FOX engineering

Aspen Business Park | 414 South 17th Street, Suite 107 | Ames, Iowa 50010

Bus and Parking Evaluation for Roers RH Development
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January 14, 2015

The purpose of this study was to evaluate the necessary parking and bus use for the Roers development. Rather than base this bus and parking evaluation on projections and estimates, this study was performed on actual data from observations at "The Grove" development in the adjacent development on S. 16th Street. The Grove is an isolated parcel with a single bus stop that allows the counts to be correlated to the bedroom count of the Grove. In addition, assuming that the lack of a car will promote/require bus ridership, the parking was evaluated as well to see if there was a correlation of the parking ***not*** used to bus ridership.

The Grove's site specifics:

- 586 Beds
- 587 legal parking spaces
- No vacancies at the times of the counts
- Assume that nearly all the residents are students as that is their target market
- The bus schedule is approximately every half hour

The parking was evaluated on two separate occasions on September 30th (Tuesday) and October 1st (Wednesday) 2014. The parking was counted before 6 AM. On September 30th there were 92 empty spaces and on October 1st there were 94 open spaces. The percentage of spaces not used was 15.9%.

The number of people using the bus were evaluated over three separate occasions. The first occasion was observed via camera on October 1st (Wednesday) and the second two occasions were by an observer on November 18th (Tuesday) and 19th (Wednesday). The observation time period was from 7 AM to 7 PM - *not the full time that bus provides service to the site*. The results of riders getting ***on*** the bus from the Grove developments are as follows:

- October 1st – 108 riders
- November 18th – 112 riders
- November 19th – 106 riders

The number of riders getting off was always less for the total time period (61, 77, and 70 riders), which is expected as some would have arrived back after 7 PM or shared a car ride back to the facility.

The average number of daily riders from the Grove developments is 108.7 (7AM to 7PM) for a percentage of Grove residents of 18.5%. This is slightly more than the number of parking spaces not used of 15.9%.

The peak number of riders getting ***on*** the bus for each date was 21, 18, and 20. The peak period was between 7:30 AM and 9:30 AM. Peak ridership is approximately 18% of the total number of riders. Reference the data sheets provided with this report.

Using the data from the Grove to extrapolate bus usage for the Roers Development will be based on the following assumptions:

- Bus usage is at the same rate for professionals as it is for students. Based on feedback in the planning of the Phase 3 of the ISU Research Park the employers estimate 15% of their employees do not own a car. Very similar to the 15.9% of Grove residents without a car. **This assumption should be considered conservative;** it would be expected that professionals would use a bus *less* as financial considerations are less for professionals and time a greater concern for professionals.

- The number of units is estimated to be 350. The number of beds is estimated at 790 beds.
- All beds are not filled. However, some apartments will have more than one person per bedroom in a professional's use versus student's use. Assume this balances out that the number of bedrooms equals the number of persons.

Using the bedroom count of 790, then the number of daily bus riders would be 146 riders in the 7AM to 7PM time period. Peak ridership at one pickup time would be 26 riders. Professional riders would likely be earlier than student riders and the peaks would possibly not coincide. Students as a general rule are not early risers.

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Cyclone Village
Traffic Impact Analysis

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I. Introduction

A. Purpose

The purpose of this traffic impact analysis (TIA) is to forecast the travel demand and related traffic impacts associated with the proposed Cyclone Village Development project. This development is located on South 17th Street immediately west of the existing Aspen Business Park.

The results of the TIA will identify acceptable levels of service (LOS) and provide input regarding traffic improvements that may be necessary to obtain acceptable LOS in the study area. Roadway capacity is evaluated on the basis of LOS analysis. Levels of Service are given letter designations of A through F, and are categorized based on driver perception and ease of traffic movements. LOS A represents free-flow conditions with no delays, while LOS E and F are generally considered unacceptable in urban areas.

B. Analytical Process

A detailed technical process was used in order to achieve the above objectives. Key steps in the process include:

- Trip Generation – The product of the trip generation is the estimated number of trips to and from each proposed land use within a development or project. Input includes statistics on the proposed development (i.e. number of dwelling units, bedrooms, persons etc.), and trip generation for each proposed use, (i.e. trips per person, etc.).

- Trip Distribution – The prime output of trip distribution is the quantification of the "desire" to travel from one location (the origin) to another location (the destination). The % of trips generated in the cardinal direction of north, south, east and west are documented. No route or trip path is implied by the trip distribution process.

- Trip Assignment – The assignment process requires that a roadway network be identified such that each estimated trip generated can be assigned to a specific path (roadway) connecting each origin-destination pair. The aggregation of all trips assigned to a given link in the roadway link in the network is the final traffic forecast for the roadway network.

- Capacity Analysis – This step consists of determining physical requirements needed to accommodate the forecasted traffic volumes and the associated level of service (LOS). The *Synchro 8* traffic modeling software, utilizing the *Highway Capacity Manual (HCM)* methods, is a key tool in this step.

II. **Background**

A Cyclone Village Apartments

The project consists of 220 apartments. It is expected that 50% of the residents will be Iowa State University students and 50% will be young professionals that are employed locally. Access to Cyclone Village will be via 17th Street by utilizing the intersections of Golden Aspen Drive and South 16th Street and Kellogg Avenue and South 16th Street.

B Location

The proposed Cyclone Village Apartment project is located on South 17th Street immediately west of the existing Aspen business park. Please refer to figure 1.

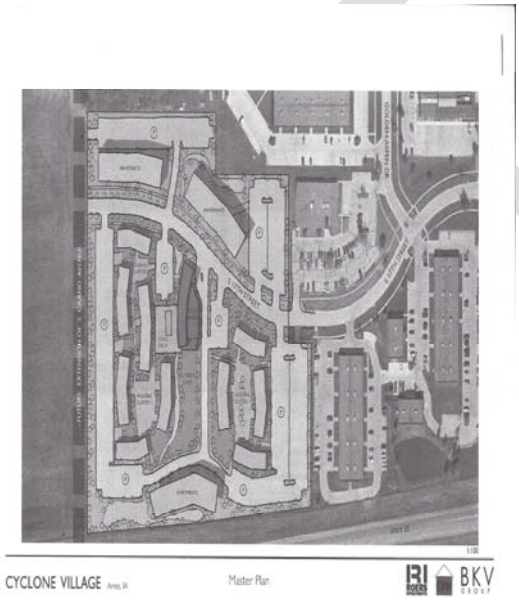


Figure 1 Cyclone Village Apartments

C Study Area

The study area for this TIA was determined in consultation with the Ames City Traffic Engineer. It was concluded that the intersections that are most likely to be impacted by the Cyclone Village project are along south 16th Street. Those intersections include:

1. 16th Street / University Boulevard
2. 16th Street / Christensen Drive
3. 16th Street / Riverside Drive
4. 16th Street / Grand Avenue
5. 16th Street / Golden Aspen Drive
6. 16th Street / Kellogg Avenue
7. 16th Street / Duff Avenue

Surveillance cameras were used to record traffic data at these intersections. The cameras recorded traffic data on October 1, 2014. Figure 2 below shows the intersections of interest and where the 5 surveillance cameras were located.

The traffic counts recoded at the intersections were used to evaluate the current level of service and to calculate the turning movements at each of the intersections. The Iowa DOT transportation model was used to evaluate the 2035 traffic volumes. One large difference between the two methods is that for the current traffic volumes, Grand Avenue is just a very short street to the north but in 2035 it is connected south from south 4th Avenue. The traffic patterns will be altered in this area when Grand Avenue is connected from the north.

The traffic lanes at each of the intersections evaluated are shown in figure 2 below. The traffic lanes that were utilized in the capacity analysis phase of this TIA are shown in figure 2 below.

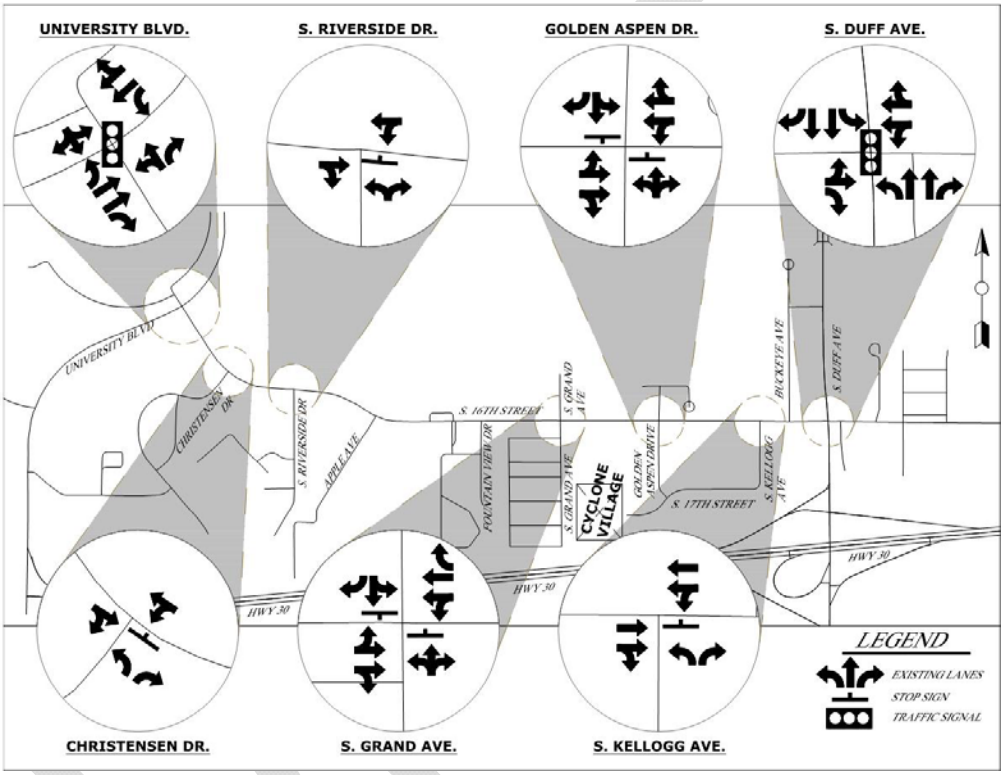


Figure 2 Intersection Traffic Lanes

D Background Traffic Volumes

The traffic counts used for background traffic volumes were recorded, by video camera, on October 1, 2014 at each of the intersections identified above. The digital data from the video cameras was used to determine hourly volumes, turning movements and % cars and trucks at each intersection. This study identified the peak hours as 8:00 – 9:00 AM and 4:30 – 5:30 PM. Please refer to appendix A.

The current traffic volumes for the AM peak and the PM peak periods are shown in figures 3 and 4 below.

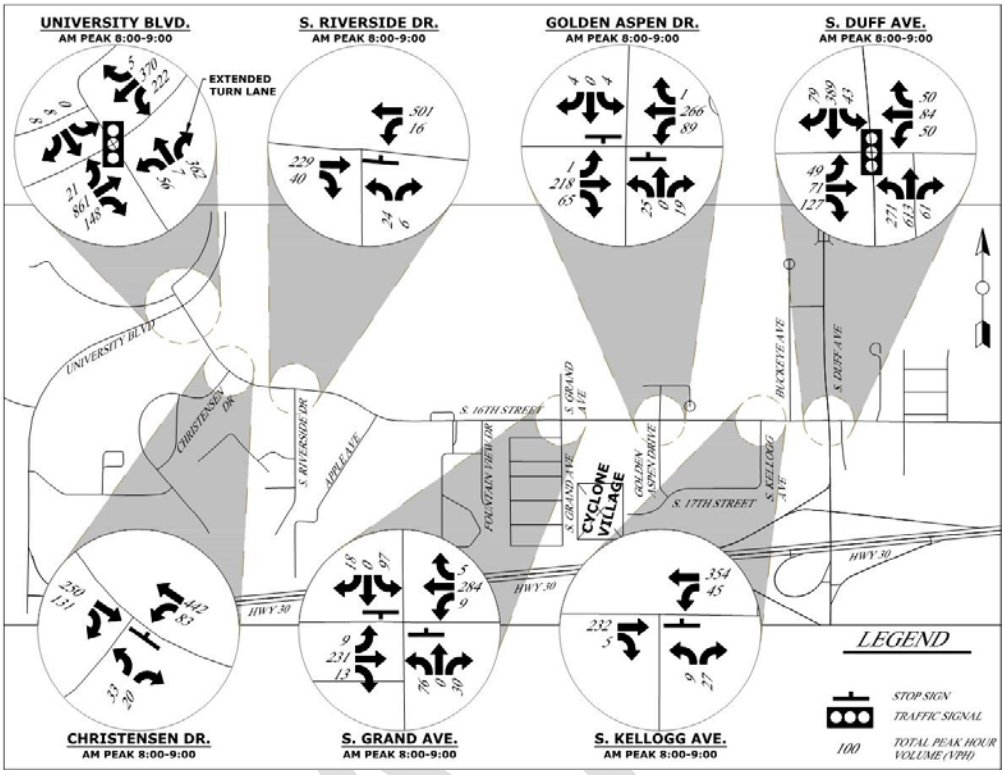


Figure 3 Current AM Peak Volumes

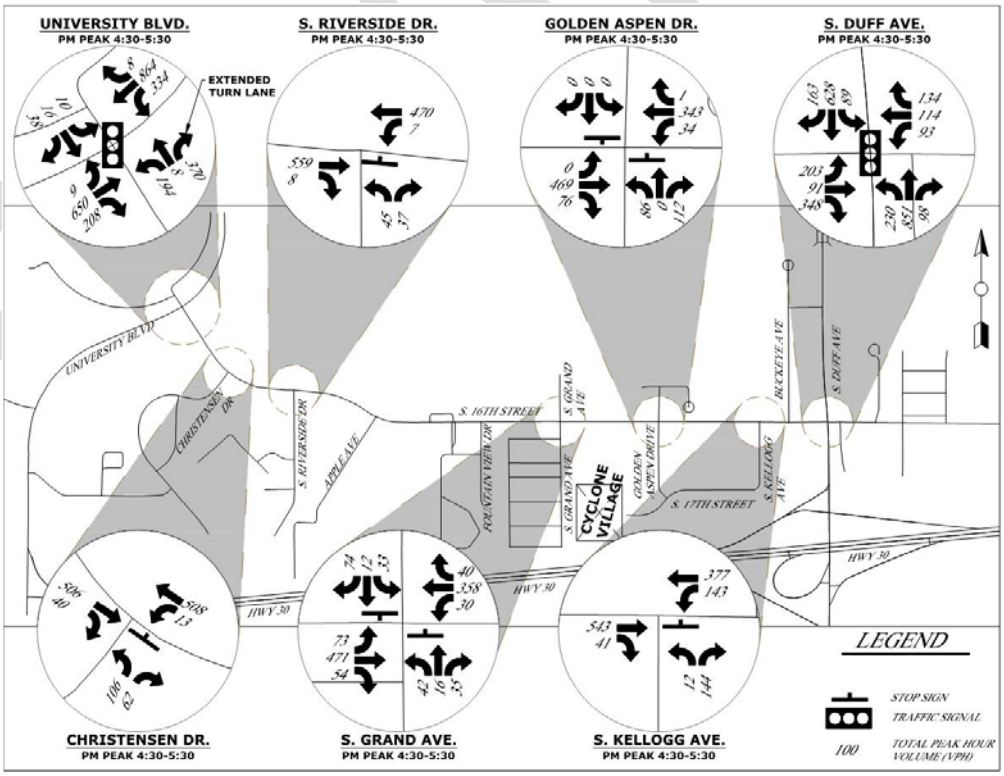
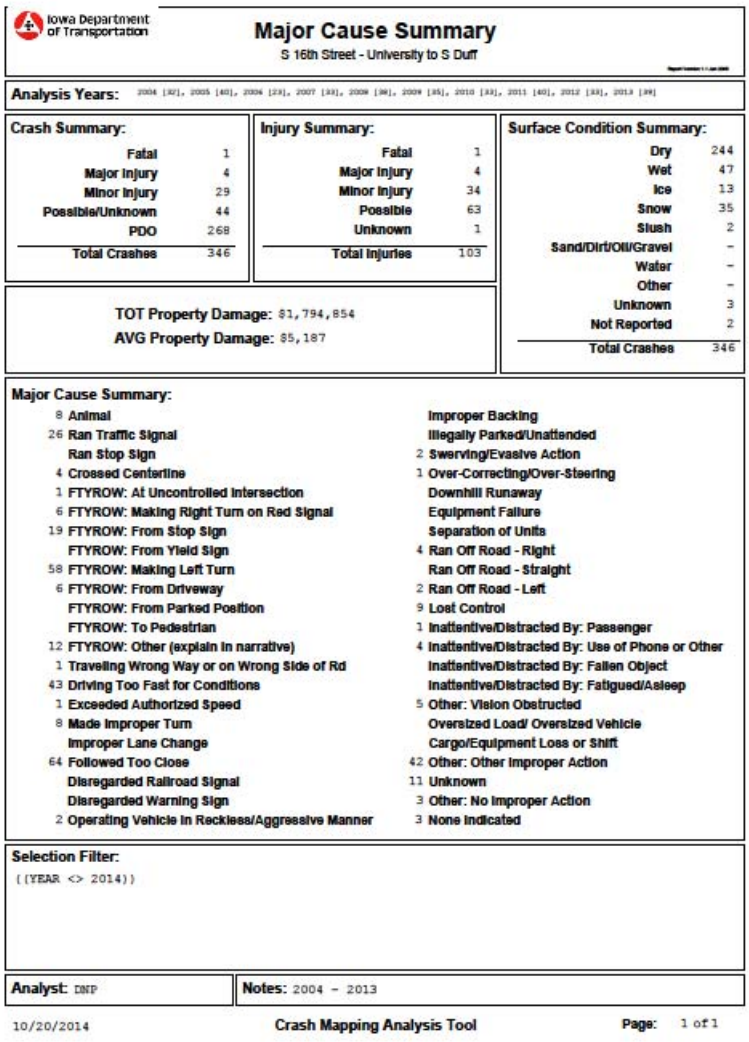


Figure 4 Current PM Peak Volumes

E Crash History

The cash history was evaluated along the South 16th Street corridor utilizing the Iowa DOT crash data. The corridor was analyzed from University Boulevard on the west to South Duff Avenue on the east. The data covers the years of 2004 to 2013, a total of 10 years. The major crash cause summary is shown in figure 5 below.



Iowa Department of Transportation

Major Cause Summary

S 16th Street - University to S Duff

Analysis Years: 2004 [32], 2005 [40], 2006 [23], 2007 [33], 2008 [38], 2009 [35], 2010 [33], 2011 [40], 2012 [33], 2013 [39]

Crash Summary:

Fatal	1
Major Injury	4
Minor Injury	29
Possible/Unknown	44
PDO	268
Total Crashes	346

Injury Summary:

Fatal	1
Major Injury	4
Minor Injury	34
Possible	63
Unknown	1
Total Injuries	103

Surface Condition Summary:

Dry	244
Wet	47
Ice	13
Snow	35
Slush	2
Sand/Dirt/Oil/Gravel	-
Water	-
Other	-
Unknown	3
Not Reported	2
Total Crashes	346

TOT Property Damage: $1,794,854

AVG Property Damage: $5,187

Major Cause Summary:

8	Animal		Improper Backing
26	Ran Traffic Signal		Illegally Parked/Unattended
	Ran Stop Sign	2	Swerving/Evasive Action
4	Crossed Centerline	1	Over-Correcting/Over-Steering
1	FTYROW: At Uncontrolled Intersection		Downhill Runaway
6	FTYROW: Making Right Turn on Red Signal		Equipment Failure
19	FTYROW: From Stop Sign		Separation of Units
	FTYROW: From Yield Sign	4	Ran Off Road - Right
58	FTYROW: Making Left Turn		Ran Off Road - Straight
6	FTYROW: From Driveway	2	Ran Off Road - Left
	FTYROW: From Parked Position	9	Lost Control
	FTYROW: To Pedestrian	1	Inattentive/Distracted By: Passenger
12	FTYROW: Other (explain in narrative)	4	Inattentive/Distracted By: Use of Phone or Other
1	Traveling Wrong Way or on Wrong Side of Rd		Inattentive/Distracted By: Fallen Object
43	Driving Too Fast for Conditions		Inattentive/Distracted By: Fatigued/Asleep
1	Exceeded Authorized Speed	5	Other: Vision Obstructed
8	Made Improper Turn		Oversized Load/ Oversized Vehicle
	Improper Lane Change		Cargo/Equipment Loss or Shift
64	Followed Too Close	42	Other: Other Improper Action
	Disregarded Railroad Signal	11	Unknown
	Disregarded Warning Sign	3	Other: No Improper Action
2	Operating Vehicle in Reckless/Aggressive Manner	3	None Indicated

Selection Filter:

((YEAR <> 2014))

Analyst: DNP

Notes: 2004 - 2013

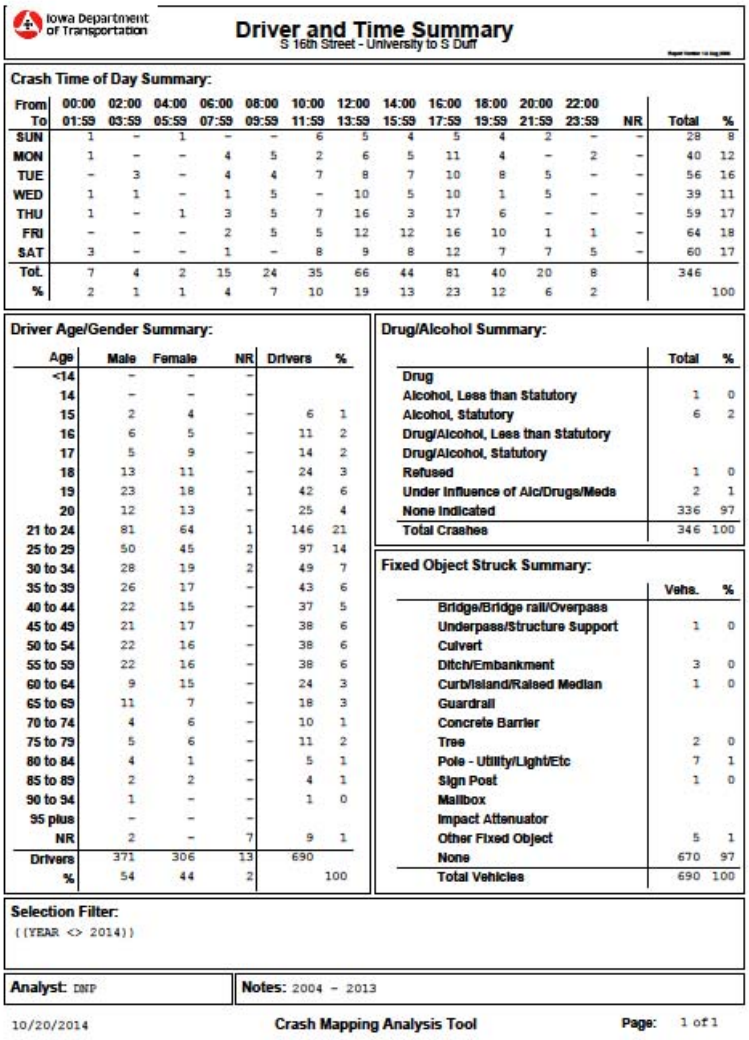
10/20/2014 Crash Mapping Analysis Tool Page: 1 of 1

Figure 5 Major Crash Cause Summary

The crash history has been consistent over this 10 year time with an average 35 of crashes each year. The crashes are distributed evenly along the corridor except at the signalized intersections of South 16th Street and University Boulevard and South 16th Street and South Duff Avenue. These two locations are signalized intersections. When reviewing the crashes in figure

5 there are four causes that may be related to traffic signals. They include: Ran Traffic Signal; Making Right Turn on Red Signal; Making Left Turns; and Followed Too Close.

In Figure 6 we find the Driver and Time summary. When evaluating the data presented, the time when the largest percentage of crashes occur was from 12:00 midnight to 6:00 AM. The most crashes occur on Tuesday, Thursday, Friday and Saturday. The majority of the drivers are 21 to 29 years of age.



Iowa Department of Transportation

Driver and Time Summary

S 16th Street - University to S Duff

Crash Time of Day Summary:

From / To	00:00 01:59	02:00 03:59	04:00 05:59	06:00 07:59	08:00 09:59	10:00 11:59	12:00 13:59	14:00 15:59	16:00 17:59	18:00 19:59	20:00 21:59	22:00 23:59	NR	Total	%
SUN	1	–	1	–	–	6	5	4	5	4	2	–	–	28	8
MON	1	–	–	4	5	2	6	5	11	4	–	2	–	40	12
TUE	–	3	–	4	4	7	8	7	10	8	5	–	–	56	16
WED	1	1	–	1	5	–	10	5	10	1	5	–	–	39	11
THU	1	–	1	3	5	7	16	3	17	6	–	–	–	59	17
FRI	–	–	–	2	5	5	12	12	16	10	1	1	–	64	18
SAT	3	–	–	1	–	8	9	8	12	7	7	5	–	60	17
Tot.	7	4	2	15	24	35	66	44	81	40	20	8		346	
%	2	1	1	4	7	10	19	13	23	12	6	2			100

Driver Age/Gender Summary:

Age	Male	Female	NR	Drivers	%
<14	–	–	–		
14	–	–	–		
15	2	4	–	6	1
16	6	5	–	11	2
17	5	9	–	14	2
18	13	11	–	24	3
19	23	18	1	42	6
20	12	13	–	25	4
21 to 24	81	64	1	146	21
25 to 29	50	45	2	97	14
30 to 34	28	19	2	49	7
35 to 39	26	17	–	43	6
40 to 44	22	15	–	37	5
45 to 49	21	17	–	38	6
50 to 54	22	16	–	38	6
55 to 59	22	16	–	38	6
60 to 64	9	15	–	24	3
65 to 69	11	7	–	18	3
70 to 74	4	6	–	10	1
75 to 79	5	6	–	11	2
80 to 84	4	1	–	5	1
85 to 89	2	2	–	4	1
90 to 94	1	–	–	1	0
95 plus	–	–	–		
NR	2	–	7	9	1
Drivers	371	306	13	690	
%	54	44	2		100

Drug/Alcohol Summary:

Drug	Total	%
Alcohol, Less than Statutory	1	0
Alcohol, Statutory	6	2
Drug/Alcohol, Less than Statutory		
Drug/Alcohol, Statutory		
Refused	1	0
Under Influence of Alc/Drugs/Meds	2	1
None Indicated	336	97
Total Crashes	346	100

Fixed Object Struck Summary:

	Vehs.	%
Bridge/Bridge rail/Overpass		
Underpass/Structure Support	1	0
Culvert		
Ditch/Embankment	3	0
Curb/Island/Raised Median	1	0
Guardrail		
Concrete Barrier		
Tree	2	0
Pole - Utility/Light/Etc	7	1
Sign Post	1	0
Mailbox		
Impact Attenuator		
Other Fixed Object	5	1
None	670	97
Total Vehicles	690	100

Selection Filter:

{{YEAR <> 2014}}

Analyst: DNP

Notes: 2004 - 2013

10/20/2014 Crash Mapping Analysis Tool Page: 1 of 1

Figure 6 Driver and Time Summary

The total 10 year crash history along the corridor is shown in figure 7 below. The crashes are distributed evenly along the corridor except at the signalized intersections of South 16th Street and University Boulevard and south 16th Street and South Duff Avenue

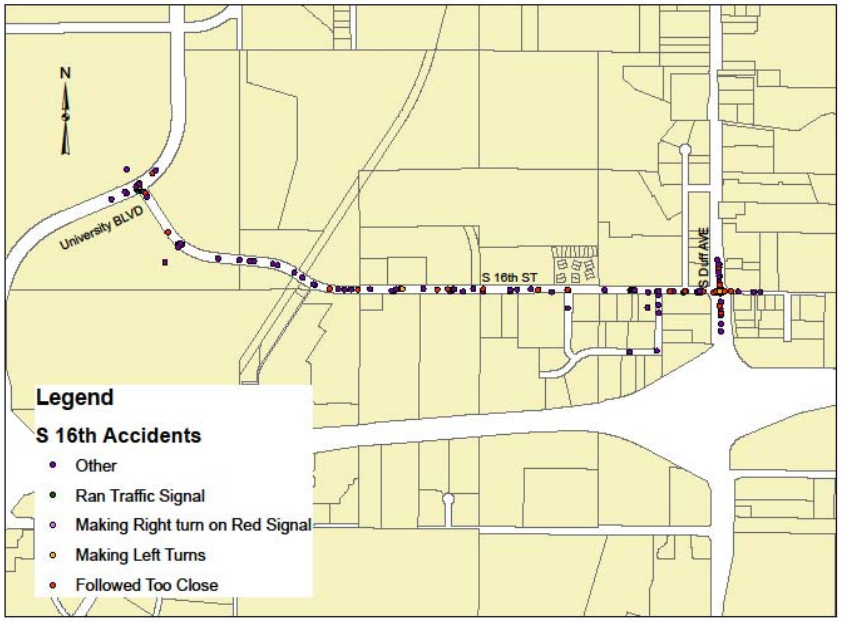


Figure 7 Crash History All Parameters

Since the largest concentration of crashes occur at the two signalized intersections, this analysis will focus on the four crash parameters that may be associated with traffic signal operations. Those four include: Ran Traffic Signal; Making Right Turn on Red Signal; Making Left Turns; and Followed Too Close. In figure 8 below these four parameters are illustrated for the 10 year summary. Each circle represents one crash of the type shown in the legend.

Figure 8 Crash History Four Parameters

A closer look at the two signalized intersections is appropriate since more crashes occur there than along the other intersections along the corridor. In figure 9 the crashes for the 10 year history is illustrated. It focuses on the four parameters that may be associated with traffic signal operations at the intersection of South 16th Street and University Boulevard. There are nine crashes during the analysis time period. On the average, less than one crash per year. The crashes include: four left turn, three followed too close, one right turn on red, and one ran traffic signal.

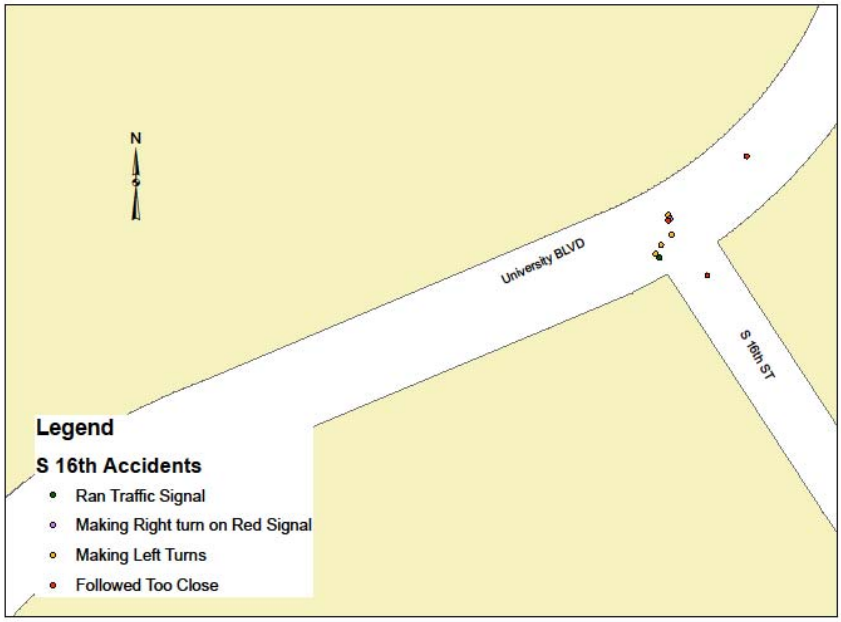


Figure 9 University Boulevard Crashes

In figure 10 the crashes for the 10 year history is illustrated and focuses on the four parameters that may be associated with traffic signal operations at the intersection of South 16th Street and South Duff Avenue. There are thirty two crashes during the analysis time period. On the average, three crashes crash per year. The crashes include: thirteen left turn, fourteen followed too close, two right turn on red, and three ran traffic signal.

Figure 10 South Duff Avenue Crashes-

III. Site Trip Generation

Site trip generation refers to the relationship between vehicle trip making and land use activity. Trip generation rates were taken from statistical studies of similar land use categories and documented by the Institute of Transportation Engineers (ITE). The application of these rates for proposed land uses results in a travel demand which is then distributed by direction and assigned to the adjacent road network.

ITE's *Trip Generation, Version 9* was used in this TIA to calculate expected trips generated by the middle and south projects. ITE Code 220 Apartment was used to calculate vehicle trips. Table 1 is a summary of the trips that are expected to be generated by the Cyclone Village apartments.

Use	ITE Code	Units	Amount	Daily Rate	AM Peak Hour		PM Peak Hour		Daily Trips	AM Peak Trips		PM Peak Trips	
					Enter	Exit	Enter	Exit		Enter	Exit	Enter	Exit
									0	0	0	0	0
Apartments	220	Units	300	6.65	0.1	0.41	0.4	0.25	1995	30	123	120	75

Table 1 Expected Trip Generation

IV. Directional Trip Distribution

Trip distribution is the process of allocating the site generated trips to the street network and is based on general location and direction of major population areas, employment, and commercial hubs, combined with the availability of roadways to connect these attractions to the proposed land development. The trips generated by the Cyclone Village apartments will be

directed to the east and west along South 16th Street. Iowa State University is a major influence on the trip distribution patterns. It is estimated that 50% of the residents will be ISU students and their trips will be to and from the university. This study assumes that the remaining 50% of the residents will be young professionals and some will be employed at ISU. The distribution pattern shown in figure 11 illustrates these assumptions.

Figure 11 Directional Distribution

The traffic volumes were routed from the Cyclone Village apartments (site generated) onto the street system as illustrated in figure 12 below. It is assumed that the residents would use both Golden Aspen Drive and Kellogg Avenue to access South 16th Street. They would then continue on to the east or the west. The same scenario would be expected to occur when the residents returned to the apartments. The result of this routing assumption impacts the turning movements at both Golden Aspen Drive and Kellogg Avenue. Then as the residents travel to the east and west the site generated traffic only passes through the other intersections in the study area until they arrive at either University Boulevard or at South Duff Avenue. At these two intersections the residents of the apartments would most likely make turning movements to go north or south.

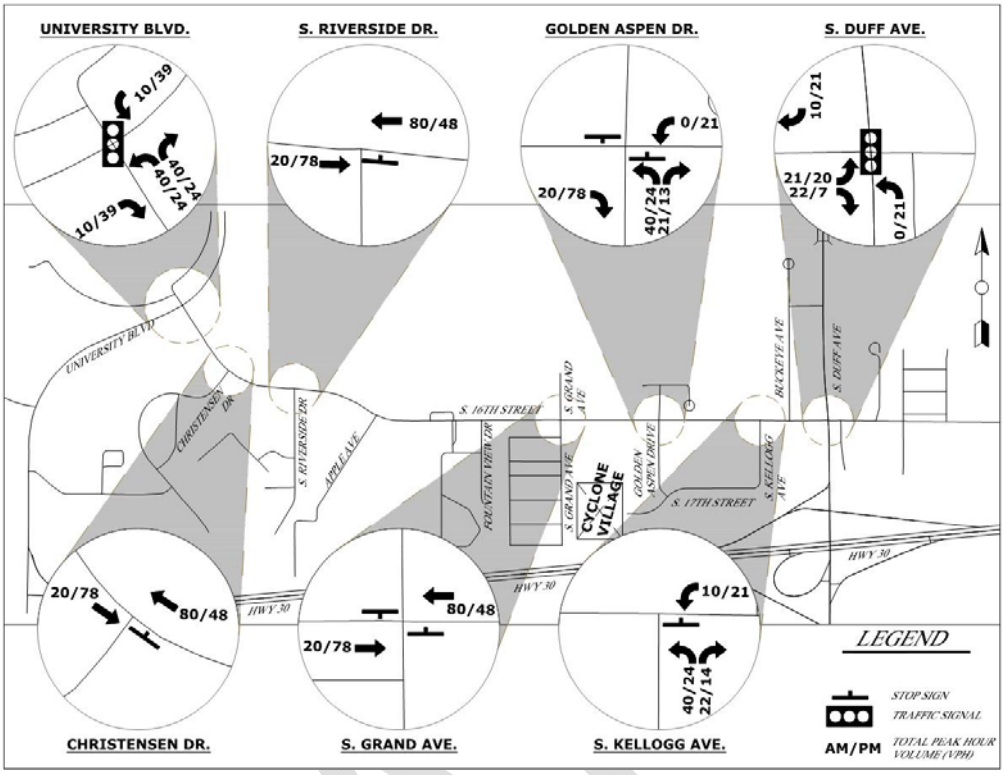


Figure 12 Site Generated Traffic volumes

V. Traffic Assignment

The traffic assignment utilized for this analysis included two separate steps. The first step utilized the current traffic volumes as a base and added the site generated traffic to estimate the 2015 traffic volumes. The second step utilized the Iowa DOT transportation model to predict traffic volumes for the year 2035. In both steps the analysis assumes that the travel patterns will not be altered in the future and that the turning movements will be the same in 2015 and in 2035 as they were recorded by cameras on October 1, 2014. The data used in these two steps is included in appendix C.

A. 2015 Traffic Assignment

The first step in the traffic assignment combines existing traffic volumes (the current condition) and the site generated traffic. The trips estimated to be generated by the Cyclone Village apartments were added to the current volumes to estimate the 2015 (total) build out traffic volumes. The calculations that document the combining of the current traffic volumes with the site generated traffic volumes are provided in appendix C. The 2015 AM and PM peak traffic volumes are illustrated in figures 13 and 14 below.

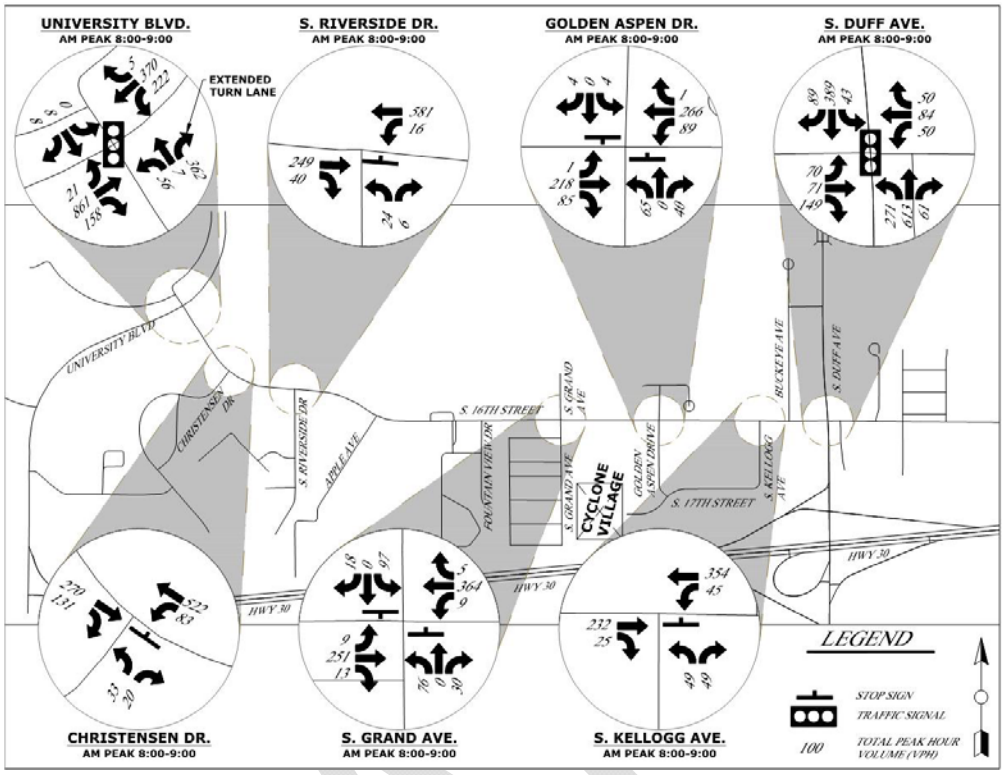


Figure 13 2015 AM Peak Volumes

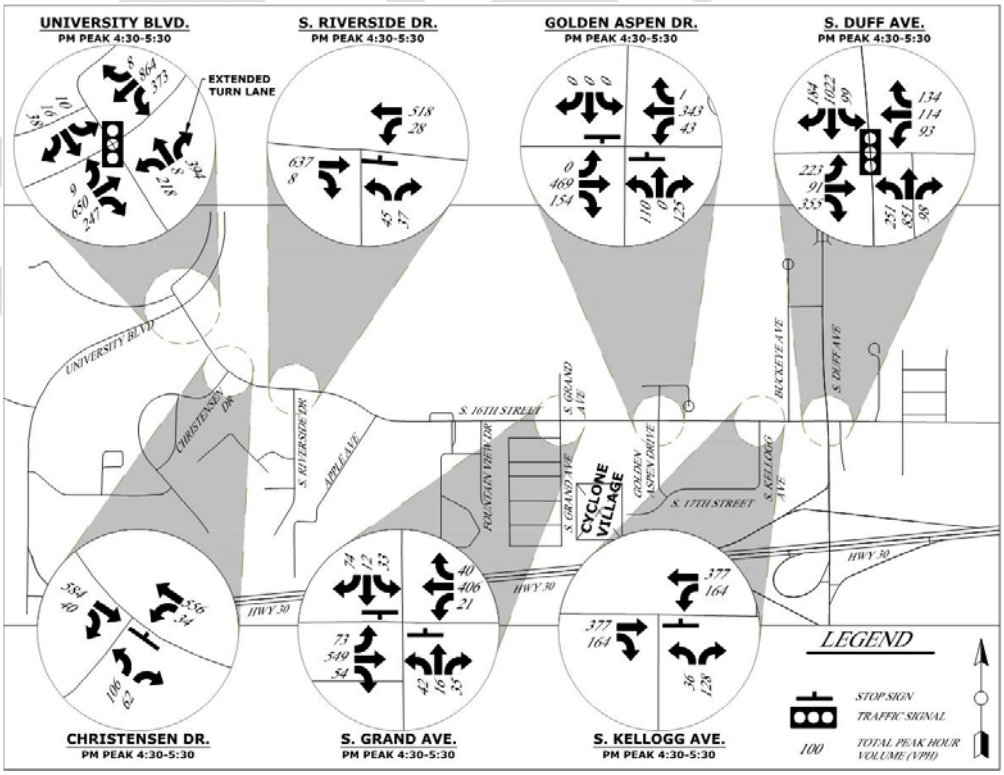


Figure 14 2015 PM Peak Volumes

B. 2035 Traffic Assignment

In the second step, the process, utilized to estimate the traffic volumes projected for the year 2035, used the Iowa DOT transportation model (the model). The last time the model was officially updated was in 2007. For this analysis the Iowa DOT made a model run for the year 2035. The 2035 projection included all of the land uses, current and proposed, along the corridor along with the proposed expansion to the ISU Research Park. Since all of the land uses were included in the 2035 projection it was not necessary to add the site generated traffic, from the Cyclone Village apartments, since their traffic contribution was already included.

The 2035 model run only includes the total daily traffic on South 16th Street. As a result it was necessary to calculate the AM and PM peak periods, the turning movements, the side street AM and PM peak periods and their turning movements. The calculations took eight steps to complete. Those steps included:

1. The % of the traffic making turning movements, at each intersection, was calculated from the traffic counts. These percentages were then used to predict the turning movements for the 2015 and the 2035 traffic volumes. It was assumed the traffic patterns did not change.
2. The peak hour factor (for each South 16th Street approach) was calculated, for each peak period at each intersection, using the current peak hour volume and the total approach volume.
3. The projected 2035 daily traffic volumes for South 16th Street were taken from the model. The volumes only included those for South 16th Street. There were no volumes for the side streets in the 2035 model.
4. The peak hour factor calculate in step 2 above was applied to the 2035 model projections to arrive at the 2035 peak period traffic volumes for South 16th Street.
5. The turning movement percentages, calculate step 1 above, were applied to the volumes from step 4 to arrive at turning movements for, each intersection, along South 16th Street for the year 2035.
6. For the side streets, since there are no projected volumes for the year 2035 in the model it was necessary to estimate the % growth on each side street approach. The projected volumes were estimated by comparing the 2007 and the 2035 model runs. The percent growth factor was established for each intersection.
7. The % growth calculated in step 6 was applied to the current traffic volumes that were recorded, for the side street approaches, on October 1, 2014.
8. The turning movement percentages calculate step 1 above was applied to the volumes from step 7 to arrive at turning movements for each intersection side street approach for the year 2035.

The results of these calculations are shown in figures 15 and 16 below. The calculations are included in appendix C.

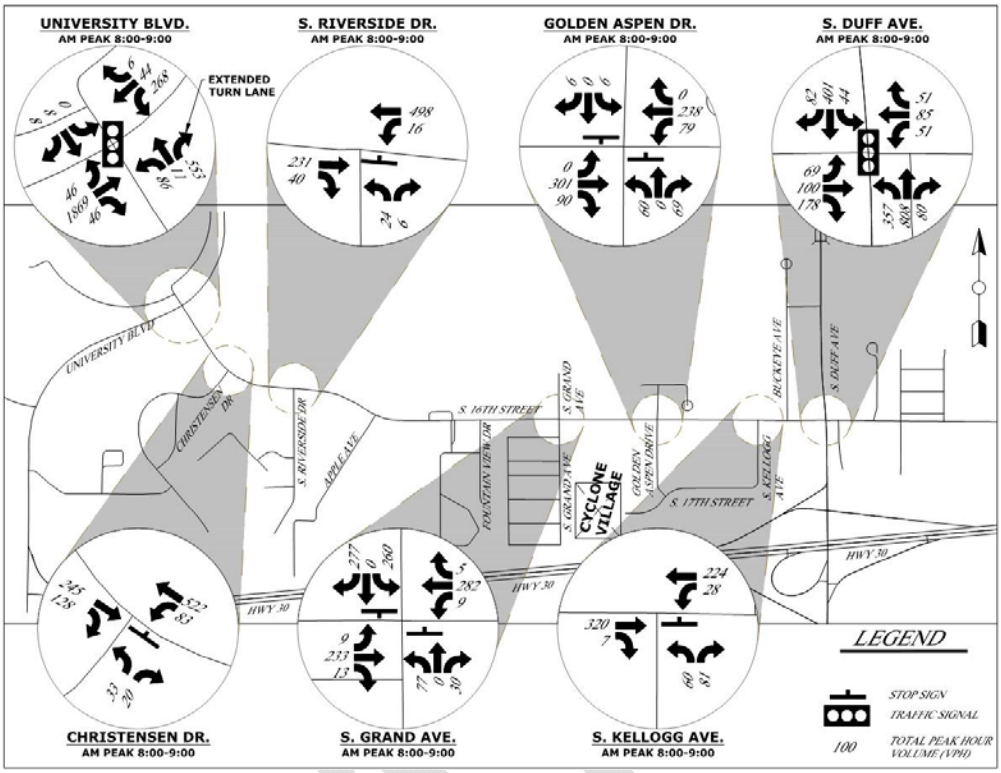


Figure 15 2035 AM Peak Volumes

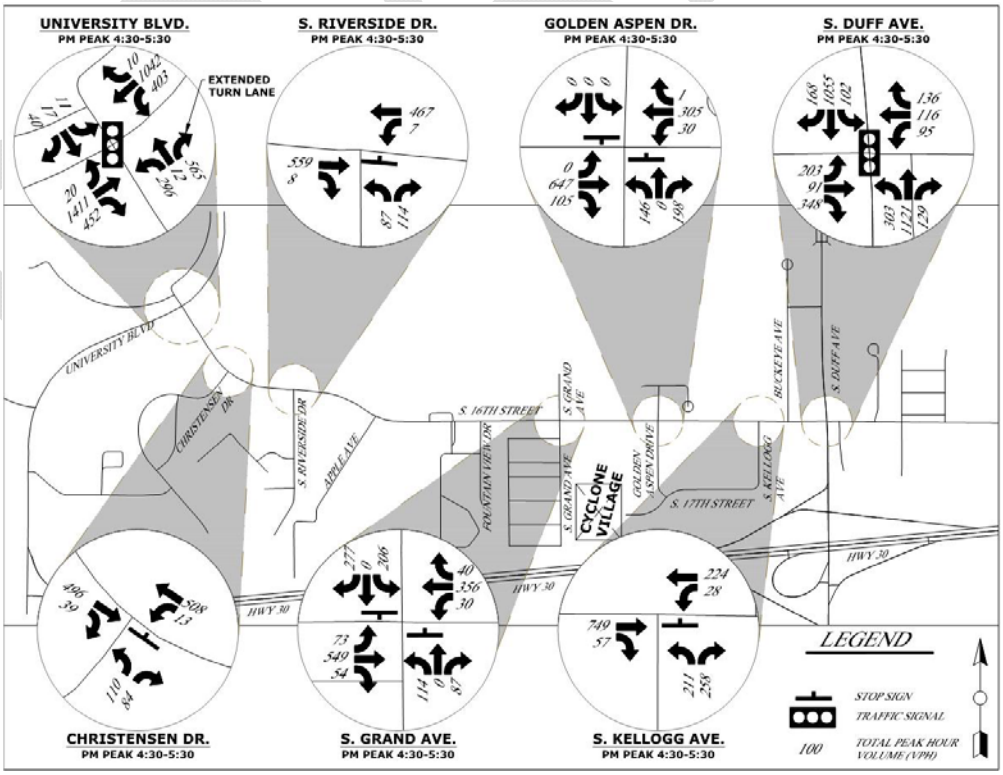


Figure 16 2035 PM Peak Volumes

VI. Capacity Analysis

Roadway capacity is evaluated on the basis of a Level of Service (LOS) analysis. Levels of Service are given letter designations of A through F, and are categorized based on driver perception and ease of traffic movements. LOS A represents free-flow conditions with no delays, while LOS E and F are generally considered unacceptable LOS in urban areas.

The capacity analysis was conducted using *Synchro* 8 traffic modeling software which follows the *Highway Capacity Manual (HCM)* methods. For unsignalized intersections, LOS is given by minor street approach, and unlike signalized intersections, no overall level of service is given per intersection. For each capacity analysis table, level of service is noted per minor street approach, both in seconds of vehicle delay and the corresponding LOS letter designation. The SYNCRO results are included in the appendix. The following tables 2 and 3 documents the SYNCRO analysis for the existing and total traffic volumes at the intersections.

A. Stop Controlled Intersections

Table 2 Stop Controlled Intersections

Stop Controlled Intersections [1]	Currrent				2015				2035			
	AM		PM		AM		PM		AM		PM	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Christensen Drive / 16th Street	**2.4**	**A**	**22.5**	**C**	**2.5**	**A**	**35.3**	**E**	**1.7**	**A**	**19.2**	**C**
Northbound Left Turn plus Right Turn	28.2	D	136.2	F	36	E	234.9	F	18.4	C	121	F
Westbound Thru plus Left Turn	8.7	A	9	A	8.8	A	9.4	A	8.4	A	9	A
Riverside Drive / 16th Street	**0.9**	**A**	**3.5**	**A**	**0.9**	**A**	**4.9**	**A**	**0.7**	**A**	**16.6**	**C**
Northbound Left Turn plus Right Turn	19.2	C	34.8	D	22.5	C	56.6	F	15.8	C	97.4	F
Westbound Thru plus Left Turn	7.9	A	9	A	8	A	9.5	A	7.9	A	8.9	A
Grand Avenue / 16th Street	**5.1**	**A**	**6.4**	**A**	**5**	**A**	**7.9**	**A**	The intersection is expected to warrant signalization.			
Northbound Left Turn plus Thru	18.2	C	58.6	F	20.8	C	89.3	F				
Northbound Right Turn	9.3	A	10.7	B	9.3	A	11.1	B				
Eastbound Left Turn	7.9	A	8.4	A	8.2	A	8.6	A				
Westbound Left Turn	7.8	A	8.9	A	7.9	A	9.3	A				
Southbound Left Turn plus Thru	13.7	B	39.5	E	15.4	C	53.4	F				
Southbound Right Turn	10.3	B	10.2	B	10.7	B	10.4	B				
Golden Aspen Drive / 16th Street	**2.5**	**A**	**5.4**	**A**	**4.4**	**A**	**12.2**	**B**	The intersection is expected to warrant signalization.			
Northbound Left Turn plus Thru plus Right	14	B	28.5	D	18.7	C	63.4	F				
Eastbound Left Turn	7.8	A	0	A	7.9	A	0	A				
Westbound Left Turn	8.1	A	9	A	8.2	A	9.5	A				
Southbound Left Turn plus Thru	15.6	C	0	A	16.9	C	0	A				
Southbound Right Turn	9.1	A	0	A	9.3	A	0	A				
Kellogg Avenue / 16th Street	**1.3**	**A**	**3**	**A**	**2.7**	**A**	**4.8**	**A**	The intersection is expected to warrant signalization.			
Northbound Left Turn plus Right Turn	10.4	B	15.2	C	13.4	B	25.9	D				
Westbound Left Turn plus Thru	7.9	A	9.6	A	8	A	9.7	A				

The analysis of Table 2 Stop Controlled Intersections we are able to see the following focus areas:

Current conditions:

- Christensen Drive — Northbound Left Turn at LOS F in the PM
- Riverside Drive — LOS is acceptable
- Grand Avenue — North and Southbound Left turns at LOS F in PM
- Golden Aspen Drive — LOS acceptable
- Kellogg Avenue — Kellogg Avenue OK

2015

- Christensen Drive — Northbound Left Turn at LOS F in the PM
- Riverside Drive — Northbound Left Turn at LOS F in the PM (new)
- Grand Avenue — North and Southbound Left turns at LOS F in PM
- Golden Aspen Drive — Northbound Left Turn at LOS F in the PM (new)
- Kellogg Avenue — Kellogg Avenue OK

2035

- Christensen Drive — Northbound Left Turn at LOS F in the PM
- Riverside Drive — Northbound Left Turn at LOS F in the PM (new)
- Grand Avenue — LOS required analysis as a signalized intersection
- Golden Aspen Drive — LOS required analysis as a signalized intersection
- Kellogg Avenue — LOS required analysis as a signalized intersection

The LOS starts to decline in the 2015 analysis as the site generated trips are added to the roadway system. . At the intersections of Christensen Drive and Riverside Drive the issue is that there is only two lanes on South 16th Street and adequate gaps in the traffic stream are not available to make the left turns. At Grand Avenue the same condition exists, there are not gaps in the traffic to make the left turns. At Golden Aspen Drive there is a decline in the LOS due to the site generated traffic being added to the current traffic volumes. This condition continues into the 2035 analysis where there is a need for a traffic signal to provide an acceptable LOS.

In 2035 the LOS is expected to declines at Riverside Drive, Grand Avenue, Golden Aspen Drive and Kellogg Avenue due to the increase in the background traffic. The deterioration is not due to the Cyclone Village Apartments because that impact has already been evaluated in the 2015 analysis. The only change that may be attributed to the apartments is at Golden Aspen Drive as shown in the 2015 analysis.

B. Signalized Intersections

Table 3 Signalized Intersections

Signalized Intersections [1]	Current				2015				2035			
	AM		PM		AM		PM		AM		PM	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
University Boulevard / 16th Street	**10.5**	**B**	**26.4**	**C**	**10.2**	**B**	**27.8**	**C**	**24.8**	**C**	**43.6**	**D**
Eastbound Left Turn plus Thru plus Right Turn	38.8	D	29.8	C	37.1	D	27	C	62.1	E	32	C
Westbound Left Turn plus Thru	41.8	D	96.8	F	42.6	D	84.8	F	70.7	E	50.4	D
Westbound Right Turn	41.5	D	28.3	C	40.5	D	23.8	C	0	A	0	A
Northbound Left Turn	5.6	A	16.5	B	4.6	A	18.3	B	4.1	A	18.1	B
Northbound Thru	9.2	A	22.3	C	7.5	A	24.8	C	13.6	B	48.9	D
Northbound Right Turn	6.8	A	18.1	B	5.5	A	20.2	C	6	A	26	C
Southbound Left Turn	7.6	A	18.4	B	6.4	A	26.5	C	139	F	101.4	F
Southbound Thru plus Right Turn	5.5	A	16	B	4.3	A	16.6	B	3.6	A	19.7	B
Duff Avenue / 16th Street	**10.3**	**B**	**21.9**	**C**	**11.2**	**B**	**19.4**	**B**	**8.4**	**A**	**16.8**	**B**
Eastbound Left Turn plus Thru	38.8	D	27.4	C	36.9	D	26.2	C	25.1	C	25.4	C
Eastbound Right Turn	38.8	D	27.4	C	36.9	D	26.2	C	25.1	C	25.4	C
Westbound Left Turn plus Thru plus Right Turn	45.5	D	123.9	F	45	D	118.5	F	24.7	C	46.7	D
Northbound Left Turn	5.5	A	20.4	C	4.9	A	19	B	6.1	A	23.6	C
Northbound Thru	6.8	A	16.8	B	5.8	A	14.4	B	7.2	A	14	B
Northbound Right Turn	0	A	11.8	B	0	A	10.4	B	0	A	8.5	A
Southbound Left Turn	4.7	A	12.3	B	4.1	A	10.5	B	4.9	A	10.6	B
Southbound Thru	8.1	A	23.4	C	7.2	A	20.4	C	9	A	18.4	B
Southbound Right Turn	7.1	A	15.1	B	6.4	A	13.6	B	0	A	11.4	B
Golden Aspen Drive / 16th Street									**5.4**	**A**	**6.4**	**A**
Eastbound Left Turn									0	A	0	A
Eastbound Thru plus Right Turn									2.4	A	0.6	A
Westbound Left Turn									0.3	A	0.1	A
Westbound Thru plus Right Turn	The intersection is stop controlled.				The intersection is stop controlled.				0.1	A	0.2	A
Northbound Left Turn									27	C	22.4	C
Northbound Thru plus Right Turn									0	A	26.8	C
Southbound Left Turn plus Thru									23.6	C	0	A
Southbound Right Turn									23.7	C	0	A
Kellogg Avenue / 16th Street [2]									**8.2**	**A**	**14.2**	**B**
Eastbound Thru plus Right Turn	The intersection is stop controlled.				The intersection is stop controlled.				7	A	10.7	B
Westbound Left Turn plus Thru									8.4	A	8.8	A
Northbound Left Turn plus Right Turn									10.7	B	23.9	C
Grand Avenue / 16th Street									**13.8**	**B**	**15**	**B**
Eastbound Left Turn									9.9	A	16.8	B
Eastbound Thru plus Right Turn									9.2	A	17.2	B
Westbound Left Turn									9.6	A	9.8	A
Westbound Thru plus Right Turn	The intersection is stop controlled.				The intersection is stop controlled.				9.4	A	7.5	A
Northbound Left Turn									26.5	C	28.7	C
Northbound Thru plus Right Turn									17.1	B	13.8	B
Southbound Left Turn									19.6	B	20.9	C
Southbound Thru plus Right Turn									14.5	B	11.5	B

Notes.

1. Unless otherwise noted, the intersections were analyzed utilizing methods contained in the 2010 Edition of the Highway Capacity Manual.

2. The 2010 Edition of the Highway Capacity Manual does not analyze intersections with shared and exclusive lanes. Therefore, the 2000 Highway Capacity Manual was used to analyze this intersection.

The analysis of table 3, Signalized Intersections, allows us to see the following focus areas:

Current conditions:

- University Boulevard — Westbound left turn LOS F in the PM
- South Duff Avenue — Westbound left turn LOS F in the PM

2015

- University Boulevard — Westbound left turn LOS F in the PM
- South Duff Avenue — Westbound left turn LOS F in the PM

2035

- University Boulevard — West, east and south bound left turn LOS F in the PM
- South Duff Avenue — OK
- Grand Avenue — OK
- Golden Aspen Drive — OK
- Kellogg Avenue — OK

University Boulevard shows a low LOS service all through the analysis periods. This is due to the traffic volumes using University Avenue for access into and out of ISU. The low LOS is not due to added traffic volumes from the Cyclone Village Apartments.

South Duff Avenue shows a low LOS service for the current traffic and for the 2015 analysis. This is due to the traffic volumes using South Duff Avenue for access into and out Ames and to the businesses located to the north. The low LOS for South duff Avenue is not due to the added traffic volumes from the Cyclone Village Apartments. The LOS conditions show an improvement in the analysis year of 2035. This change is most likely due to the extension of Grand Avenue from South 4th Street to South 16th Street. The extension of Grand Avenue will have an impact on the travel patterns along South Duff Avenue.

The intersections of Grand Avenue, Golden Aspen Drive and Kellogg Avenue were analyzed as signalized intersections. All three are expected to perform at a high LOS.

VII. Conclusions and Recommendations

The purpose of this traffic impact analysis (TIA) is to forecast the travel demand and related traffic impacts associated with the proposed Cyclone Village Apartments. The apartments are located on South 17th Street immediately west of the existing Aspen Business Park.

The assumptions made in this analysis include:

- The residents of the Cyclone Village Apartments will be 50% students and 50% young professionals.
- That Grand Avenue would be extended from South 4th Avenue to South 16th Avenue by the year 2035
- That the traffic lanes on South 16th Street would remain the same as they are today
- That the traffic patterns and the turning movements at the individual intersections would stay the same throughout the analysis periods.

The following specific conclusions and recommendations are made:

1. The crash history analysis indicates that the crash rate is stable and is spread out over several years. The intersections of University Boulevard and South Duff Avenue are signalized intersections with the largest number of crashes. The number of crashes that were analyzed are not expected to increase as a result of the Cyclone Village Apartments.

2. Condition of intersections currently indicates that University Boulevard, Christensen Drive, Grand Avenue and South Duff have low LOS values due to left turning vehicles. These conditions are existing today.

3. Condition of intersections in 2015, when Cyclone Village is constructed, indicates a low LOS values at Christensen Drive and Golden Aspen Drive. The condition at Christensen Drive is due to the fact that there are only two travel lanes on South 16th Street indicating adequate gaps in the traffic are not allowing left turning vehicles to proceed. At Golden Aspen Drive the decline in Los is due to the increased traffic coming from the Cyclone Village Apartments. A traffic signal is the most likely solution to improving LOS.

4. The condition of the intersections in 2035, from Iowa DOT Model, indicate that the LOS for Grand Avenue and Kellogg Avenue will decline and there may be a need for a traffic signal at these locations. Grand Avenue will be extended from South 4th Street to South 16th Street at this time and the actual impact of this change in the street network will need to be evaluated at that time. The extension of Grand Avenue will most likely impact the travel patterns for the entire area.

5. A traffic signal at the intersection of South 16th Street and Golden Aspen Drive is recommended as a result of the additional traffic volumes that are associated with the Cyclone Village Apartments.

Appendix

A. Traffic Count Data

B. Crash Data Summaries

C. Traffic Volume Calculations

D. Syncro 8 Data Sheets