


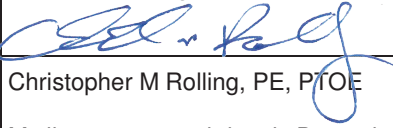
**ASPEN HEIGHTS  
WILMOTH AVE & LINCOLN WAY  
AMES, IA**

**TRAFFIC IMPACT STUDY**

**PREPARED FOR**

**ASPEN HEIGHTS  
1301 S CAPITAL OF TEXAS HWY  
AUSTIN, TEXAS**

---

	I hereby certify that this engineering document was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.	
		3-11-16
	Christopher M Rolling, PE, PTOE	Date
	My license renewal date is December 31, 2017.	
Pages or sheets covered by this seal: Entire Report		

**MARCH 2016**

**OA PROJECT No. 015-2763**

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## 1.0 INTRODUCTION AND OBJECTIVE

This report documents the results of a Traffic Impact Analysis conducted for the proposed Aspen Heights Development located on the southwest quadrant of Wilmoth Ave & Lincoln Way in Ames, Iowa. A map showing the general location of the proposed developments is shown in **Figure 1**.

This traffic study was conducted to identify the expected trips that would be generated by the proposed development and to determine the effects of site traffic on the surrounding roadway network. Specific recommendations are included at the end of this report to help mitigate the traffic impacts.

## 2.0 DATA COLLECTION

The data collection effort included acquiring peak-hour turning movement counts and documentation of current roadway geometrics and traffic control.

Intersection turning movement counts were conducted on Wednesday, December 2, 2015 at the intersection of Franklin Avenue & Lincoln Way. The count was conducted during the AM and PM peak periods of traffic flow (7:00am – 9:00am and 4:00pm – 6:00pm, respectively).

Average Daily Traffic (ADT) volumes were taken from the historic Iowa Department of Transportation (Iowa DOT) Average Annual Daily Traffic Maps. Additionally, turning movement counts were acquired in a previous traffic study performed by Duane Smith in December, 2013 at the following intersections:

- Wilmoth Ave & Lincoln Way (12/3/2013)
- State Ave & Lincoln Way (12/3/2013)

Existing traffic volumes are shown on **Figure 2**. The AM and PM peak hours were at 7:45am – 8:45am and 5:00pm – 6:00pm, respectively. Count data collected for this study can be found in **Appendix A**.

## 3.0 EXISTING CONDITIONS

Existing traffic conditions were evaluated to identify any existing deficiencies and to provide a baseline for comparison purposes.

### 3.1 Network Characteristics

There are four major roadways within the study area: Lincoln Way, State Ave, Wilmoth Ave, and Franklin Ave. Current network characteristics are summarized in **Table 1** below. Data for each roadway was acquired from aerial photography and the IowaDOT functional classification maps. All intersections in the study area are signalized.

TABLE 1: EXISTING NETWORK SUMMARY

Roadway	Section	Median Type	Posted Speed	Functional Classification
Lincoln Way	4-Lane	Undivided	35 mph	Other Principal Arterial
State Ave	2-Lane	Undivided	35 mph	Collector
Wilmoth Ave	2-Lane	n/a	25 mph	Local
Franklin Ave	2-Lane	n/a	25 mph	Local

Existing lane configurations and traffic control for the study network are illustrated in **Figure 3**.



# FIGURE 1

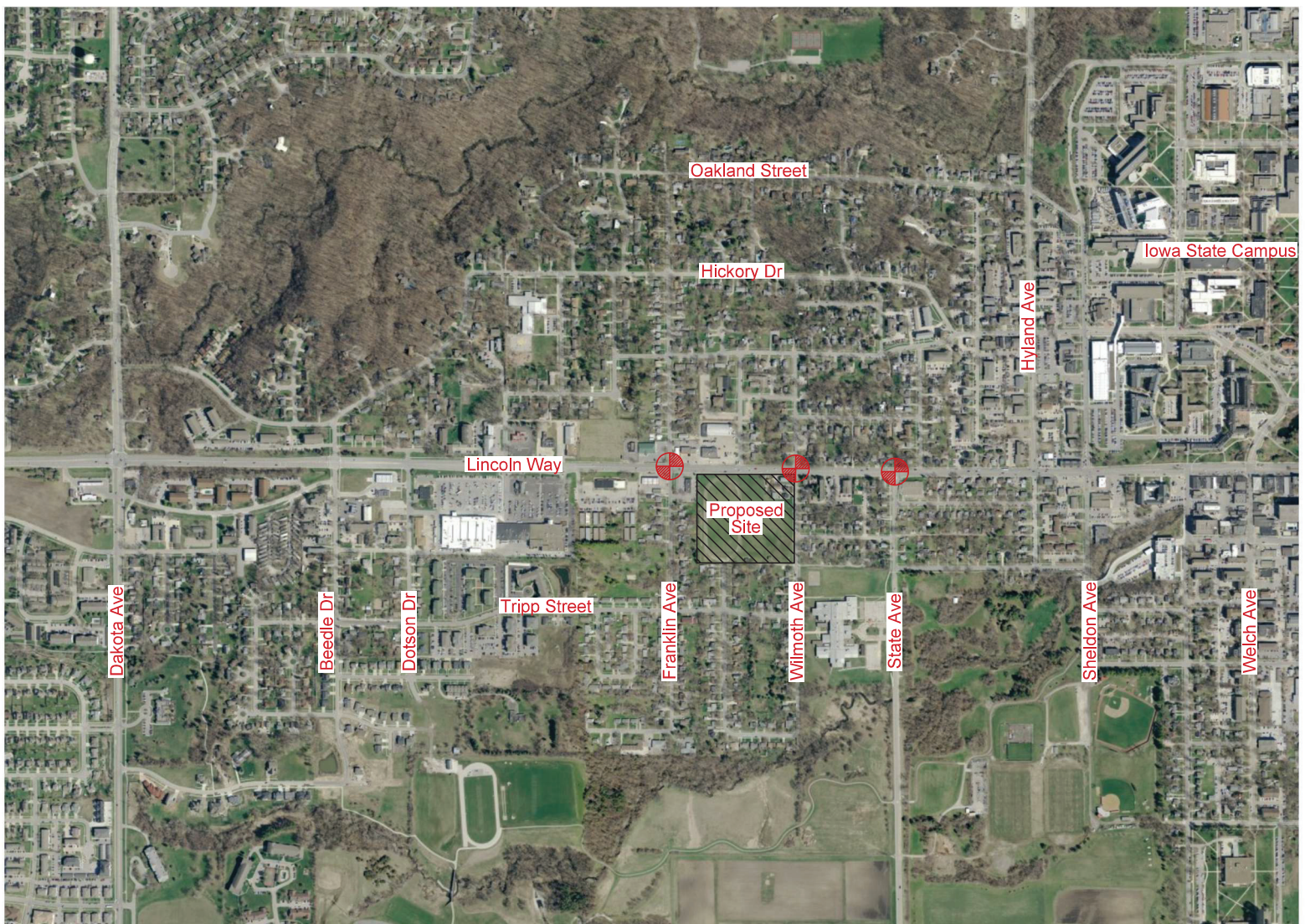
## Vicinity Map

Aspen Heights  
Ames, IA

### LEGEND



Study Intersection



# FIGURE 2

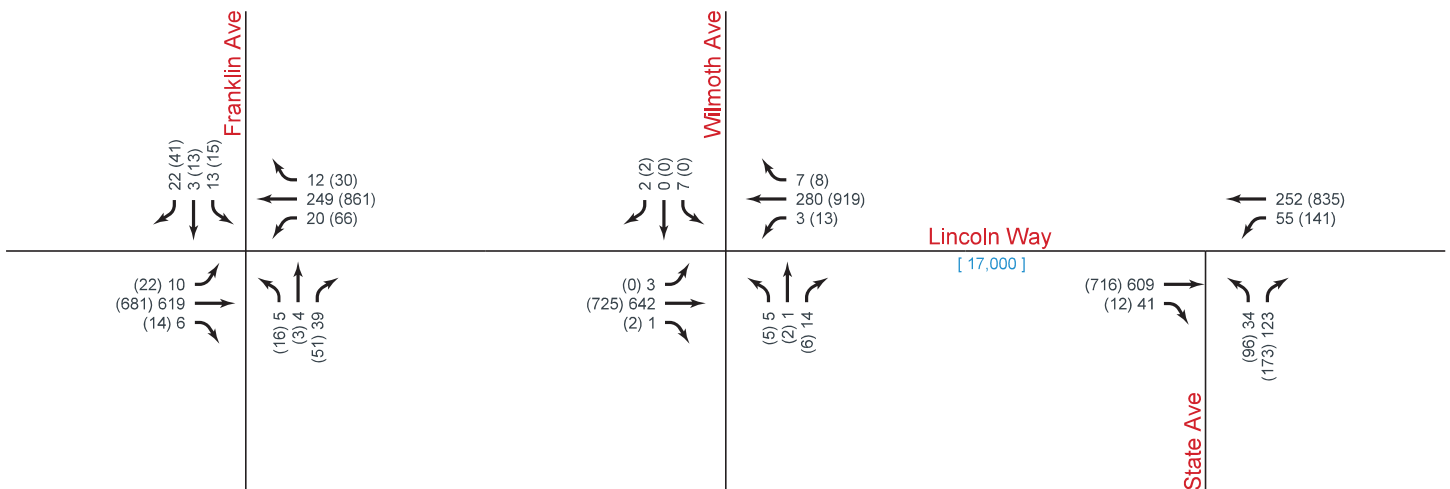
## Existing Traffic Volumes

Aspen Heights  
Ames, IA

### LEGEND

AM (PM) Peak Hour Volume

[XX,XXX] Existing ADTs



## FIGURE 3

### Existing Conditions Lane Configurations and Traffic Control

Aspen Heights  
Ames, IA

#### LEGEND



Existing Signalized  
Intersection

xx' →

Lane Configuration  
& Storage Length



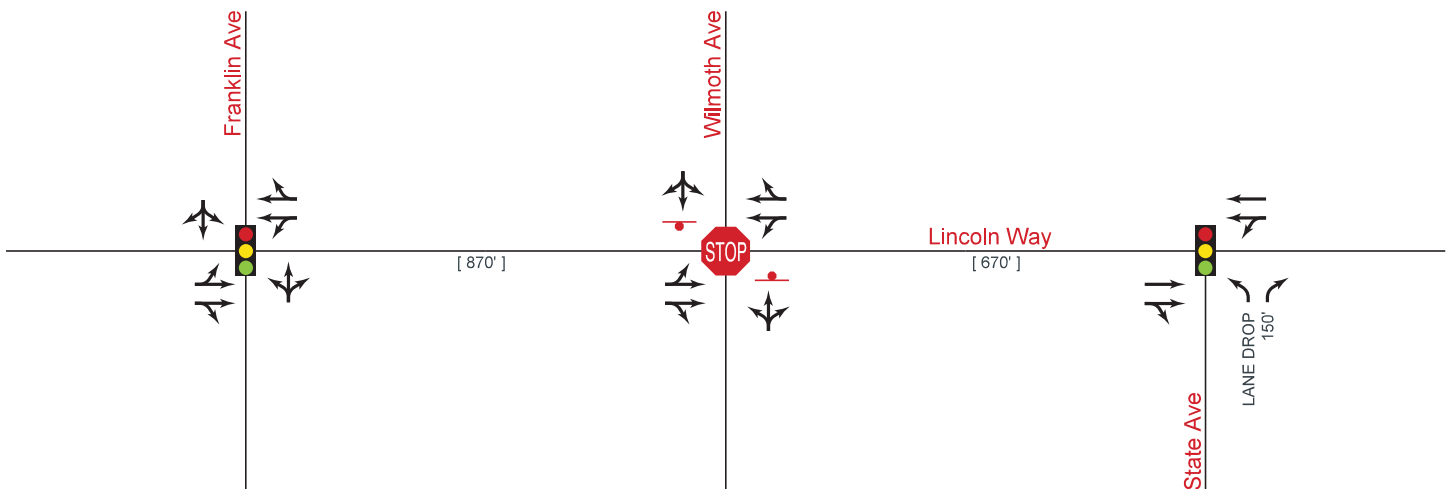
Stop Controlled  
Intersection



Stop Sign

[xx']

Center-to-Center  
Intersection Spacing



### 3.2 Existing Capacity Analysis

Capacity analyses were performed for the existing study intersections utilizing the existing lane configurations and traffic control. Analyses were conducted using Synchro, Version 9.1 which is based on the Highway Capacity Manual 2010 delay methodologies. For simplicity, the amount of control delay is equated to a grade or Level of Service (LOS) based on thresholds of driver acceptance. The amount of delay is assigned a letter grade A through F, LOS A representing little or no delay and LOS F representing very high delay. **Table 2** shows the delays associated with each LOS grade for signalized and unsignalized intersections, respectively.

TABLE 2: INTERSECTION LOS CRITERIA

Level-of-Service	Average Control Delay (seconds)	
	Signalized	Unsignalized
A	≤ 10	≤ 10
B	> 10-20	> 10-15
C	> 20-35	> 15-25
D	> 35-55	> 25-35
E	> 55-80	> 35-50
F	> 80	> 50
Highway Capacity Manual (HCM 2010)		

Results of the analyses indicate that the signalized intersections operate at LOS B or better in both peak hours. All individual movements at signalized intersections operate at LOS C or better in both peak hours. The eastbound and westbound 95<sup>th</sup> percentile queue lengths do not exceed more than 200 feet along Lincoln Way at both signalized intersections.

All movements at the unsignalized intersection of Wilmoth Ave & Lincoln Way operate at LOS D or better in both peak hours. The 95<sup>th</sup> percentile queue length for northbound and southbound minor street movements do not exceed one vehicle in both peak hours.

The Existing Conditions capacity analysis summary is illustrated in **Figure 4**. Detailed results may be found in **Appendix B**.

### 3.3 Crash Analysis

A crash analysis was conducted for the intersections of Colorado Ave & Lincoln Way, Wilmoth Ave & Lincoln Way, and State Ave & Lincoln Way to determine if there are any existing crash patterns in the area. Crash data was provided by the City of Ames through the Iowa DOT. The last three years of crash data were analyzed (2013 thru 2015). Note that Franklin Ave & Lincoln Way was not analyzed as a capital improvement project to reconstruct this intersection with left-turn lanes is planned.

There were 23 crashes at the three aforementioned intersections. Three of the crashes reported a minor injury. The majority of crashes were caused by rear end collisions with 15. Lincoln Way is a four-lane roadway with no center turn lane. It is likely that many of these rear-end collisions can be attributed to lack of refuge for left-turning vehicles. In addition, segment crashes were analyzed from Colorado Ave to State Ave along Lincoln Way. There were eight collisions in this stretch of roadway, all rear-end. Seven of these rear-end collisions occurred between Wilmoth Ave and State Ave.

**Table 3** and **Table 4** summarize the intersection crash statistics. A review of all crashes can be seen in **Figure 5**.






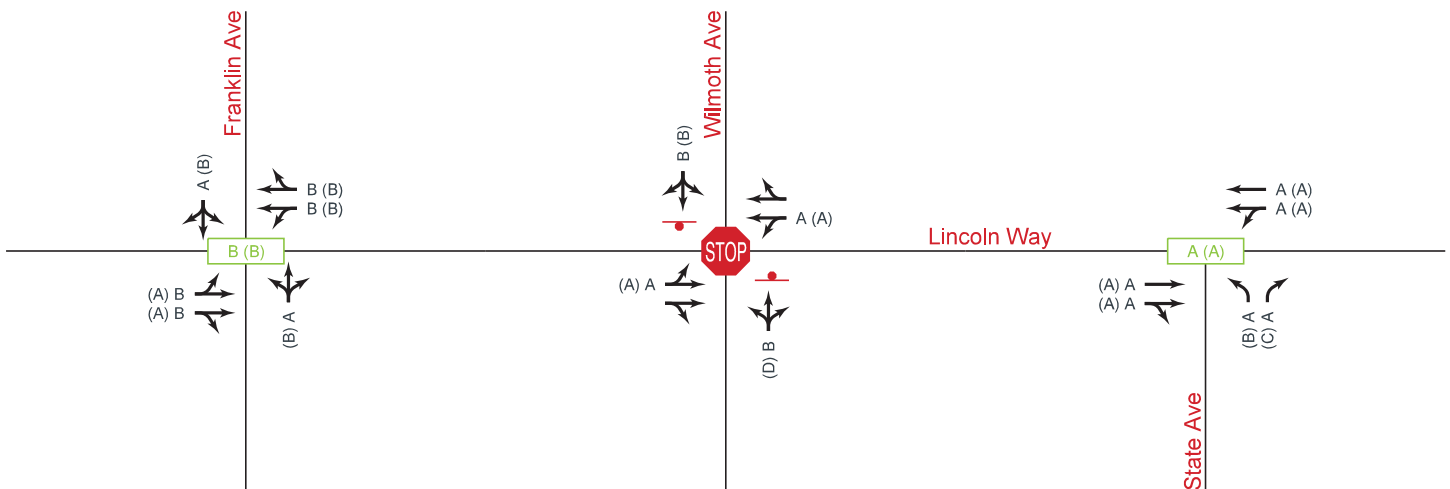
# FIGURE 4

## Existing Conditions Capacity Analysis Summary

Aspen Heights  
Ames, IA

### LEGEND

- AM (PM) Signalized Intersection LOS
- AM (PM) Movement LOS
-  Stop Controlled Intersection
-  Stop Sign
-  Lane Geometry



# FIGURE 5

## Crash Analysis Summary

Aspen Heights  
Ames, IA



### LEGEND

- ←← Rear-End
- ⇌ Sideswipe
- ↘ Angle
- ↘ Fixed Object
- Pedestrian

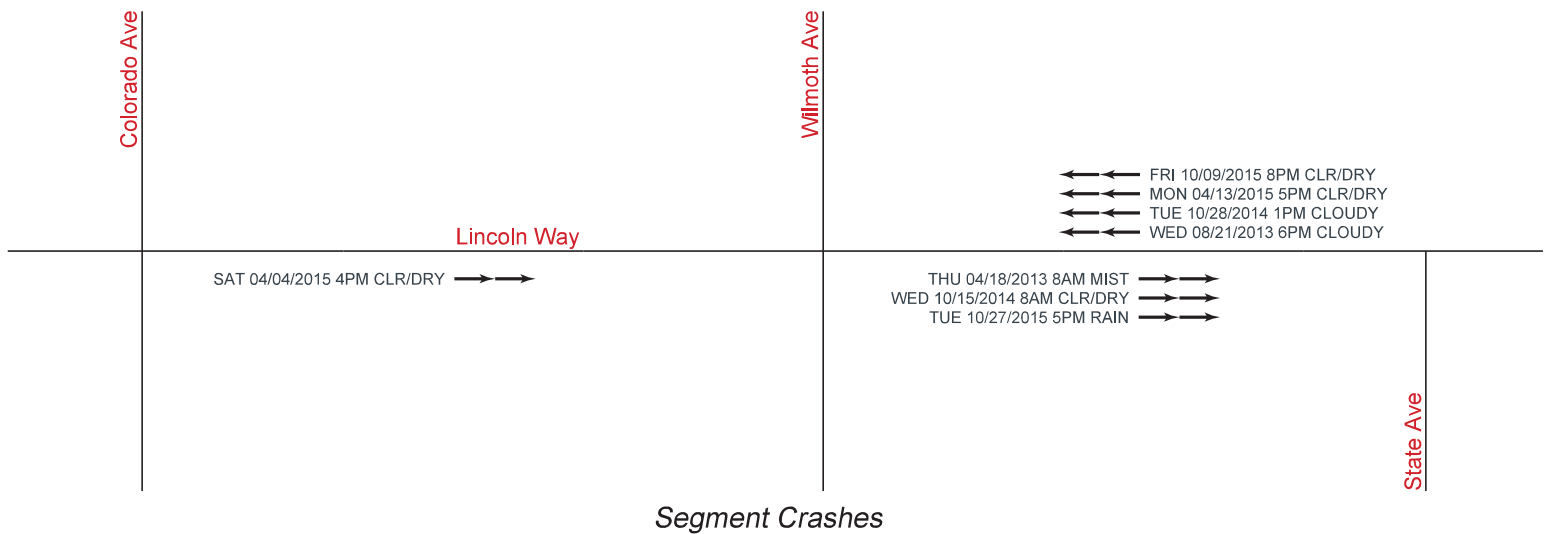
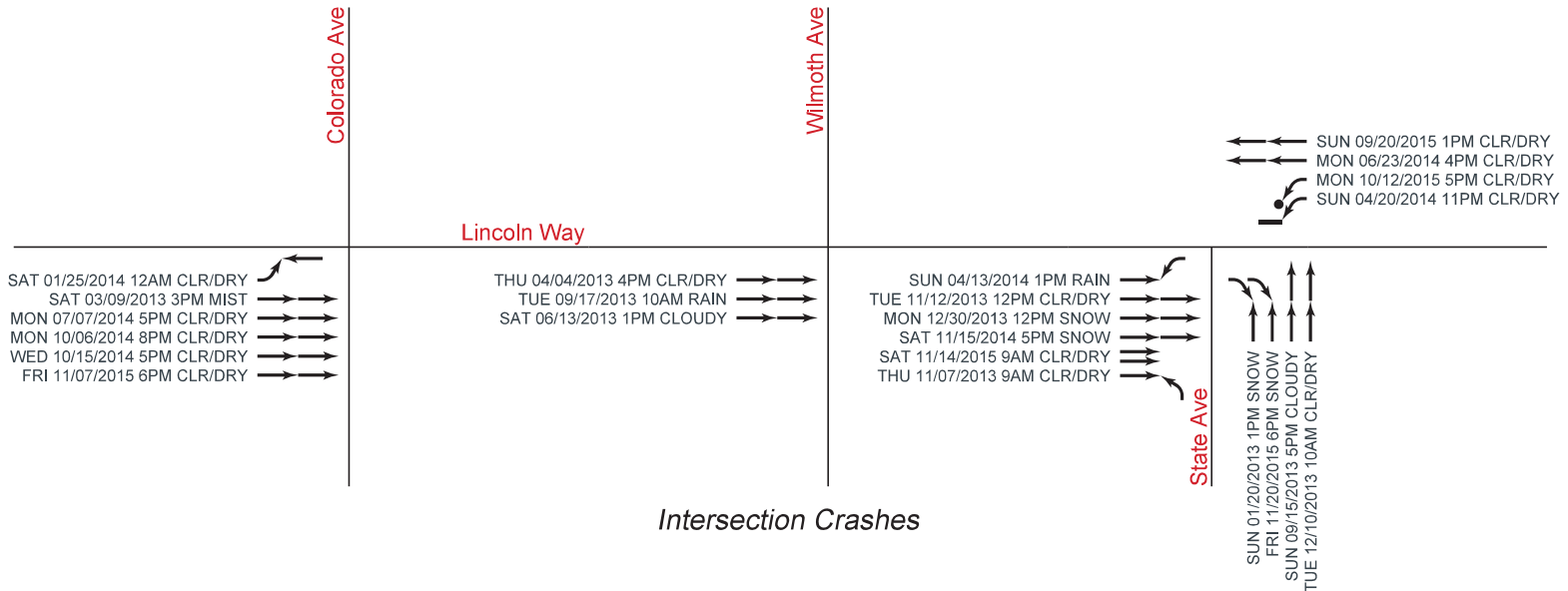


TABLE 3: INTERSECTION CRASH STATISTICS

Intersection	Crashes	2015 ADT	No. Years	Crash Rate (crashes/mev)
Colorado & Lincoln	6	17,500	3	0.31
Wilmoth & Lincoln	3	17,500	3	0.16
State & Lincoln	14	21,700	3	0.59

TABLE 4: CRASH TYPE SUMMARY

Intersection/Segment	Rear-End	Sideswipe	Angle	Fixed-Object	Pedestrian
Colorado & Lincoln	5	0	1	0	0
Wilmoth & Lincoln	3	0	0	0	0
State & Lincoln	8	1	4	1	1
Colorado to Wilmoth	1	0	0	0	0
Wilmoth to State	7	0	0	0	0

## 4.0 2040 BACKGROUND CONDITIONS

Current traffic volumes and projected roadway ADT volumes were used as a basis for peak hour volume projections. The year 2040 was chosen as the horizon year as it corresponds with the Ames Area Metropolitan Planning Organization (AAMPO) long-range travel demand model. To evaluate the horizon year scenario, it was necessary to establish peak hour volumes for 2040.

### 4.1 2040 Background Volumes

The Iowa DOT provided existing and future ADT volumes for the study area for 2040, the horizon year. Peak hour volumes were generated based on a growth rate that was developed using these ADT volumes. Annual traffic growth along roadways in the study area ranged from no growth to just under 0.5% per year. With such minimal growth projections in this study were developed using an assumed growth rate. A conservative growth rate of 0.5% was used on all area roadways.

The 2040 Background peak hour volumes are shown in **Figure 6**.

### 4.2 2040 Background Capacity Analysis

Year 2040 background conditions capacity analysis includes the addition left-turn lanes at all approaches at the intersection of Franklin Avenue & Lincoln Way. This construction is planned by the City of Ames. An exhibit of the planned improvements, as provided by the City of Ames, is included in **Appendix C**.

Results of the capacity analysis show that all signalized intersections are expected to operate at LOS B or better in both peak hours. All turning movements are expected to operate at LOS C or better in both peak hours. The 95<sup>th</sup> percentile queue lengths are expected to be contained within provided storage lengths.

At the unsignalized intersection of Wilmoth Ave & Lincoln Way, all movements are expected to operate at LOS C or better in both peak hours with the exception of northbound movements which are expected to operate at LOS E. The 95<sup>th</sup> percentile queue length for all movements are expected to be no more than one vehicle in both peak hours.

The 2040 Background Conditions capacity analysis summary is illustrated in **Figure 7**. Detailed results may be found in **Appendix D**.

# FIGURE 6

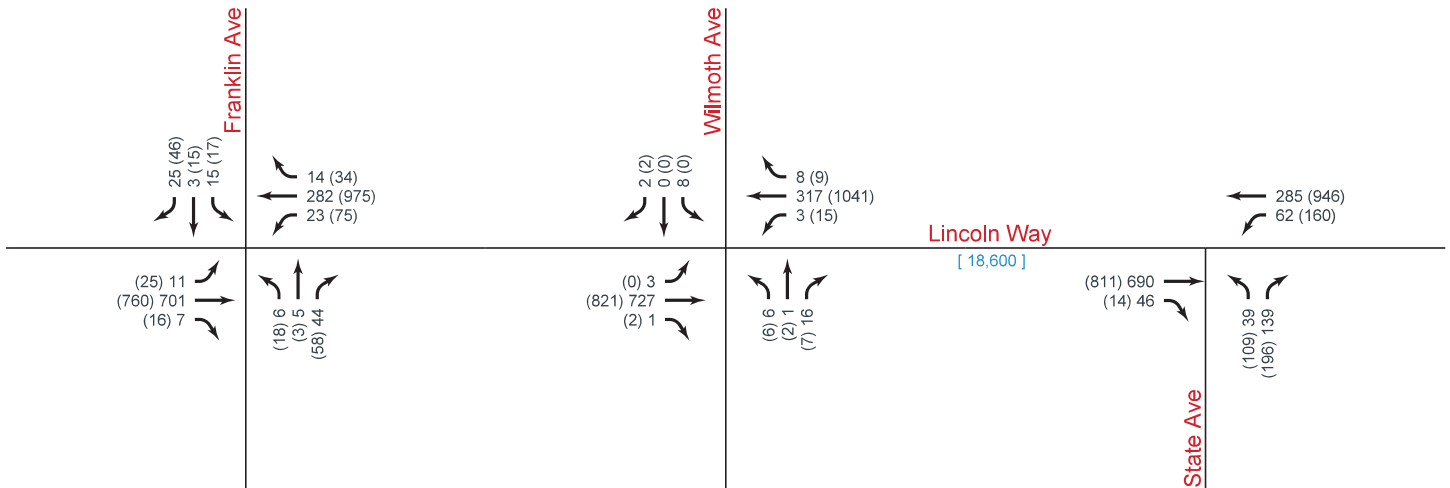
## 2040 Background Peak Hour Volumes

Aspen Heights  
Ames, IA

### LEGEND

AM (PM) Peak Hour Volume

[XX,XXX] Projected ADTs






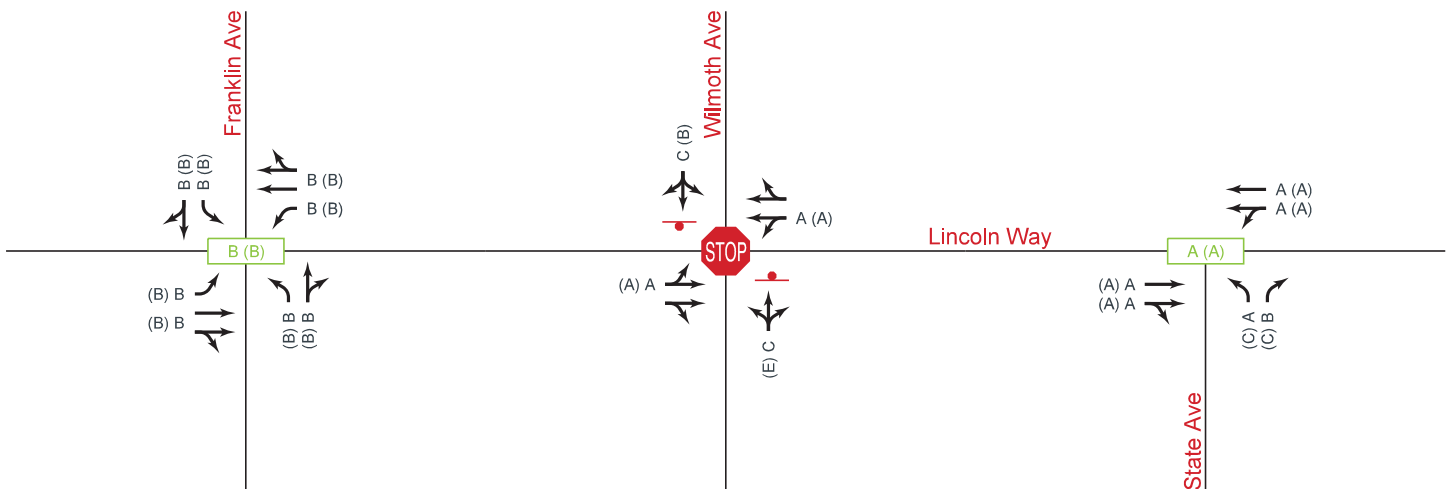
## FIGURE 7

### 2040 Background Conditions Capacity Analysis Summary

Aspen Heights  
Ames, IA

#### LEGEND

- AM (PM) Signalized Intersection LOS
- AM (PM) Movement LOS
-  Stop Controlled Intersection
-  Stop Sign
-  Lane Geometry





## 5.0 SITE CHARACTERISTICS

To determine the impact of potential site traffic on the roadway network, trips expected to be associated with the proposed site were generated and applied to the study network. The study assumes that access to the Aspen Heights development is provided at one full-movement drive along Lincoln Way located approximately 275 feet west of Wilmoth Ave & Lincoln Way. Note that the site plan includes two full-movement drives along Lincoln Way.

Section 5I-4 of the Statewide Urban Design and Specifications (SUAS) states that there may be two access points for a commercial property if there is more than 150 feet of frontage. The western-most proposed drive on Lincoln Way would not meet spacing requirements provided in SUDAS, which is 245 feet, to access points to the west along Lincoln Way. Therefore, only one drive was analyzed. Two additional full-movement accesses (apartment exits) are proposed along Wilmoth Ave located approximately 175 feet and 450 feet south of Wilmoth Ave & Lincoln Way, respectively.

The site is proposed to consist of 130 apartment units with a clubhouse, and 15,000 square feet of commercial use. The Aspen Heights site plan can be found in **Figure 8**.

### 5.1 Trip Generation

Trip generation is generally determined using rates found in the *ITE Trip Generation Manual* (9<sup>th</sup> Edition). Common Land Use Codes (LUC) are published with rates that can be applied to values related to the size of the proposed site to estimate the expected entering and exiting trips. The most similar LUCs for the proposed site include Apartment (LUC 220), Specialty Retail (LUC 826) Fast-Food Restaurant without Drive-Through Window (LUC 933), and Coffee/Donut Shop without Drive-Through Window (LUC 936).

Based on the *ITE Trip Generation Manual* (9<sup>th</sup> Edition), trip generation characteristics were developed for the land uses in the proposed development. A summary of the expected number of daily, AM peak hour, and PM peak hour trips for the development is shown in **Table 5**. The proposed development is expected to generate 4,803 daily trips, 360 AM peak hour trips, and 249 PM peak hour trips.

### 5.2 Trip Distribution

It is expected that trips originating at the site would distribute to locations around the region and would use the surrounding roadways to reach the site. The expected trip distribution for the site is shown in **Figure 9**. Opening Day peak hour site trips are illustrated in **Figure 10**.

## 6.0 OPENING DAY CONDITIONS

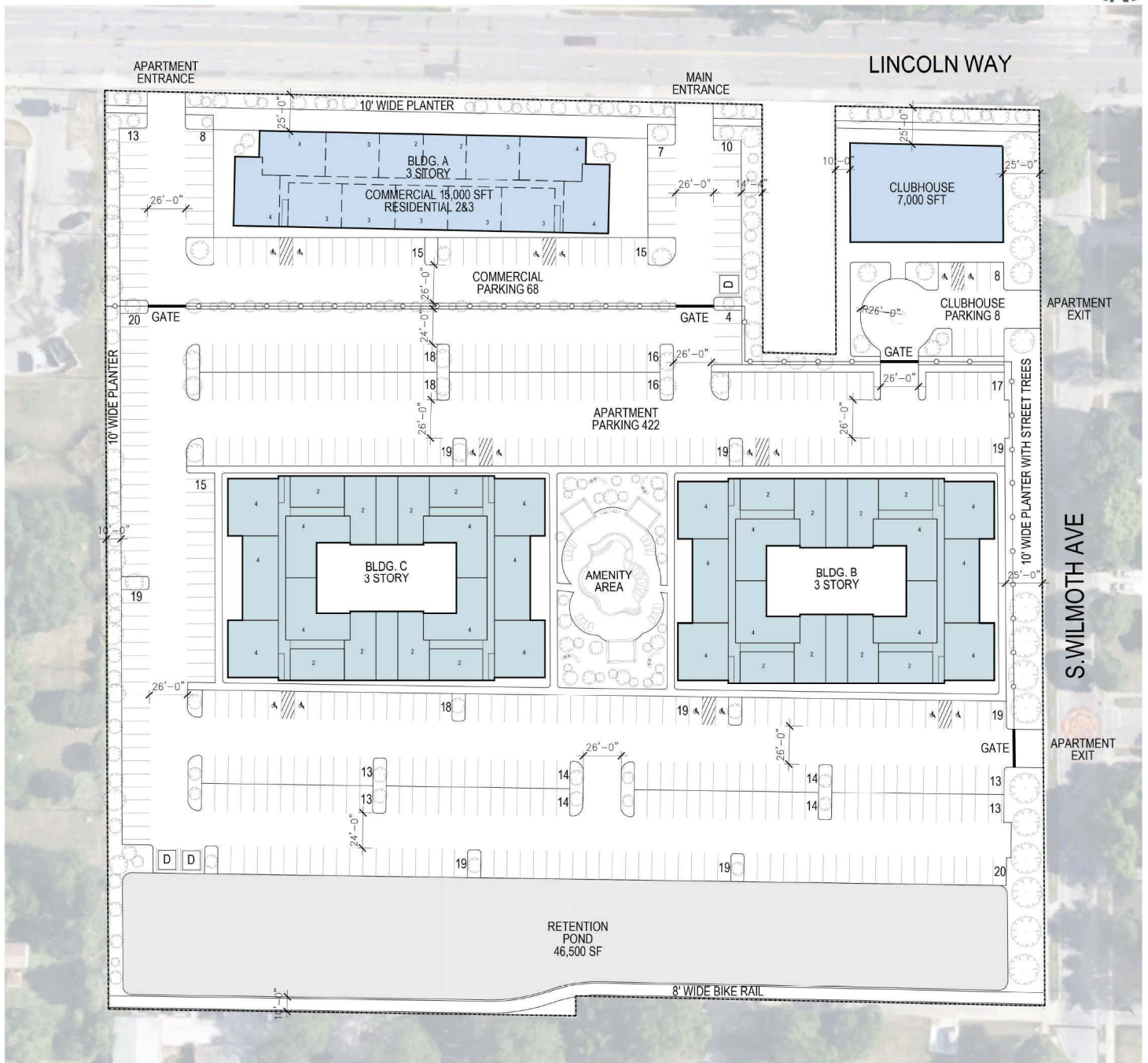
According to the Iowa DOT historical annual average daily traffic (AADT) maps, traffic volumes along Lincoln Way have shown a decline in traffic between 2003 and 2011. According to the AAMPO, a less than one percent growth along Lincoln Way has been forecasted. Based on these findings, and in conjunction with an expected opening day of the proposed site in 2016, existing volumes were combined with the expected trips generated by Aspen Heights to develop Opening Day traffic volumes.

Opening Day peak hour volumes are shown in **Figure 11**. The Opening Day analysis includes two site drives along Lincoln Way and two drives along Wilmoth Ave.

# FIGURE 8

## Site Plan

Aspen Heights  
Ames, IA



**Table 5**  
**ITE TRIP GENERATION**  
**WILMOTH AVE & LINCOLN WAY**  
**TRAFFIC IMPACT STUDY**  
**AMES, IA**

ITE Code/Page	Land Use	Size		Daily Trip Generation		Trip Distribution		Total Daily Trips	
				Trip Gen. Avg. Rate/Eq.	Daily Trips	Enter	Exit	Enter	Exit
220/333	Apartment	130	Dwelling Units	6.65	865	50%	50%	432	432
826/1579	Specialty Retail Center	10.5	1000 SF	44.32	465	50%	50%	233	233
933/1905	Fast-Food Restaurant without Drive-Through Window	3	1000 SF	716.00	2,148	50%	50%	1,074	1,074
936/NA	Coffee/Donut Shop without Drive-Through Window	1.5	1000 SF	883.44	1,325	50%	50%	663	663
Total					4,803			2,402	2,402

ITE Code/Page	Land Use	Size		AM Peak Hour Trips		Trip Distribution		Total AM Trips		Pass-by Reduction	Pass-by Trips		Primary Trips	
				Trip Gen. Avg. Rate/Eq.	AM Peak Trips	Enter	Exit	Enter	Exit		Enter	Exit	Enter	Exit
220/334	Apartment	130	Dwelling Units	0.51	66	20%	80%	13	53	0%	0	0	13	53
826/1580	Specialty Retail Center	10.5	1000 SF	-	-	-	-	-	-	-	-	-	-	-
933/1906	Fast-Food Restaurant without Drive-Through Window	3	1000 SF	43.87	132	60%	40%	79	53	50%	33	33	46	20
936/1937	Coffee/Donut Shop without Drive-Through Window	1.5	1000 SF	108.38	163	51%	49%	83	80	50%	41	41	42	39
Total					360			175	185		74	74	102	112

ITE Code/Page	Land Use	Size		PM Peak Hour Trips		Trip Distribution		Total PM Trips		Pass-by Reduction	Pass-by Trips		Primary Trips	
				Trip Gen. Avg. Rate/Eq.	PM Peak Peak Trips	Enter	Exit	Enter	Exit		Enter	Exit	Enter	Exit
220/335	Apartment	130	Dwelling Units	0.62	81	65%	35%	52	28	0%	0	0	52	28
826/1581	Specialty Retail Center	10.5	1000 SF	2.71	28	44%	56%	13	16	0%	0	0	13	16
933/1907	Fast-Food Restaurant without Drive-Through Window	3	1000 SF	26.15	78	51%	49%	40	38	50%	20	20	20	19
936/1938	Coffee/Donut Shop without Drive-Through Window	1.5	1000 SF	40.75	61	67%	33%	41	20	50%	15	15	26	5
Total					249			146	103		35	35	111	68

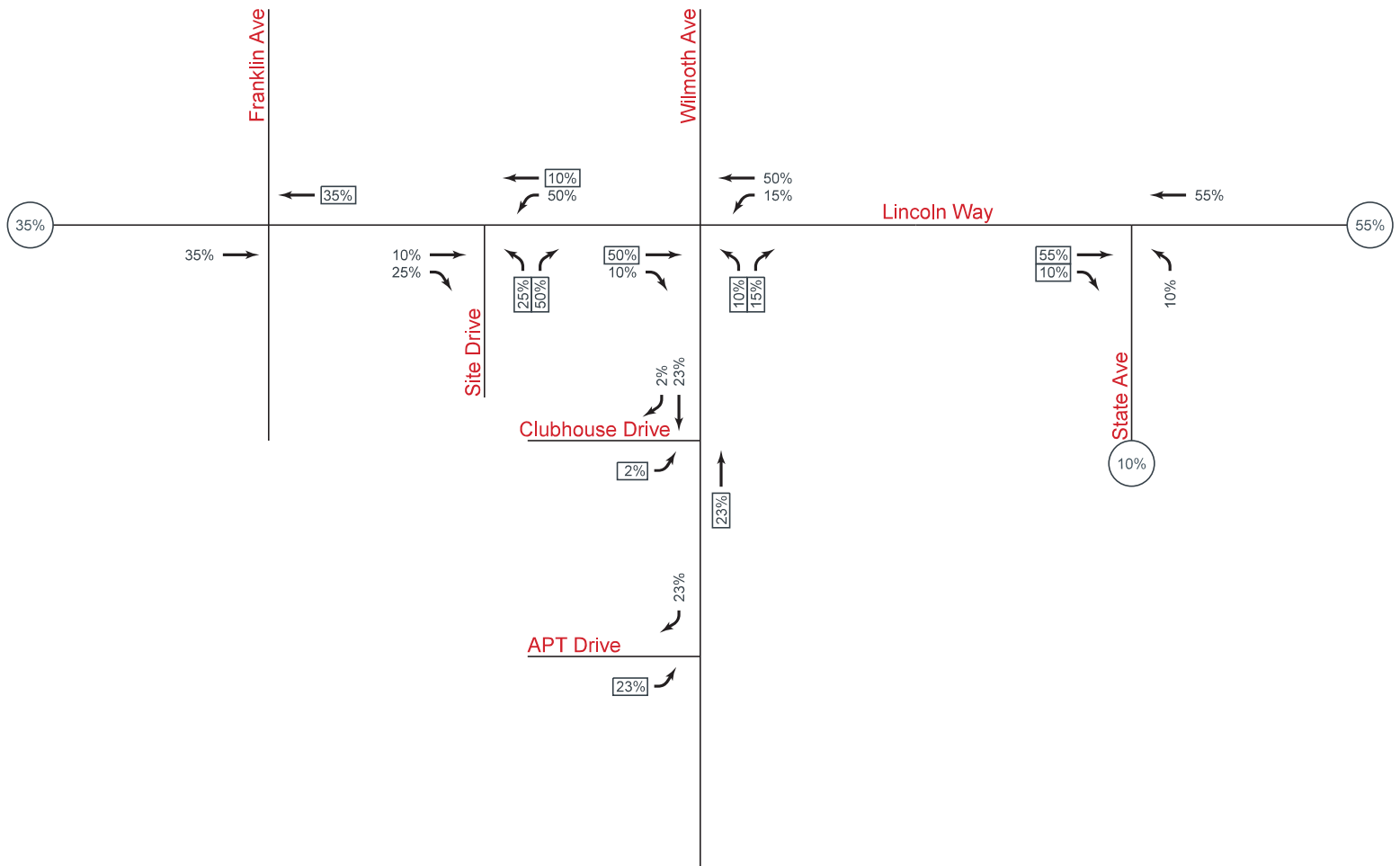
# FIGURE 9

## Trip Distribution

Aspen Heights  
Ames, IA

### LEGEND

- XX% Entering Distribution
- XX% Exiting Distribution
- XX% External Distribution



# FIGURE 10

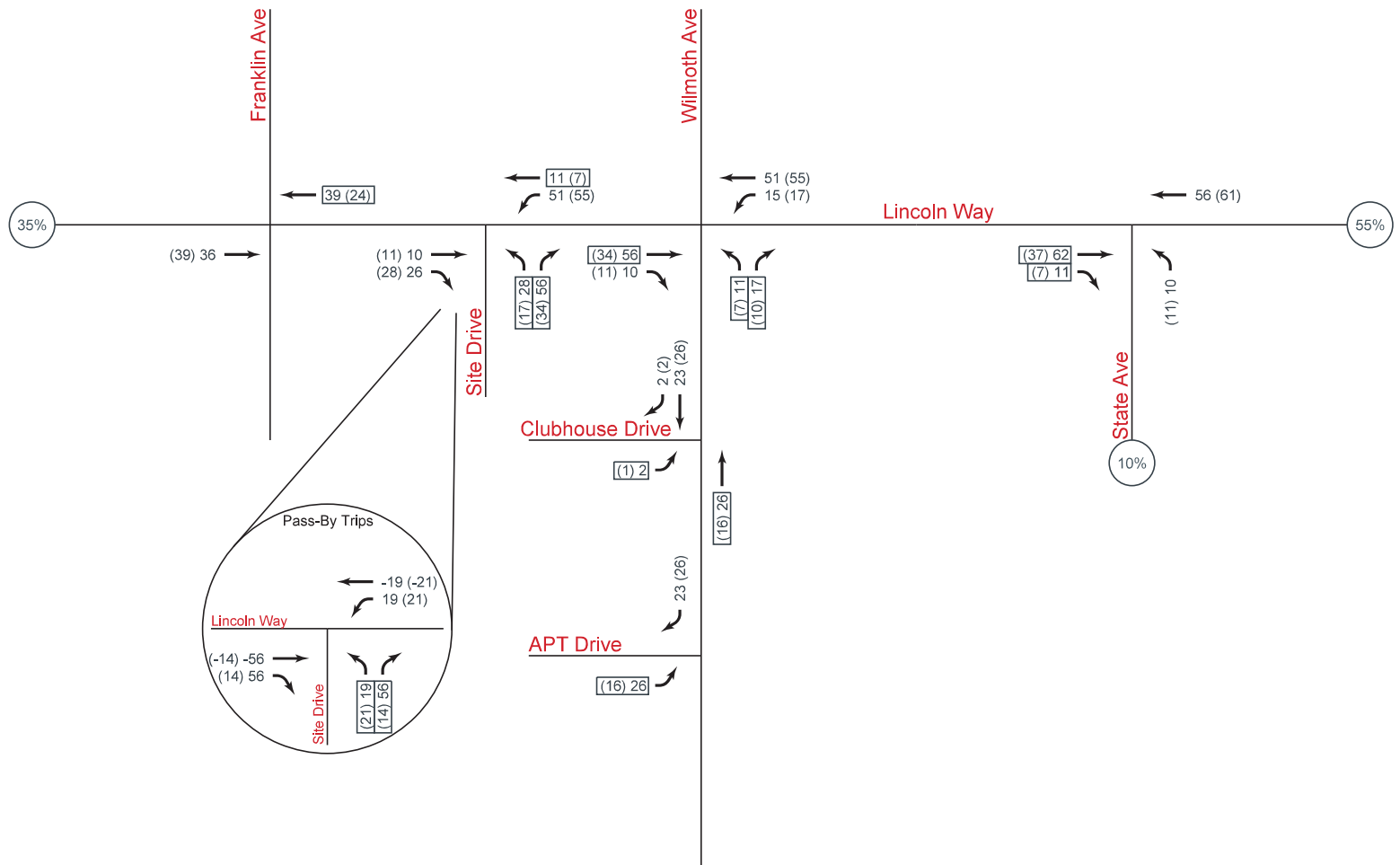
## Site Trips

Aspen Heights  
Ames, IA

### LEGEND

AM (PM) Entering Trips

AM (PM) Exiting Trips





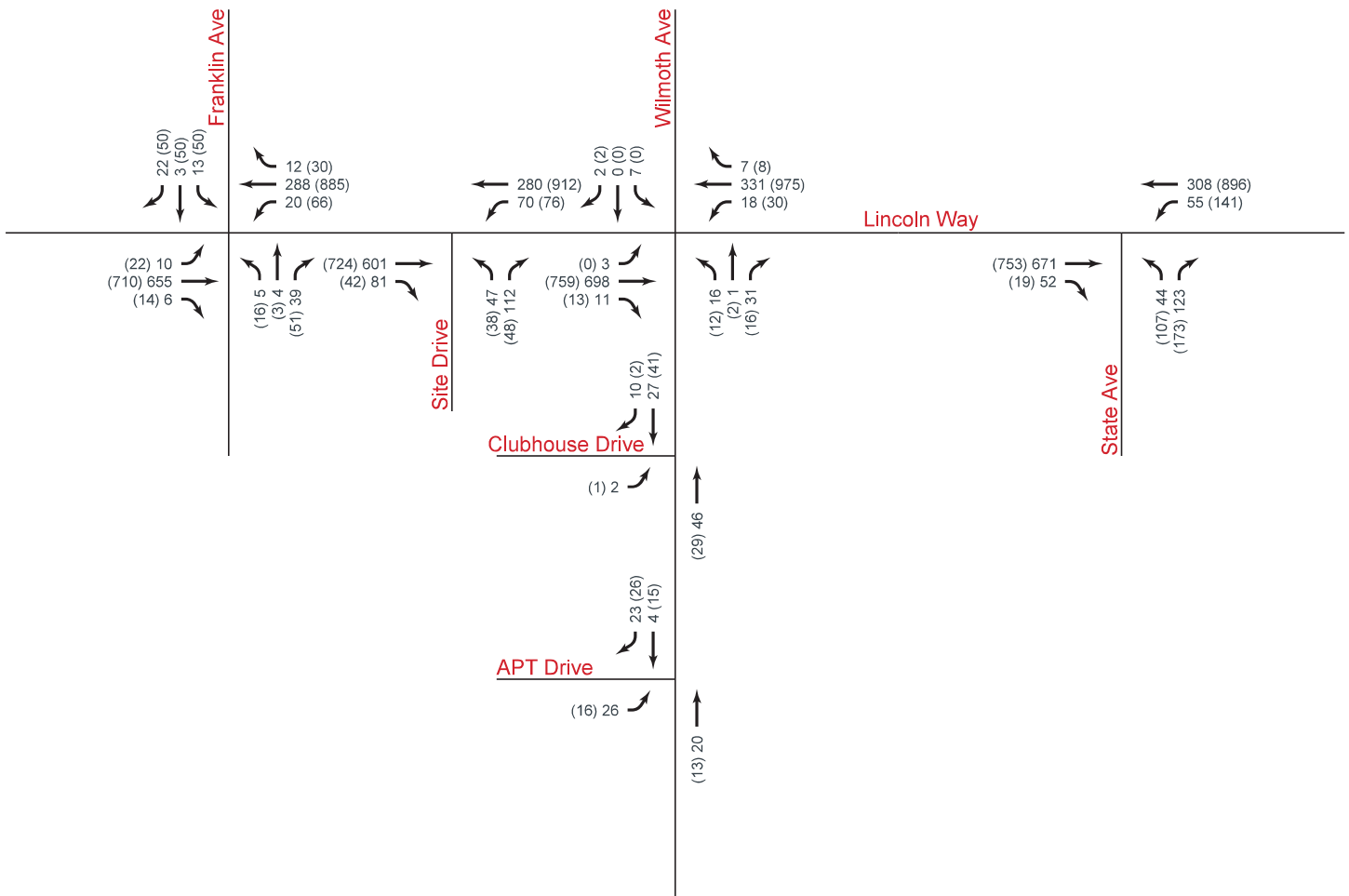
# FIGURE 11

## Opening Day Peak Hour Volumes

Aspen Heights  
Ames, IA

### LEGEND

AM (PM) Peak Hour Volume



## **6.1 Opening Day Conditions Geometric Improvement Evaluation**

The National Cooperative Highway Research Program (NCHRP) has developed guidelines for determining when to provide a right-turn or a left-turn bay on the major road of a two-way stop controlled intersection. These guidelines are based on an evaluation of the operating and collision costs associated with the turning maneuver relative to the cost of constructing a turn bay. These guidelines are published in NCHRP Report 457 and NCHRP Report 745.

The need for a major road eastbound right-turn lane was evaluated for the intersection of Site Drive & Lincoln Way. Both AM and PM peak hour volumes were examined. Based on the results of the evaluation, the eastbound right-turn lane does not meet guidance for installing a deceleration lane in either peak hours. Therefore, an eastbound right-turn lane was not included in the analysis.

In addition, the need for a major road left-turn lane was evaluated at Site Drive & Lincoln Way. Based on the results of the evaluation, a westbound left-turn lane meets guidance in both AM and PM peak hours. As previously discussed, there are several crashes along the Lincoln Way corridor, many of which are likely related to the undivided cross section on Lincoln Way. While there would be benefit to adding a left-turn lane at the site drive, this improvement would require extensive construction along the Lincoln Way corridor. Therefore, the addition of left-turn lanes here should be considered as part of a larger capital project to provide a center turn lane for this drive and other nearby public intersections. The widening of Lincoln Way is not part of the Ames Capital Improvement Plan or Long Range Transportation Plan. Therefore, a left-turn lane was not included as part of Opening Day analyses.

Note that the site plan shows is an offset between Colorado Ave and the Site Drive along Lincoln Way. Ideally, the site drive would align with Colorado Avenue. If possible, this should be done to avoid collisions with cars turning left onto or off of Lincoln Way.

Results of the NCHRP Geometric Improvement Evaluation are found in **Appendix E**.

## **6.2 Opening Day Conditions Capacity Analysis**

Results of the capacity analysis indicate that all signalized intersections are expected to operate at LOS B or better in both peak hours. All movements at signalized intersections are expected to operate at LOS C or better in both peak hours. The 95<sup>th</sup> percentile queue length for westbound movements at Franklin Ave & Lincoln Way is expected to be approximately 375 feet in the PM peak hour. This is expected to block several drives on the north side of Lincoln Way.

Most turning movements at unsignalized intersections are expected to operate at LOS C or better in both peak hours with the exception of the northbound movements at Wilmoth Ave & Lincoln Way and Site Drive & Lincoln Ave. These movements are expected to operate at LOS E in the PM peak hour. This does not meet LOS requirements; however, it is not uncommon for side streets to experience additional delay in peak hours. The 95<sup>th</sup> percentile queue length for northbound movements at Site Drive & Lincoln Way are expected to be no more than three vehicles in both AM and PM peak hours. All other queue lengths are expected to be no more than one vehicle.

The Opening Day Conditions capacity analysis summary is shown in **Figure 12**. Detailed results can be found in **Appendix F**.

# FIGURE 12

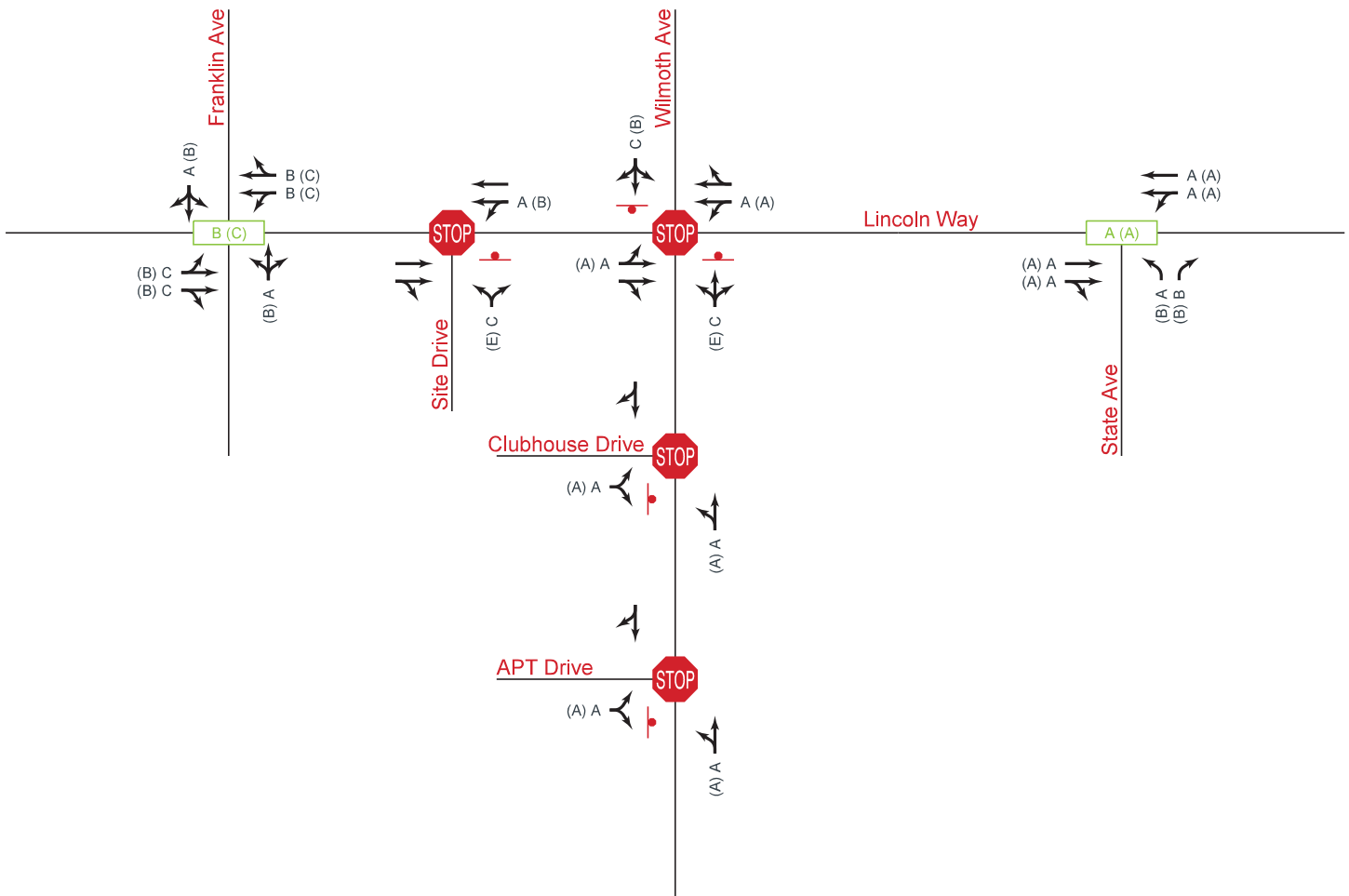
## Opening Day Conditions Capacity Analysis Summary

Aspen Heights  
Ames, IA



### LEGEND

- AM (PM) Signalized Intersection LOS
- AM (PM) Movement LOS
- Stop Controlled Intersection
- Stop Sign
- Lane Geometry



## 7.0 2040 PLUS SITE CONDITIONS

Year 2040 Background volumes were combined with site trips to develop 2040 plus Site volumes. The 2040 plus Site volumes can be seen in **Figure 13**.

### 7.1 2040 plus Site Conditions Capacity Analysis

Results of the capacity analysis show that all signalized intersections are expected to operate at LOS B or better in both peak hours. All turning movements are expected to operate at LOS C or better in both peak hours. The 95<sup>th</sup> percentile queue lengths are expected to be contained within provided storage lengths.

At unsignalized intersections, all movements are expected to operate at LOS D or better in both peak hours with the exception of northbound movements at Wilmoth Ave & Lincoln Way and Site Drive & Lincoln Way which are expected to operate at LOS E and LOS F, respectively. Again, these do not meet LOS requirements, but it is not uncommon for side streets to experience additional delay in peak hours. The 95<sup>th</sup> percentile queue length for northbound movements at Site Drive & Lincoln Way is expected to be no more than three and five vehicles in the AM and PM peak hours, respectively. The site drive on Lincoln Way should be constructed such that a five-vehicle queue could be stored without negative impacts to traffic on Lincoln Way. All other queue lengths are expected to be no more than two vehicles in both peak hours.

The 2040 plus Site Conditions capacity analysis summary is shown in **Figure 14**. Detailed results can be found in **Appendix G**.

## 8.0 RECOMMENDED IMPROVEMENTS

The purpose of this study was to provide an evaluation of the existing traffic and trips generated by a proposed development in the southwest quadrant of Wilmoth Ave & Lincoln Way in Ames, IA. Based on existing and projected traffic conditions, traffic analysis results, and coordination with the City of Ames, recommendations have been identified.

- A westbound left-turn lane is expected to meet NCHRP guidelines in opening day conditions at the intersection of Site Drive & Lincoln Way in both peak hours. Additionally, the crash analysis showed an existing crash pattern that is consistent with a roadway that lacks left-turn refuge. A left-turn lane should be constructed at this drive with 150' of storage and 150' of taper length. The City of Ames has indicated that the owner should enter into a development agreement with the City for the widening of Lincoln Way to construct the left-turn lane.
- A single site drive along Lincoln Way should be constructed to align across with Colorado Ave to avoid collisions with vehicles turning left onto or off of Lincoln Way.
- Construct two drives on Wilmoth Ave as shown in the Site Plan (Figure 8).
- Storage for a five-vehicle queue should be provided for northbound movements at the site driveway to avoid negative impacts to traffic on Lincoln Way.

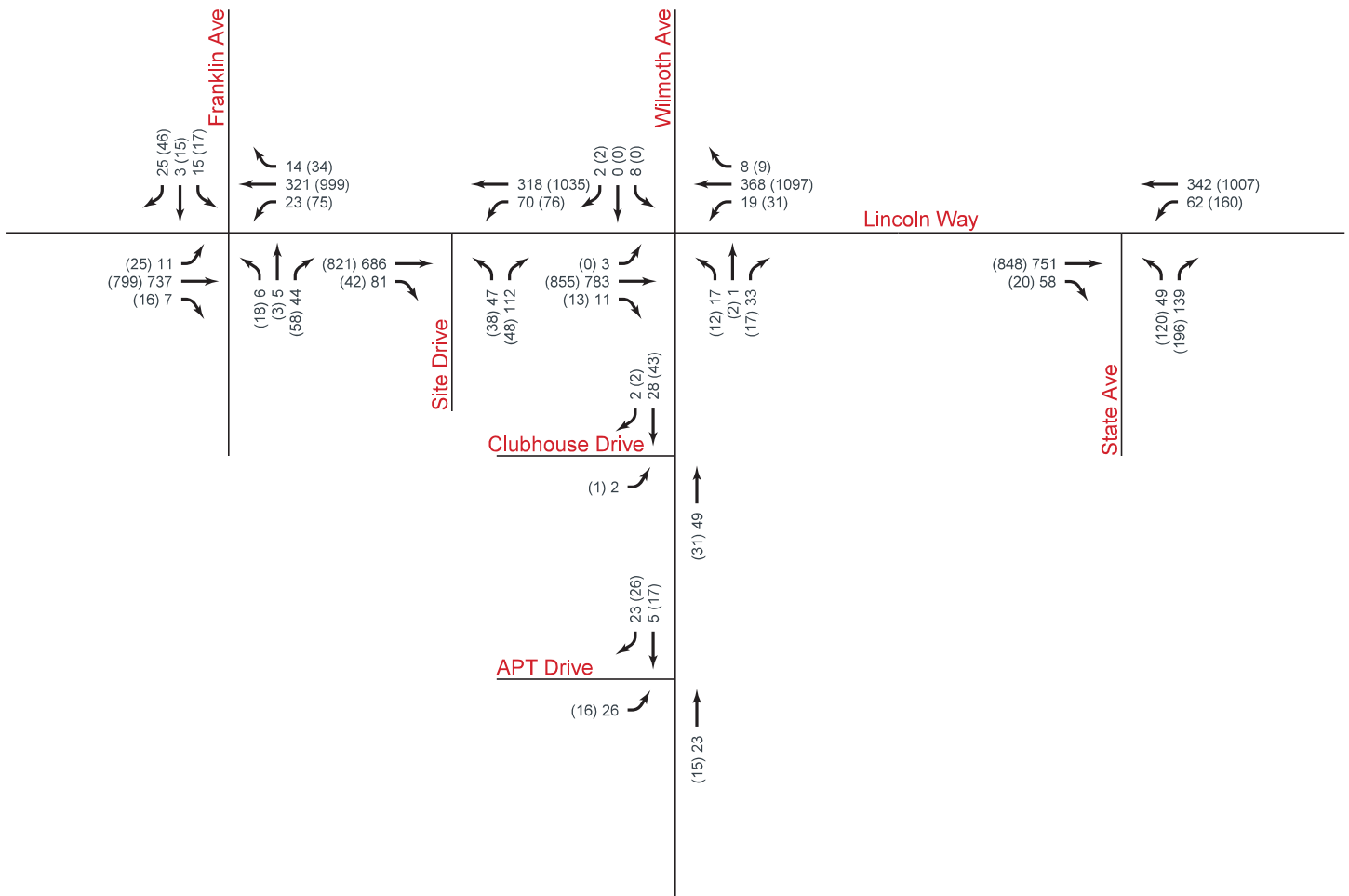
# FIGURE 13

## 2040 plus Site Peak Hour Volumes

Aspen Heights  
Ames, IA

### LEGEND

AM (PM) Peak Hour Volume





# FIGURE 14

## 2040 plus Site Conditions Capacity Analysis Summary

Aspen Heights  
Ames, IA



### LEGEND

- AM (PM) Signalized Intersection LOS
- AM (PM) Movement LOS
- Stop Controlled Intersection
- Stop Sign
- Lane Geometry

