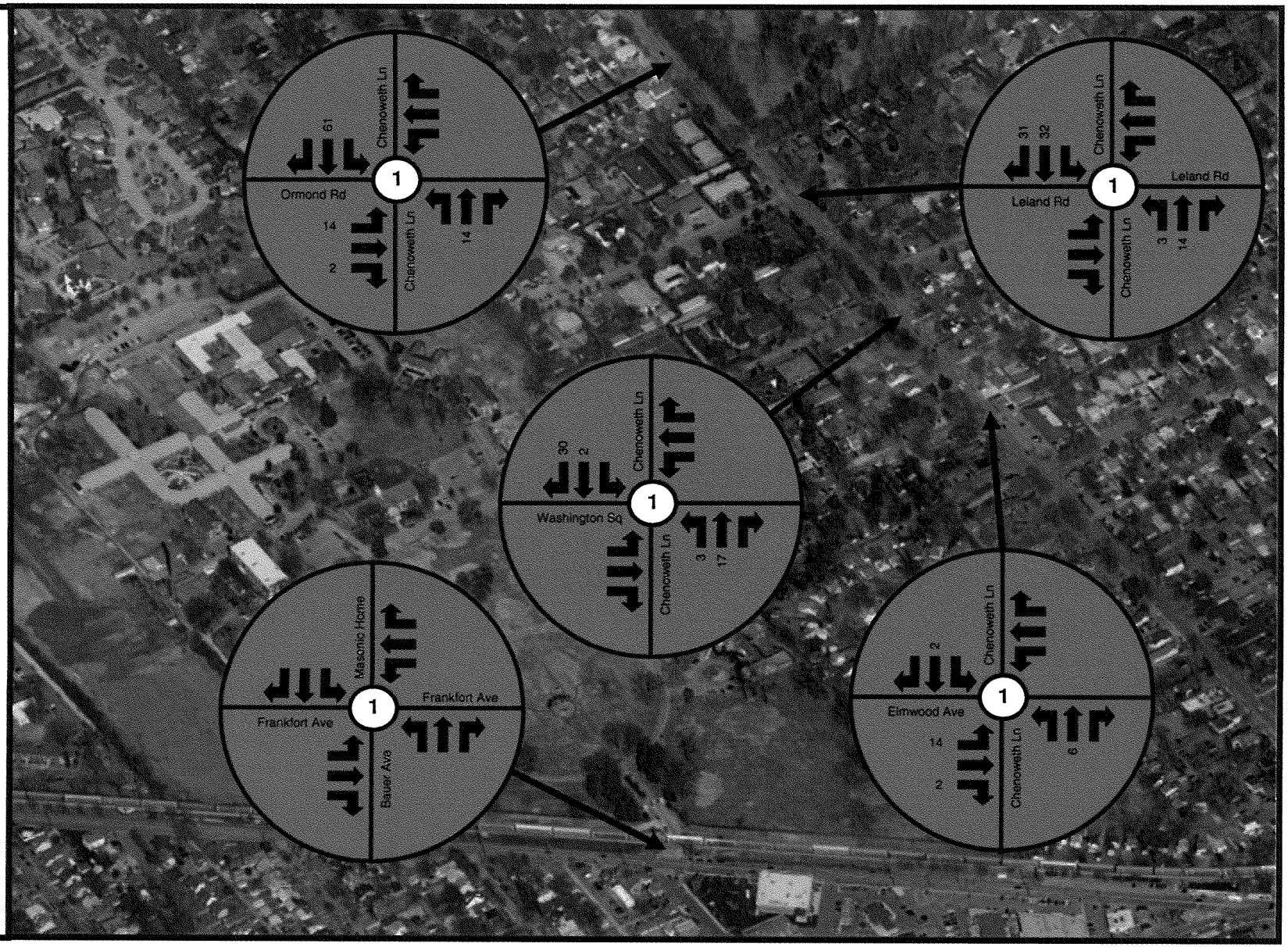
Using the greater of the daily estimates (400 trips total) and assuming that half of the trips would be split between the two peak hours, there would be 100 total trips during both the AM and PM peak hours. Using the directional split from the existing count at Masonic Home Drive and Frankfort Avenue results in the following trip counts.

- AM In – 68 trips
- AM Out – 32 trips
- PM In – 72 trips
- PM Out – 28 trips

This estimate would represent the highest degree of use by assuming everyone who said they would use the proposed access points would use them on the same day. Actual traffic volumes would most likely be lower.

For analysis purposes, these trips have been split evenly between the two inbound entrances and the two outbound entrances. In addition, it is expected that most trips using these new connections to Chenoweth Lane come from or go toward the north on Chenoweth Lane because the Frankfort Avenue entrance would be more convenient for those going to and from the south and the west. For analysis purposes, a 90/10 split between north/south Chenoweth Lane was used. Figures 15 and 16 summarize these diverted trips. Figures 17 and 18 summarize future year build traffic.

FIGURE 15: AM DISTRIBUTED TRIPS



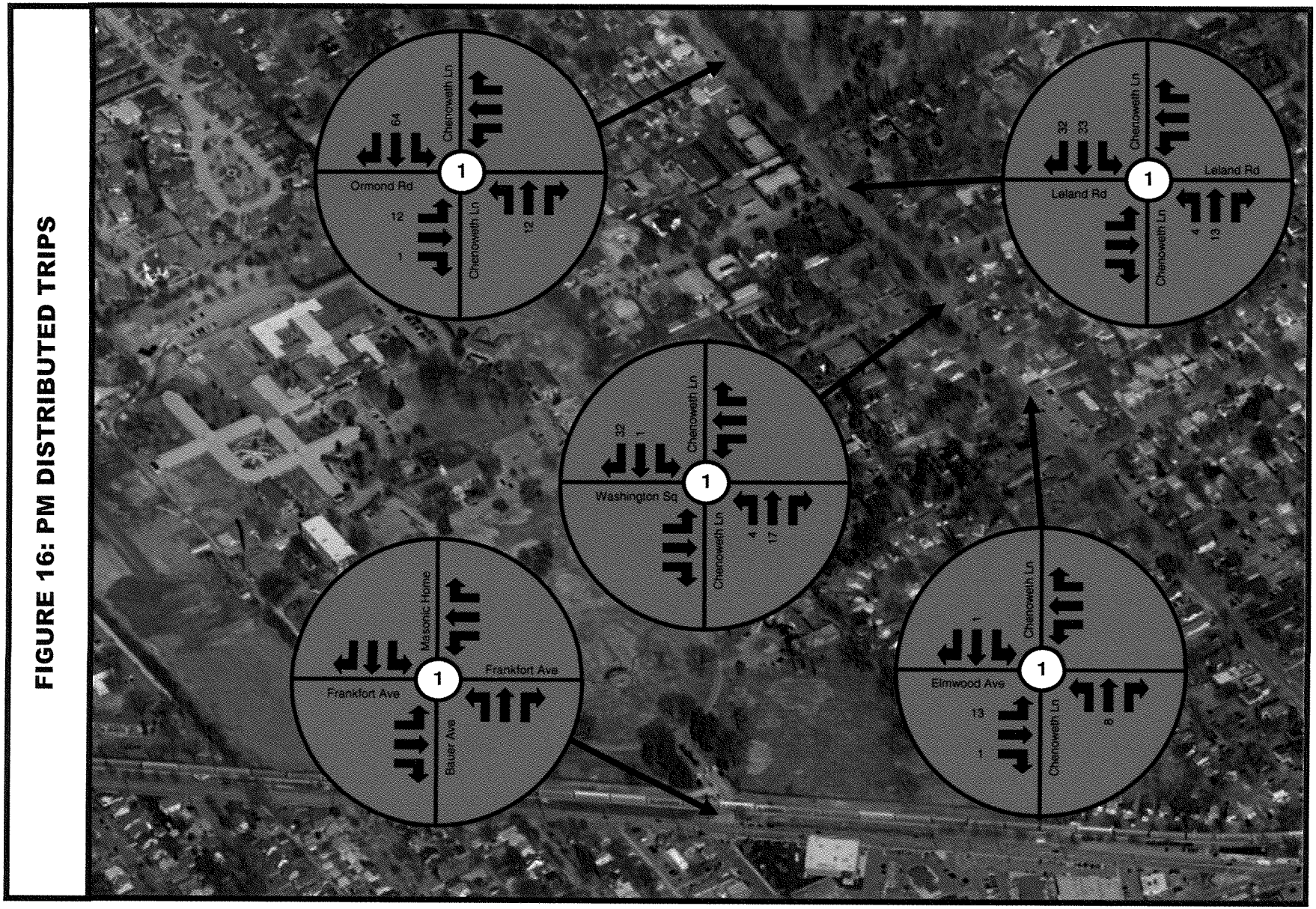


FIGURE 16: PM DISTRIBUTED TRIPS

FIGURE 17: AM BUILD TURNING MOVEMENT VOLUMES

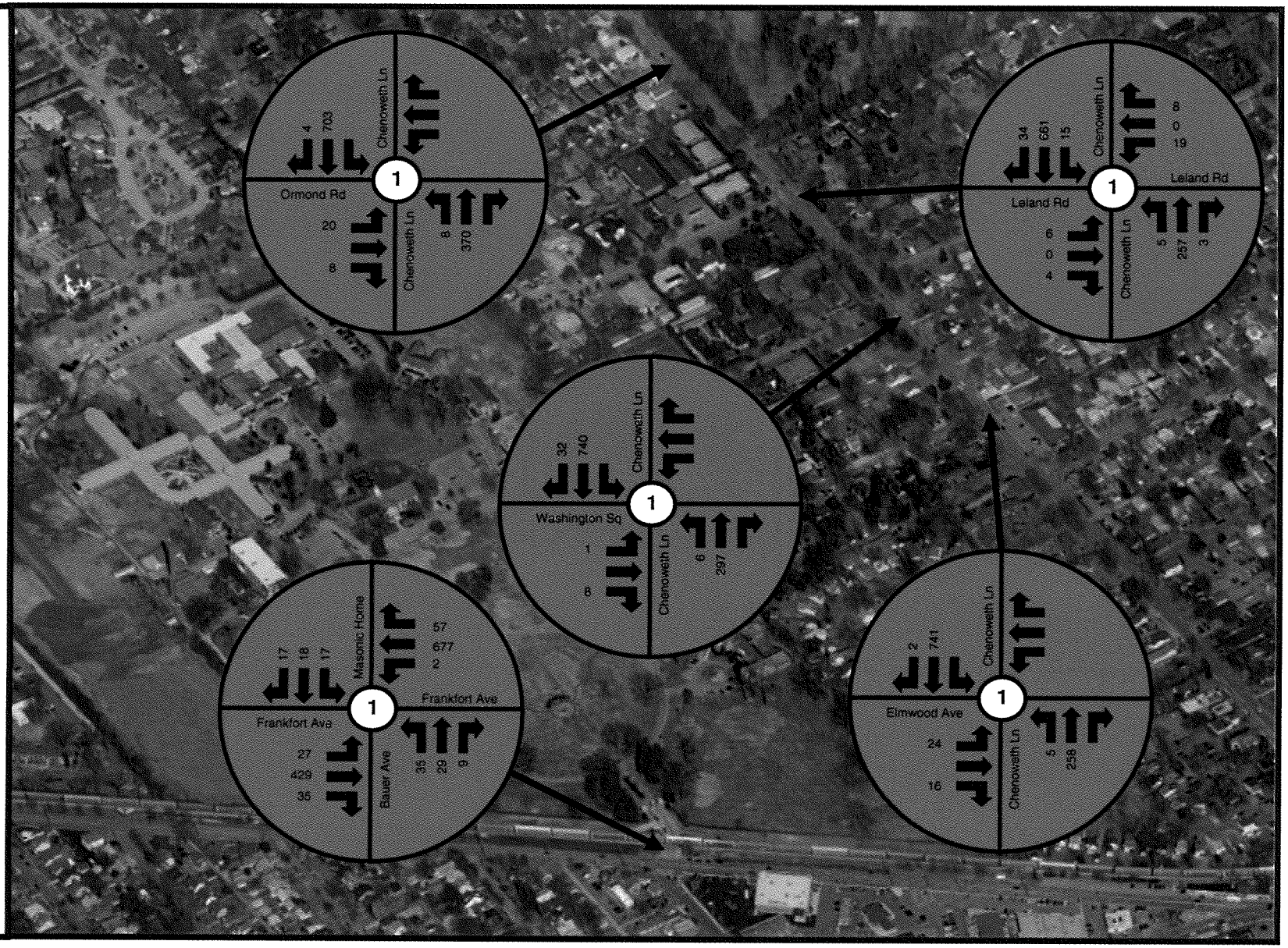
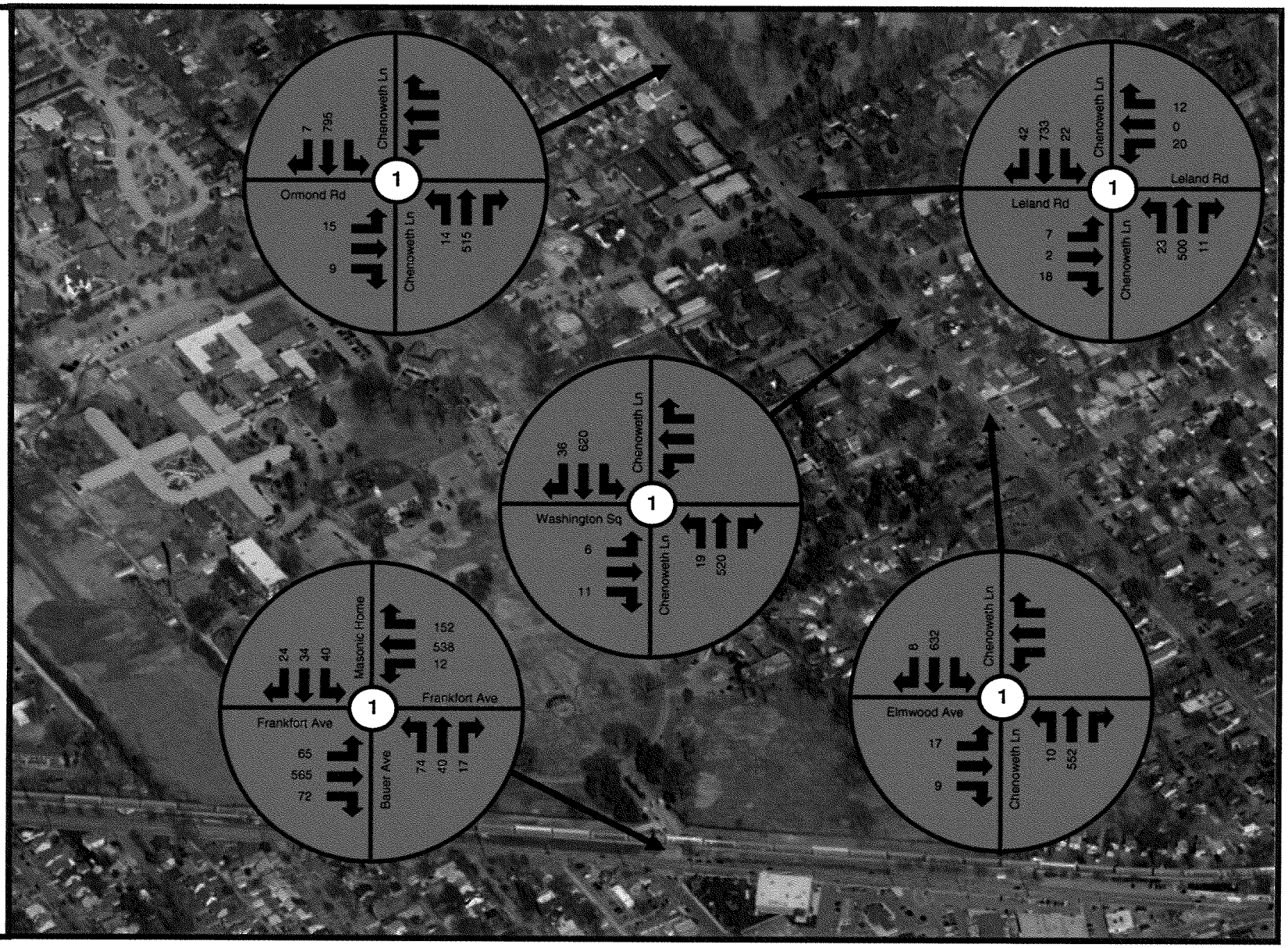


FIGURE 18: PM BUILD TURNING MOVEMENT VOLUMES



7.0 CAPACITY ANALYSIS

Level of service (LOS) is a term that is commonly used to evaluate roadway functions. Level of service is defined as a qualitative measure of operational conditions and the perception of these conditions by motorists. These conditions are usually defined in terms of factors such as speed and travel time, maneuverability, delay, and safety. There are six levels of service, which are designated by the letters "A" through "F." Level of service "A" represents the best operating conditions, while level of service "F" defines the worst.

The methodology used to analyze the capacity and level of service was based on standard traffic engineering procedures outlined in the *Highway Capacity Manual* (HCM 2010 The analysis was performed using the latest version of the Highway Capacity software. The procedure considers traffic and geometric conditions of the facility, such as traffic volumes, percent of large vehicles, design speed, lane and shoulder widths, grades, and directional distributions to determine the LOS.

Delay is a critical performance measure on interrupted-flow facilities. Delay is measured as the time a vehicle is slowed by a signalized or stop-controlled intersection compared to the average travel time of a vehicle if it were unimpeded by the intersection. Delay includes the time a vehicle decelerates approaching the intersection and accelerating as it leaves the intersection. Although the definition of delay is the same for both signalized and stop-controlled intersections, the thresholds used to determine LOS differ. LOS thresholds for signalized and unsignalized intersections are summarized in Tables 1.1 and 1.2, below.

Table 1.1 : LOS Threshold for Signalized Intersections

Delay (sec)	LOS	Description
1-10	A	Free Flow
10-20	B	Reasonable Unimpeded Flow
20-35	C	Stable Operation
35-55	D	*Approaching Unstable Flow
55-80	E	Unstable Flow
>80	F	Congested Flow

** Considered acceptable For urban areas*

Table 1.2 : LOS Threshold for Unsignalized Intersections

Delay (sec)	LOS	Description
1-10	A	Free Flow
10-15	B	Reasonable Unimpeded Flow
15-25	C	Stable Operation
25-35	D	*Approaching Unstable Flow
35-50	E	Unstable Flow
>50	F	Congested Flow

** Considered acceptable for urban areas.*

Capacity analyses were performed for all study area intersections for both the AM and PM peak hours, including the following scenarios:

Note that the capacity analyses included a comparison—expressed as a volume to capacity (v/c) ratio—of the traffic volume to the operating capacity of the road based on its characteristics (number of lanes, shoulder width, grades, etc.). The v/c ratio ranges from zero (0) to 1.0, defined as follows:

- **v/c = 0**: the flow rate is zero—this is the starting point for the comparison.
- **v/c = 0– 0.999**: the volume of traffic is less than the road's capacity to handle it.
- **v/c = 1.0**: the flow rate equals the roadway's capacity; i.e., the road is approaching the limits of its ability (capacity) to handle the traffic volume.
- **v/c = > 1.0**: the traffic volume exceeds the road's capacity, producing unacceptable delays and LOS "F."

7.1 MASONIC HOME DRIVE, BAUER AVENUE, AND FRANKFORT AVENUE

This intersection currently operates at an LOS A in the AM peak hour and an LOS B in the PM peak hour. These levels are expected to remain the same in the future year 2020 no-change (i.e., without the proposed new Chenoweth Lane connections) scenario or with diversion of traffic to these proposed additional campus access locations. All movements at this intersection would also remain at their current LOS or better with Chenoweth Lane connections to the campus. Table 2 summarizes the analysis results.

7.2 ELMWOOD AVENUE AND CHENOWETH LANE

Since this intersection is stopped controlled for the eastbound approach, the southbound approach will remain free-flowing and no calculations were made for that approach.

The northbound, left/through movements currently operate at LOS B in the AM peak hour and LOS A in the PM peak hour. These LOS's are projected to remain the same in the future year 2020 no-change scenario or with campus traffic diversion to this intersection.

The eastbound, left/right movements operate at a LOS C in both peak hours and are projected to remain LOS C in the future year 2020 no-change scenario; however, the LOS would drop to D in the scenario where campus traffic diverts to this intersection. Average delay would increase by approximately 5 seconds in the AM peak hour and 9 seconds in the PM peak hour over the no-change scenario for this movement. Table 3 summarizes the analysis results.

Table 3: Elmwood Avenue / Chenoweth Lane Level of Service

	Peak	Existing			Future Year No Action			Future Year With Diversion		
Movement	Hour	v/c Ratio	Delay	LOS	v/c Ratio	Delay	LOS	v/c Ratio	Delay	LOS
Northbound, Left/Through	AM	0.020	10.3	B	0.020	10.7	B	0.020	10.7	B
	PM	0.020	8.9	A	0.020	8.8	A	0.020	9.1	A
Eastbound Left/Right	AM	0.140	19.9	C	0.170	22.0	C	0.290	26.8	D
	PM	0.070	17.6	C	0.070	17.3	C	0.230	26.5	D

7.3 WASHINGTON SQUARE AND CHENOWETH LANE

Since this intersection is stopped controlled for the eastbound approach, the southbound approach will remain free-flowing and no calculations were made for that approach.

The northbound, left/through movements currently operate at LOS B in the AM peak hour and LOS A in the PM peak hour. These LOS's are projected to remain in the future year 2020 no-change scenario or with campus traffic diversion to this intersection.

The eastbound, left/right movement operates at a LOS C in both peak hours. It is expected these LOSs will remain in the future year (no-change) scenario or with campus traffic diversion to this intersection. Table 4 summarizes the analysis results.

Table 4: Washington Square / Chenoweth Lane Level of Service

	Peak	Existing			Future Year No Action			Future Year With Diversion		
Movement	Hour	v/c Ratio	Delay	LOS	v/c Ratio	Delay	LOS	v/c Ratio	Delay	LOS
Northbound, Left/Through	AM	0.010	10.9	B	0.010	11.3	B	0.010	11.7	B
	PM	0.020	8.9	A	0.020	9.0	A	0.030	9.3	A
Eastbound Left/Right	AM	0.060	19.8	C	0.070	21.5	C	0.080	22.6	C
	PM	0.100	17.5	C	0.110	18.6	C	0.120	19.9	C

7.4 LELAND ROAD AND CHENOWETH LANE

The northbound, left/through/right movements currently operate at LOS A in both peak hours. These LOS's are projected to remain in the future year 2020 no-change scenario. With change to campus access, this approach would drop to a LOS B in the PM peak hour.

The southbound left/through/right movements currently operate at LOS A in both peak hours. These LOS's are projected to remain in the future year no-change scenario or with campus traffic diversion to this intersection.

The westbound left/through/right movements currently operate at LOS C in the AM peak hour and LOS E in the PM peak hour. The AM peak hour is projected to remain LOS C through the future year no-change scenario or with campus traffic diversion to this intersection. The PM peak hour for this movement is expected to drop to LOS F with either the future year no-change scenario and with the diversion scenario.

The eastbound, left/through/right movements currently operate at LOS C in the AM peak hour and LOS D in the PM peak hour. In future year 2020 the AM peak hour is expected to remain a LOS C with the PM peak hour projected to drop to LOS E. With diversion, the AM peak hour is projected to drop to LOS D while the PM peak hour would remain an LOS E.

Table 5: Leland Road / Chenoweth Lane Level of Service

		Existing			Future Year No Action			Future Year With Diversion		
Movement	Peak Hour	v/c Ratio	Delay	LOS	v/c Ratio	Delay	LOS	v/c Ratio	Delay	LOS
Northbound, Left/Through/Right	AM	0.000	9.2	A	0.000	9.3	A	0.010	9.9	A
	PM	0.020	9.5	A	0.030	9.7	A	0.040	10.2	B
Southbound, Left/Through/Right	AM	0.020	7.8	A	0.020	7.8	A	0.020	7.9	A
	PM	0.030	8.6	A	0.040	8.7	A	0.040	8.8	A
Westbound, Left/Through/Right	AM	0.150	20.2	C	0.170	22.2	C	0.190	25.0	C
	PM	0.410	46.3	E	0.500	60.0	F	0.600	81.0	F
Eastbound, Left/Through/Right	AM	0.120	19.5	C	0.130	21.0	C	0.120	27.9	D
	PM	0.260	32.8	D	0.310	37.7	E	0.360	46.6	E

7.5 ORMOND ROAD / CHENOWETH LANE

Since this intersection is stopped controlled for the eastbound approach, the southbound approach will remain free-flowing and no calculations were made for that approach.

The northbound, left/through movements currently operate at a LOS A in both peak hours. These LOS's are projected to remain in the future year no-change scenario. With diversion, LOS A is projected to remain in the AM peak hour and drop to a LOS B in the PM peak hour. However, this drop in LOS is due to a one second increase in delay.

The eastbound, left/right movements currently operate at LOS C in both peak hours. It is projected these LOSs will remain in the future year no change scenario. With campus access provided to Ormond Road, this movement would drop from a LOS C to a LOS D in both peak hours.

Table 6: Ormond Road / Chenoweth Lane Level of Service

Movement	Peak Hour	Existing v/c Ratio	Existing Delay	Existing LOS	Future Year No Action v/c Ratio	Future Year No Action Delay	Future Year No Action LOS	Future Year With Diversion v/c Ratio	Future Year With Diversion Delay	Future Year With Diversion LOS
Northbound, Left/Through	AM	0.010	9.1	A	0.010	9.3	A	0.010	9.6	A
	PM	0.020	9.5	A	0.030	9.8	A	0.030	10.2	B
Eastbound Left/Right	AM	0.080	18.8	C	0.090	19.7	C	0.260	28.0	D
	PM	0.060	19.2	C	0.060	21.3	C	0.210	34.4	D

8.0 CONCLUSIONS

Diversion of traffic to the Chenoweth Lane connectors will have little impact to any intersection. Several intersections do show a one level of service drop with traffic diverted to the various Chenoweth Lane connectors; however, all of these movements maintain at least a level of service D. The Leland Avenue approaches to Chenoweth Lane both drop below a level of service D, but they maintain the same level of service as the no-change scenario.