

# Midvale Plaza Redevelopment

## Traffic Impact Study

Completed by:  
Schreiber/Anderson Associates  
717 John Nolen Drive  
Madison, WI 53713  
[www.saa-madison.com](http://www.saa-madison.com)

---

## Table of Contents

1.	Background	1
2.	Proposed Development	1
3.	Existing Conditions	2
4.	Traffic Analysis and Assumptions	3
5.	Traffic Projections and Trip Assignment	3
6.	Pedestrian, Transit, and Bicycle Projections	4
7.	Transportation Analysis	4
8.	Recommended Improvements	7

## List of Tables

Table 1	2006 Traffic Analysis Summary	3
Table 2	2008 Traffic Analysis Summary	5
Table 3	2008 Traffic Analysis Summary with Improvements	7

## List of Figures

Figure 1	Development Location and Study Area
Figure 2	Proposed Development
Figure 3	Existing Traffic Control and Geometrics
Figure 4	Existing Traffic Volumes
Figure 5	Existing PM Peak Hour Traffic Counts 4:00 to 5:00
Figure 6	Development-Generated Trip Distribution and Assignment
Figure 7	2008 PM Peak Hour Traffic Volumes with Development
Figure 8	Recommended Improvements

## Appendices

Appendix A	Trip Generation	8
Appendix B	Level of Service	9
Appendix C	Peak Hour Traffic Counts – 2006	10
Appendix D	Level of Service Analysis – 2006	11
Appendix E	Level of Service Analysis – 2008	12
Appendix F	Level of Service Analysis – 2008 With Improvements	13

## 1. Background

Midvale Plaza is a proposed mixed-use development on the existing block in the northwest corner of the intersection of Midvale Boulevard and Tokay Boulevard on the west side of the City of Madison. It entails the redevelopment of an existing retail strip mall that includes a neighborhood branch of the Madison Public Library system. The block is bounded by Midvale Boulevard, Tokay Boulevard and Caromar Drive. The project is being submitted as a GDP/Phase 1 SIP to the City of Madison. The City has requested that a traffic study be performed as part of the review process. The purpose of the traffic study is to evaluate the impact of the development on the local transportation system and make recommendations regarding means or measures to address any deficiencies that the analysis finds in the transportation system. The location of the proposed development and study area are shown in Figure 1.

## 2. Proposed Development

The project encompasses approximately 3.6 acres of the block bounded by Midvale Boulevard, Tokay, and Caromar Drive. The proposed mixed-use development includes 143 one and two bedroom apartments, a 20,000 square foot public library, and 19,000 square feet of mixed retail. There will be 226 parking stalls constructed underground and 99 surface parking stalls. Currently there is approximately 28,500 square feet of retail space and an 11,500 square foot library. There is also a separate 5,000 square foot commercial building on the site that is currently vacant. Of the total retail space available, approximately 17,000 square feet is presently under lease. There are 187 surface parking spaces on the existing site.

The project is to be constructed in two phases. The first phase is scheduled to begin construction in 2006, with the final phase completed by 2008. The first phase will consist of construction on the southern portion of the property and will include 43 residential units, 20,000 square foot library, and 9,000 square feet of retail space. The second phase of the project will include the remainder of the retail and apartments on the north side of the property.

Access to and from the development will primarily be via a new central drive through the middle of the property that will connect from Midvale Boulevard to Caromar Drive. A new break in the Midvale Boulevard will be provided midblock to allow left turn only movement from southbound Midvale Boulevard. The underground parking for the residential units will connect at Midvale Boulevard for the northern half of the site. For the southern half of the site there will be an access off of Caromar Street. As an alternative in Phase 2, consideration is also being given to having the access for the northern units off of Caromar Drive if the units were to be sold as condominiums. The proposed development plan is shown in Figure 2.

### 3. Existing Conditions

The existing street geometry, parking conditions, and traffic control for the redevelopment site and adjacent area are shown in **Figure 3**. Only one of the two intersections adjacent to the development (Midvale Boulevard and Tokay Boulevard) is controlled by a traffic signal. The intersection of Tokay Boulevard and Caromar Drive is controlled by a stop sign.

All streets surrounding the development currently are restricted to no on-street parking except for a section of Midvale Boulevard along the northern half of the development as shown in **Figure 3**. Midvale Boulevard is a four lane arterial roadway with a median that restricts turn movements at the intersections. Tokay Boulevard is a two lane collector street also with a center median. Caromar Drive is a two lane (30 foot) residential street with parking on one side. There are two (2) bus stops on Tokay Boulevard on the south side of the site on either side of the street. Access into the site is currently allowed with two drives off of Midvale Boulevard, two drives off of Tokay Boulevard, and one drive off of Caromar Drive. The Caromar Drive access is presently the only access to the development that allows full access (movement in all directions). The northern edge of the site is bounded by apartments. Across the street on the south is a church. The remaining area across from the site on the south, east and west is single family residential.

The intersection of Midvale Boulevard and Tokay Boulevard is controlled by a traffic signal. Both the north and south approaches at Midvale have two through lanes and a left turn lane. The Tokay Boulevard approaches are both single lane although the east and west approaches have room for two lanes, only one lane is designated. The intersection of Caromar Drive is a "T" intersection that is stop controlled at Tokay Boulevard. The surrounding streets all have sidewalks and crosswalks at the intersections.

Daily traffic volumes taken by the city of Madison in 2005 are shown in **Figure 4**. This includes both Tokay Boulevard and Midvale Boulevard. The current bus routes and bus shelter locations are also shown. Presently both Metro routes 6 and 7 serve the development via Tokay Boulevard.

Turning movement counts were taken at both Midvale/Tokay and Caromar/Tokay during the peak afternoon hours of 4:00 and 5:00 p.m. Traffic counts on the Tokay/Midvale intersection were taken at fifteen minute intervals and expanded to the peak hour. They were then compared to peak hour traffic counts taken by the City of Madison in 2005 for relative accuracy. A full hour of counts was taken at Caromar Drive and Tokay Boulevard. A summary of the count results is included in **Appendix D**. A breakdown of the turning movements for the peak hour of 4:00 to 5:00 is shown in **Figure 5**.

Both intersections were evaluated for their existing level of service (LOS). This included the stopped intersection and the one signalized intersection. A summary of the current LOS at each of the intersections is shown in **Table 1**. The detailed analysis is included in the **Appendix**.

Table 1 2006 Traffic Analysis Summary														
Weekday PM Peak Hour														
Level of Service by Approach														
Location	Traffic Control	Int.	Northbound			Southbound			Eastbound			Westbound		
		LOS	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Midvale Blvd/Tokay Blvd	Traffic Signal		B	B	B	A	B	B	C	C	C	C	C	C
Tokay Blvd/Caromar Street	Stop Sign		-	-	-	A	-	A	A	A	-	-	A	A

#### 4. Traffic Analysis and Assumptions

Due to the retail and library facilities in the development, the analysis focused on the afternoon peak hour period. Previous traffic counts in the area have substantiated the fact that the peak hour is between 4:00 and 5:00 p.m.

The analysis was focused on the pre- and post-evaluation of the level of service and the delay at the two primary intersections surrounding the development

The trip generation rates for the development were taken from *The Institute of Transportation Engineers (ITE) Trip Generation Manual, 7<sup>th</sup> Addition* based on the appropriate land use coding for apartment, retail, and library land use as outlined in Appendix A.

The traffic signal analysis at Midvale Boulevard and Tokay Boulevard was analyzed as a single signal using HCS+ and assumed a cycle length and timing defaults as provided for by the City of Madison Traffic Engineering Department. The two-way stop approach at Caromar and Tokay Boulevard was also analyzed using HCS+.

#### 5. Traffic Projections and Trip Assignment

The total trips generated by the new development were determined for the AM peak hour, PM peak hour and Saturday peak hour as shown in Appendix A. The trips generated for each land use were then reduced by an estimate of linked trips (retail, residential, and library that are made between uses within the development) and pass by trips (trips that are already on the street and are not newly created) to determine the number of total of trips. Both linked and pass-by trips were assumed to be 10% each. The ITE literature estimates that both of these categories could reduce the vehicular trip generation by up to 20%, but a smaller number was used to remain on the conservative side of the estimates.

Since the traffic counts taken at the site also include the existing development using the site, the total number of new trips generated by the development needs to take into consideration the number of existing trips generated by the current development. These

trips would then be subtracted from the number of new trips generated in order to determine the number of net new trips generated by the development. These figures are shown in Appendix A.

The highest number of trips generated by the development is estimated to be on Saturday with a total of 287 trips during the peak hour. If linked trips, pass by trips and existing trips are subtracted, the total number of new additional trips created by the development is 82 trips during the Saturday peak hour.

In order to remain on the conservative side for the estimates, the analysis assumed no reduction in trips and used the peak Saturday trip generation for analysis purposes and assumed they were the same as the week day PM peak hour. This resulted in a total number of additional trips as 153 inbound and 134 outbound during the PM peak hour of the day. These trips were assigned to the network based on the results of the area traffic counts and broken down between residential and retail/library trips. Based on these assumptions, 80% of the residential traffic was assumed to come from Midvale Boulevard and 20% from Tokay Boulevard. For the retail and library traffic, 60% was assumed to come off of Midvale, 30% from Tokay Boulevard, and 10% from the local neighborhood streets. The assumptions made on directional splits and assignments are shown in Figure 6.

Based on the historical rate of increase in traffic volumes, the base traffic volumes (2006) were increased to the year 2008 for each of the streets involved in the traffic study. The basis for making these projections assumed a 1% increase per year in traffic volume. The projected traffic was then added to the 2008 base-year traffic volumes to develop the 2008 traffic volumes with development, which are shown in Figure 7.

## 6. Pedestrian, Transit and Bicycle Projections

Given the retail and library component of this development draws heavily from the neighborhood, it is expected that there will be a large number of trips generated on foot from the neighborhood. As a result, the establishment of safe cross walks in the neighborhood is critical to the development.

Transit service to the area is provided on Tokay Boulevard. There are currently two bus routes directly servicing the study area. The service frequency is 30 minutes in the weekday peak periods and one hour during the rest of the day and weekends. Beginning in August of this year, Metro is planning to add additional bus service and new shelter in the area. This improvement will include an increase in frequency of bus service and connections to the Allied/South Transfer Point and the West Transfer Point. The addition of the two new bus stop locations is shown in Figure 8.

## 7. Transportation Analysis

A summary of the existing intersection analysis completed for both intersections is shown in Table 1. Currently the signalized intersection at Midvale and Tokay Boulevard operate at an LOS "C" or better for each of the approaches. The Midvale Boulevard approaches operate at an LOS "B" and the Tokay Boulevard approaches operate at an acceptable but lower level of

service. Although the east and west approaches on Tokay Boulevard have a single approach lane in either direction, both approaches have enough room and operate as two lanes and therefore function better than what is indicated in the analysis. In the case of the westbound approach, one lane operates as a left turn lane, while providing enough room for a second lane for through movement and right turns. In the case of the eastbound approach, there is enough room for a separate right turn movement and a left/through movement. The eastbound approach has a heavy right turn movement while the westbound approach has a heavy left turn movement. The Tokay Boulevard/Caromar Drive intersection functions well at an LOS "A".

An analysis was also done, based on the projected 2008 peak hour traffic volumes, for each intersection. This included both the increase in background traffic as well as the development traffic. As mentioned previously, the development traffic was not discounted for pass by, linked, or existing trips. The results of this analysis are shown in Table 2.

Table 2 2008 Traffic Analysis Summary														
Weekday PM Peak Hour														
Level of Service by Approach														
Location	Traffic Control	Int.	Northbound			Southbound			Eastbound			Westbound		
		LOS	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Midvale Blvd/Tokay Blvd	Traffic Signal		B	B	B	A	B	B	C	C	C	C	C	C
Tokay Blvd/Caromar Street	Stop Sign		B	-	B	-	-	-	A	A	A	A	A	A
Tokay Blvd/Caromar Street Condos	Stop Sign		-	-	-	B	-	B	A	A	A	A	A	A

The comparison of the level of service (LOS) before and after development suggests that there is no change in the operation of the traffic signal at Tokay and Midvale Boulevard. Each of the approaches will function at a similar level of service even though there has been some increase in traffic volumes on several of the approaches. The traffic signal continues to function at an acceptable level of service. The intersection of Tokay Boulevard and Caromar Drive also functions at an acceptable level of service, however, it was reduced from an LOS "A" to an LOS "B".

The development also includes a request to move the access to the underground parking for the 100 units on the north side of the development in Phase 2 to Caromar Drive. In the event that would occur, instead of apartments, it was assumed that there would be 75

condominium units. The same number of trips generated as the 100 unit apartment complex was used assuming that the trip generation of the condominium units would be higher. The results of this analysis are shown in Table 2 and labeled as Condos. The results indicate that there would be the same level of service at the intersection of Caromar Drive and Tokay Boulevard with the additional trips added to Caromar Drive. It was assumed that all trips from the condos would use that intersection and not use Caromar Drive to the north or cut through the development to Midvale Boulevard.

The addition of lane channelization was investigated at the two approaches on Tokay Boulevard. Currently both approaches appear to function as two lanes, but they are not striped to allow that operation. The eastbound leg of Tokay Boulevard is approaching the need for a separate exclusive right turn lane (100 vph). The westbound approach could also benefit from an exclusive left turn lane based on existing and projected traffic volumes. In addition, separate timing for the left turn movements on the westbound lane of Tokay Boulevard was also explored to determine its effectiveness. It would also improve the LOS of the intersection.

The addition of these improvements was analyzed for the Midvale/Tokay intersection and are included in Appendix F. While these improvements would not significantly change the level of service of the intersection, the analysis shows that it would reduce the delay at each of the intersection approaches. However, the additional phasing for the left turn movement on Tokay westbound (a westbound lead green) would not marginally improve the intersection LOS and indications are that it would increase the delay on the Midvale Boulevard approaches. Separating the left and right turn movements for the southbound approach at Caromar would also not change the movement's level of service, however it would reduce the delay particularly since the intersection has such a heavy right turn movement.

The change in intersection LOS with the additional lane geometrics is shown in Table 3.

During the course of the traffic counts, it was documented that there are a number of vehicles (11 during the peak hour) that make a "U" turn on Tokay Boulevard at Caromar from eastbound to westbound. It is assumed that this is the result of the inability for vehicles to make a left turn into the development from southbound Midvale Boulevard. The proposed addition of the turn lane to allow this movement should reduce the need for vehicles to make a "U" turn at this location.

There is also the concern that moving the entrance for the underground parking for the north portion of the development onto Midvale Boulevard instead of Caromar will encourage additional "U" turns for this traffic at Ames Street. Ames Street currently has poor sight distance visibility as investigated by city staff. Placing both underground parking access points on Caromar would eliminate this safety concern. The tradeoff would be the possibility of additional traffic using Caromar Drive northbound from the development.

*acceptable but not excellent*



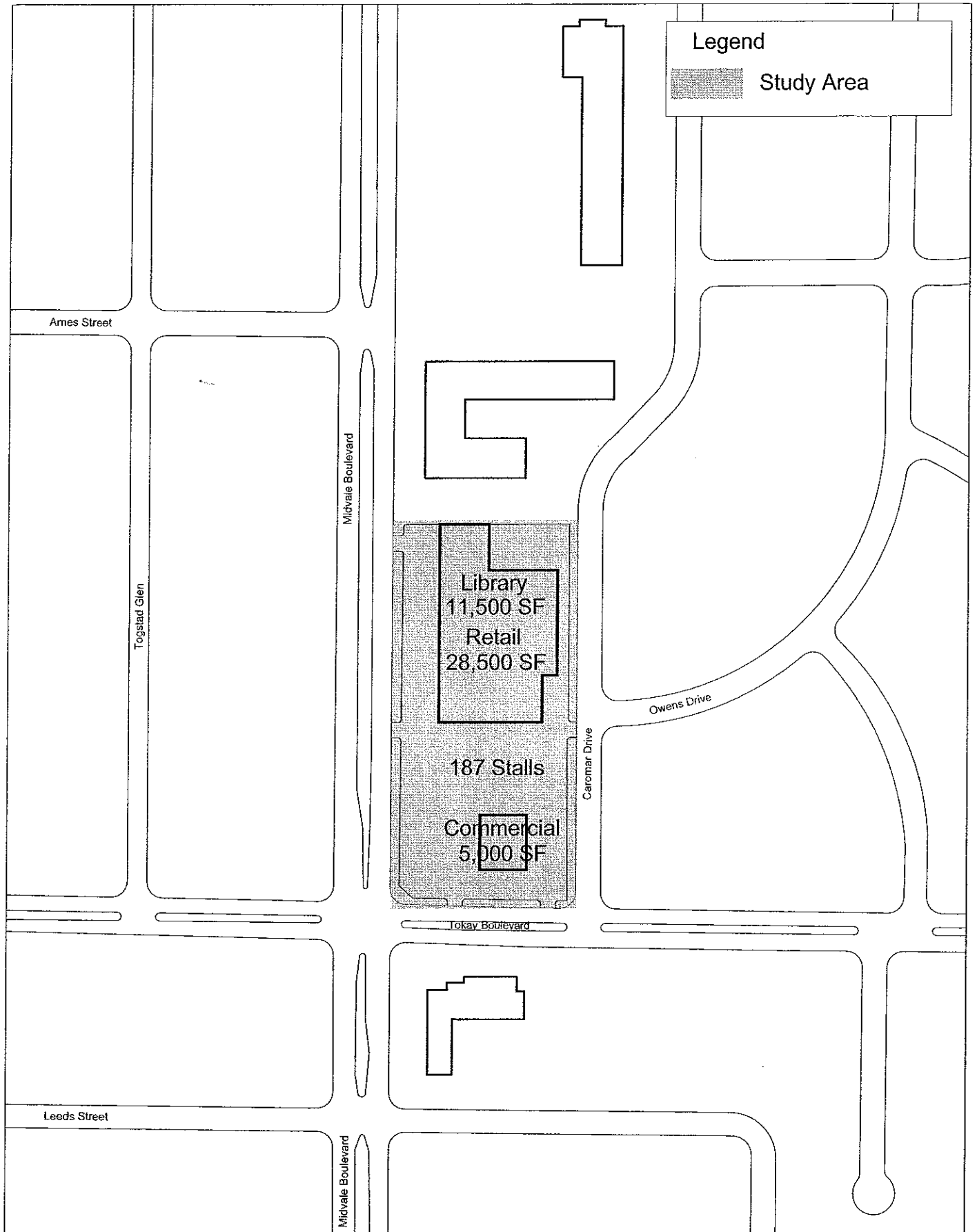
Table 3 2008 Traffic Analysis Summary With Improvements														
Weekday PM Peak Hour														
Level of Service by Approach														
Location	Traffic Control	Int.	Northbound			Southbound			Eastbound			Westbound		
		LOS	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Midvale Blvd/Tokay Blvd	Traffic Signal		A	A	A	A	B	B	C	C	B	C	B	B
Tokay Blvd/Caromar Street	Stop Sign		-	-	-	B	-	B	A	A	A	A	A	A

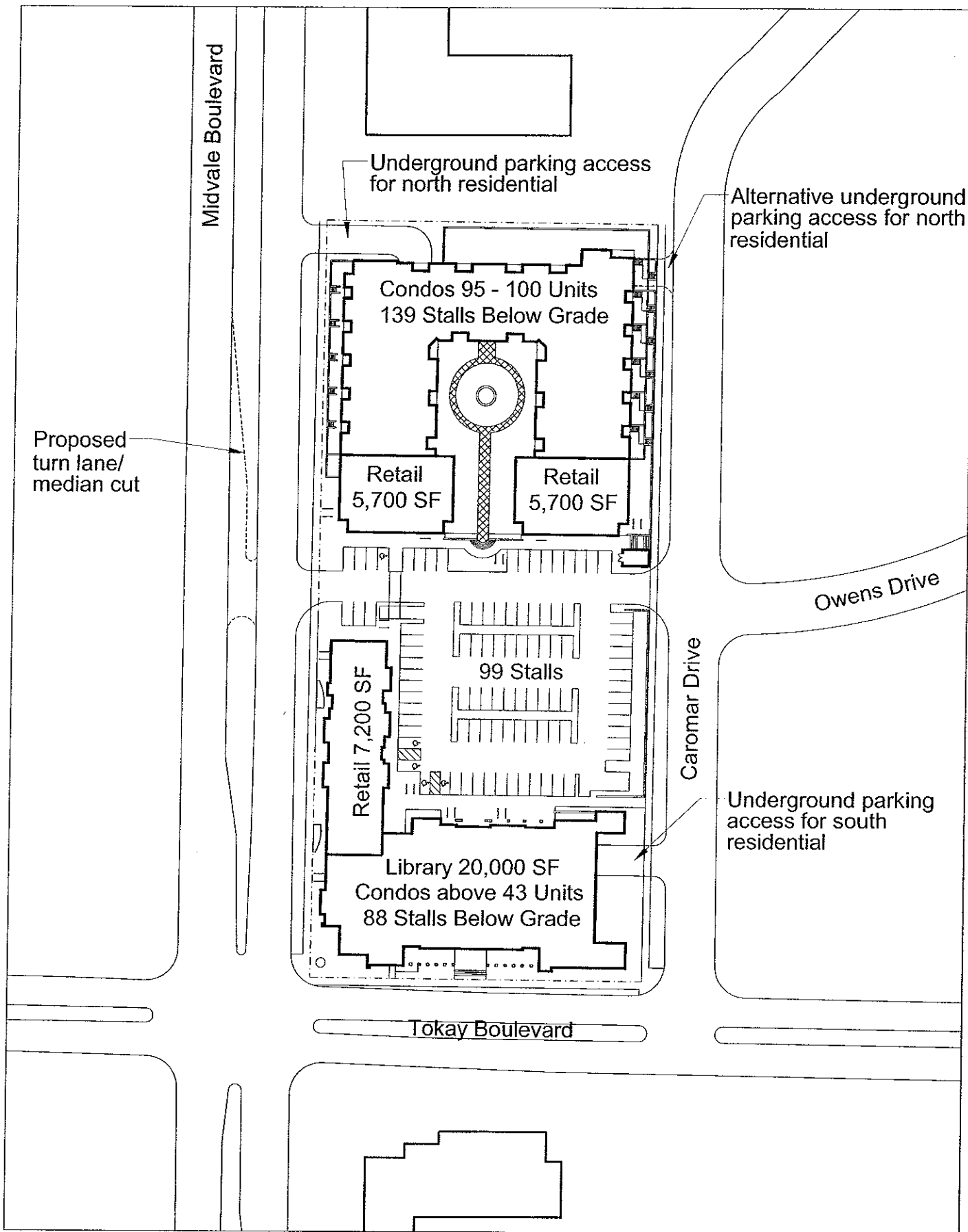
## 8. Recommended Improvements

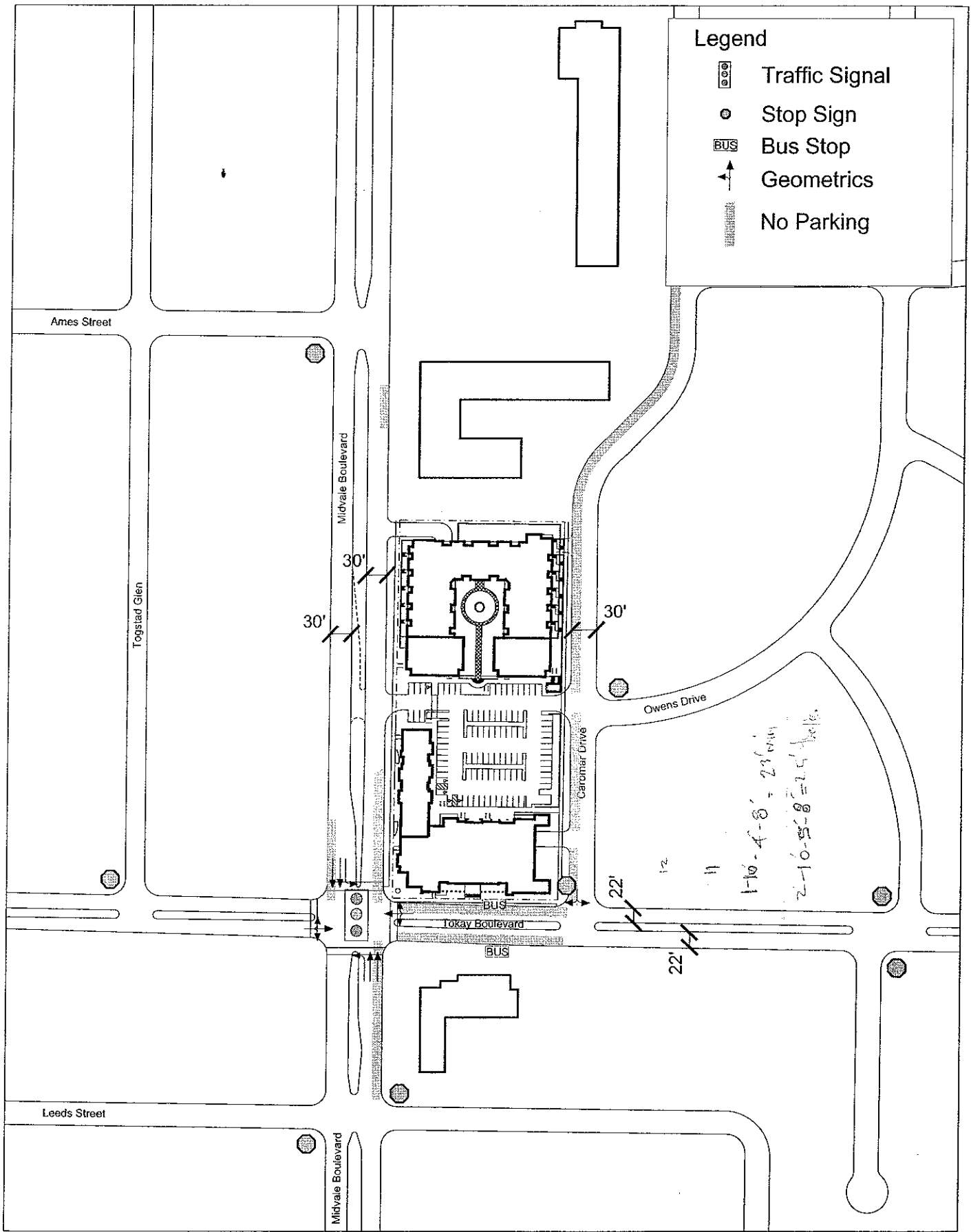
As a result of this analysis and investigation, there are a number of recommendations for improvements to the transportation system adjacent to the proposed development, as shown in Figure 8. It is recommended that all these improvements be completed as a part of the first phase of development.

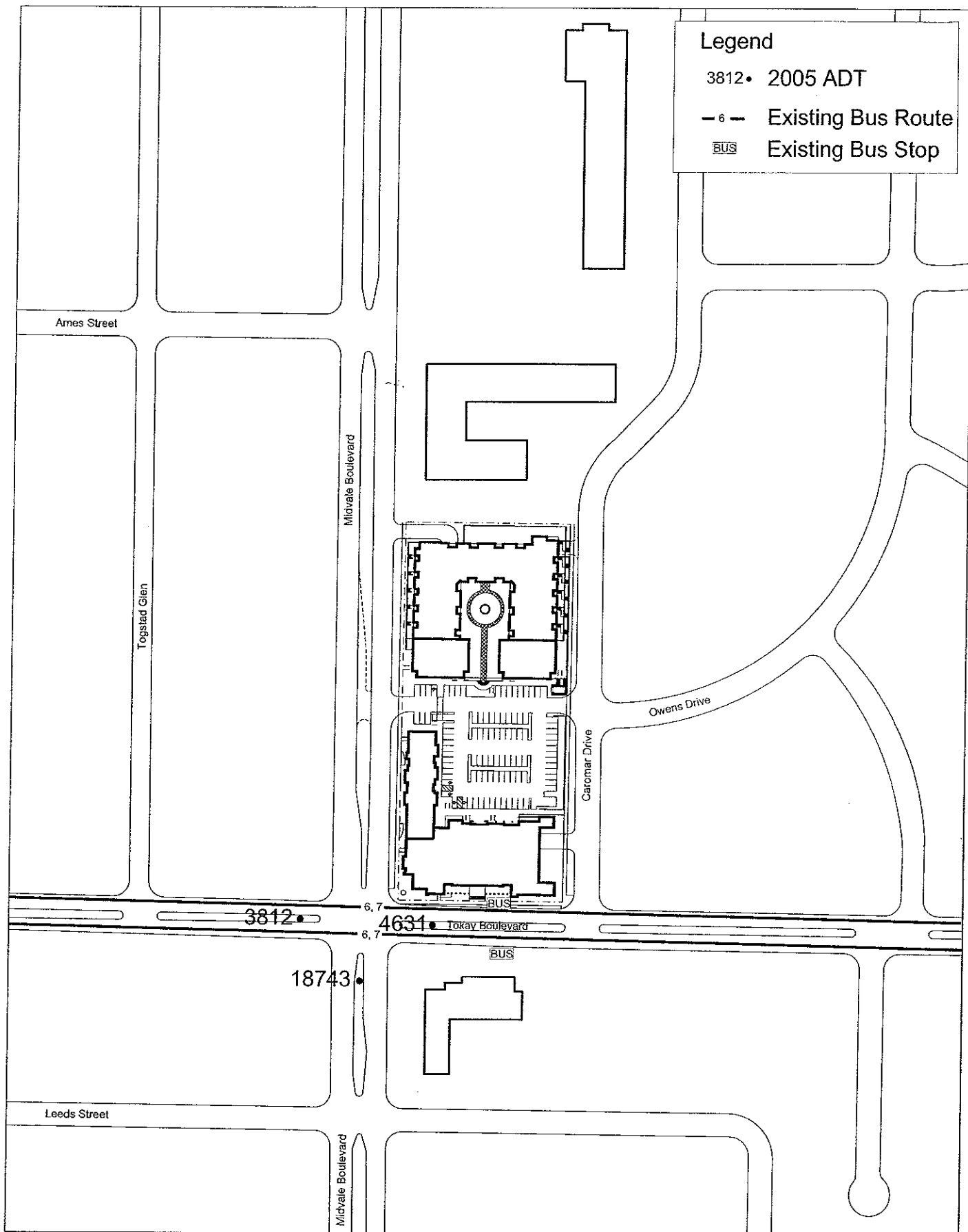
- Channelize the westbound approach of Tokay Boulevard for a separate left turn movement.
- Channelize the eastbound approach of Tokay Boulevard for a separate right turn movement.
- Channelize the intersection of Calomar Drive for separate left and right turn lanes at Tokay Boulevard. Given the 30 foot width of the existing street, this would mean widening the street a few feet on the west side.
- Provide a break in the Midvale median directly across from the west side access point to the development to allow left turn inbound only.
- Monitor the "U" turn movement at Ames Street to determine if an additional crossing needs to be provided that has a safer sight distance due to the increase in traffic making this movement.
- Add painted crosswalks at the intersection of Caromar Drive and Owen Drive.

As a part of the second phase of the development, consideration should be given to allowing access for the underground parking for on Caromar if the units were to be developed as condominiums.





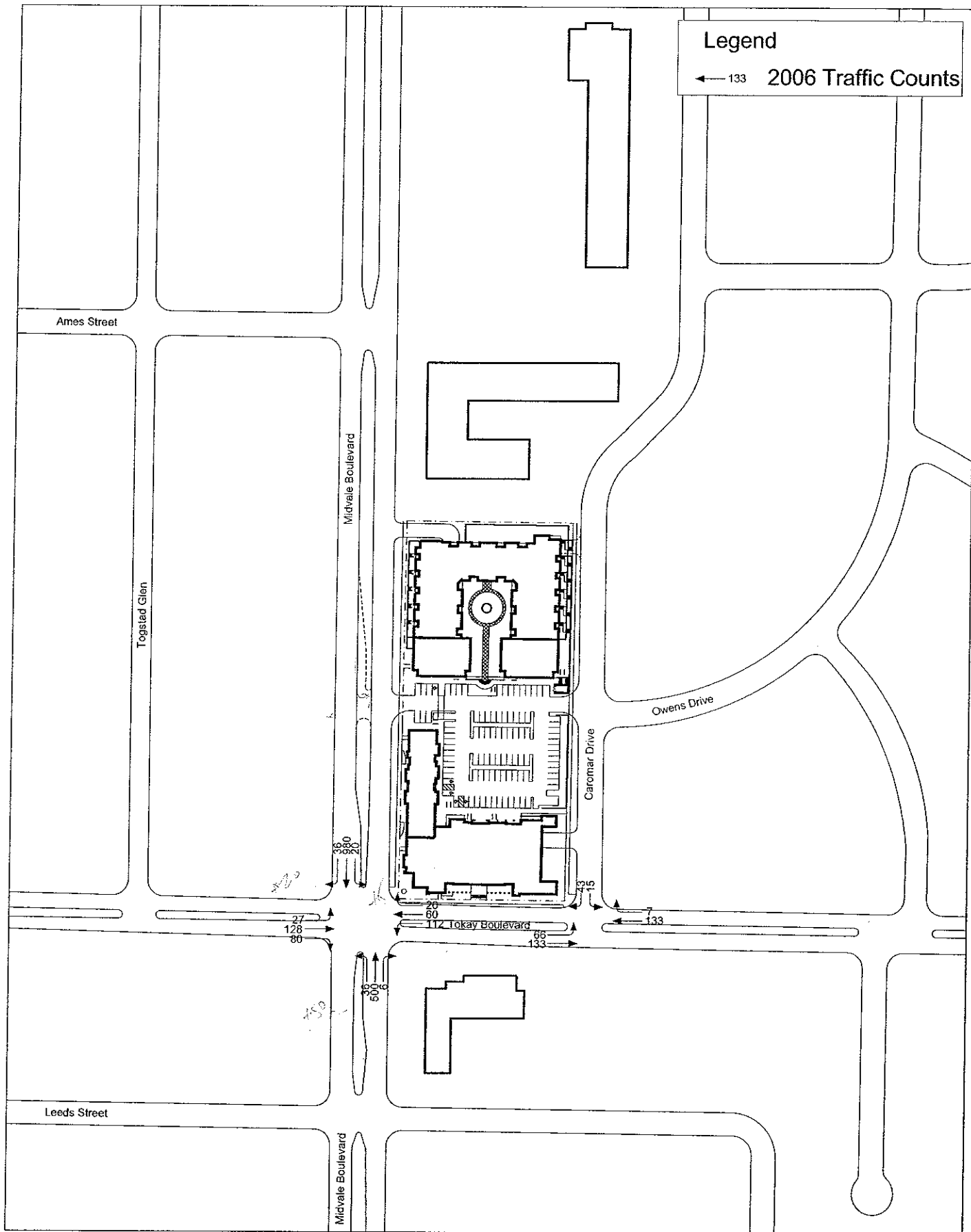


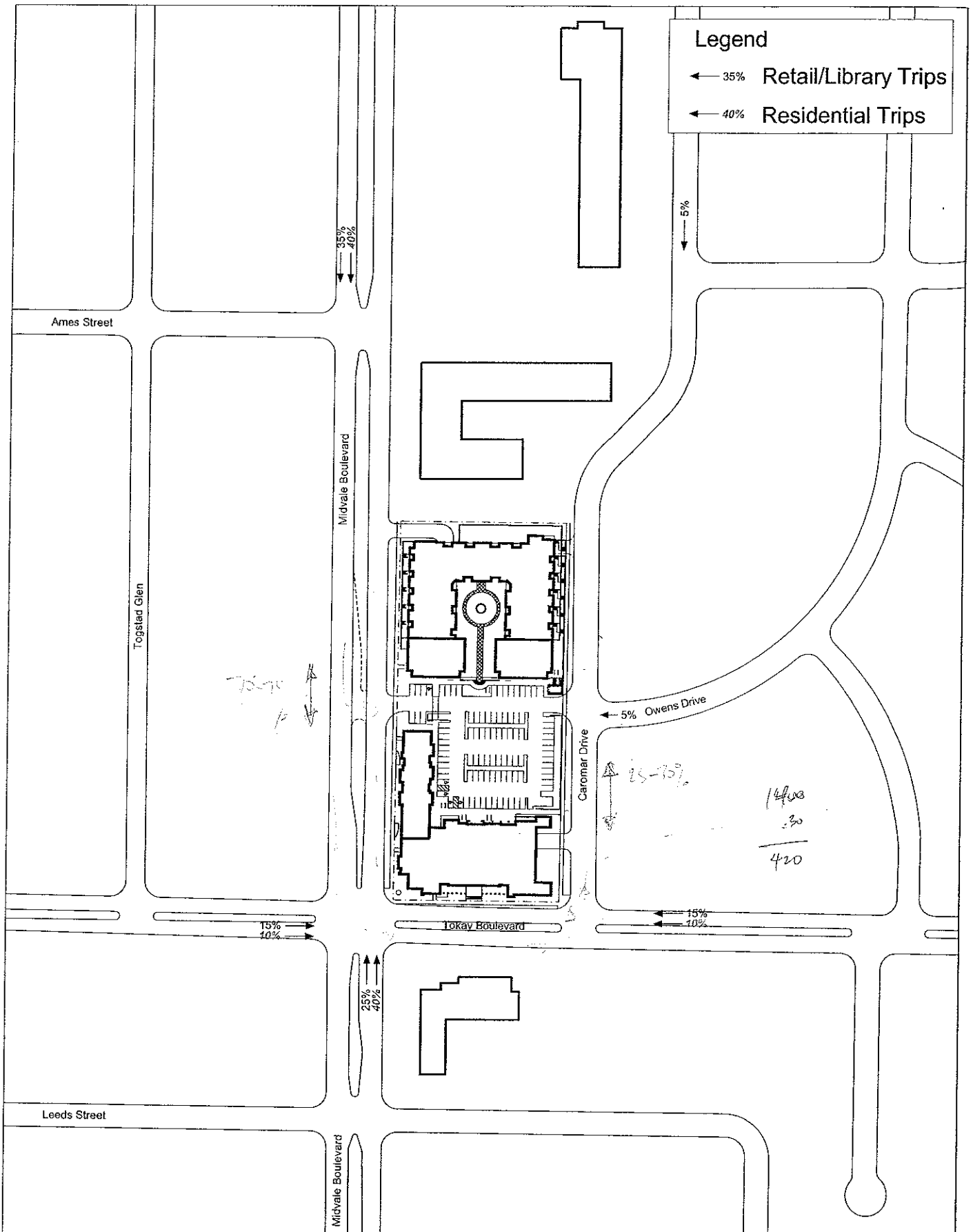


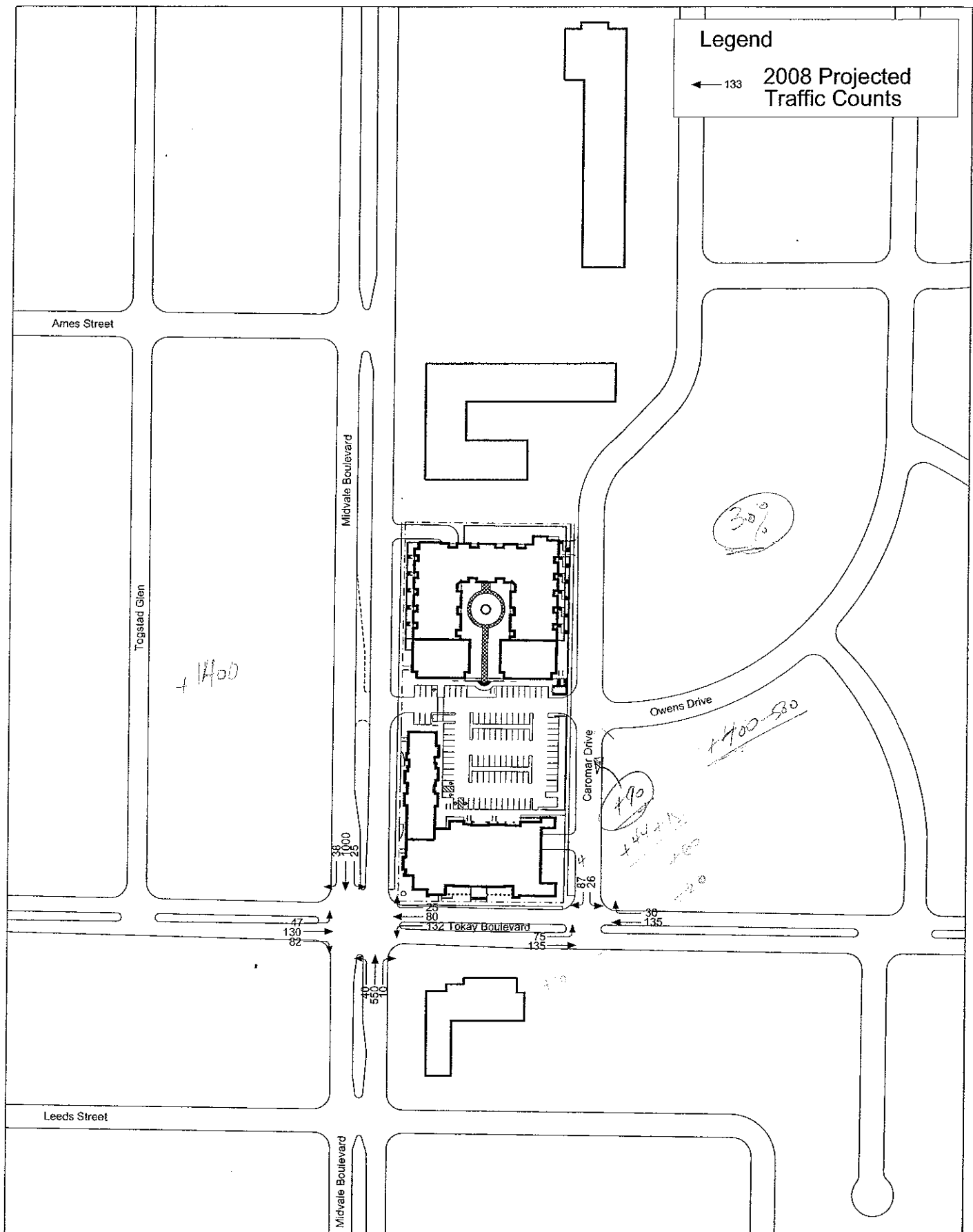
# Midvale Plaza Traffic Impact Study

## Existing Traffic Volumes & Bus Routes

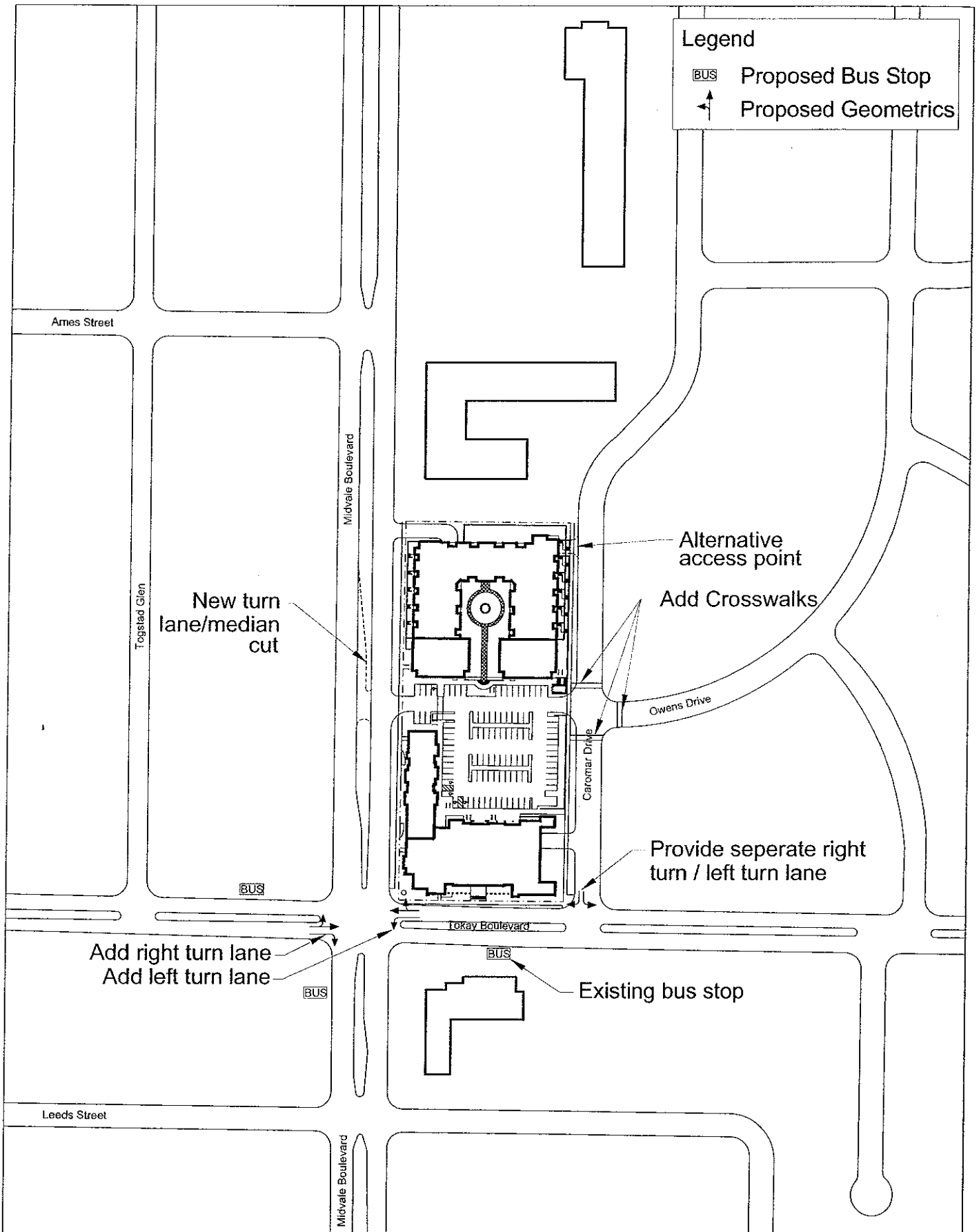












Appendix A  
Trip Generation

**MIDVALE PLAZA  
TRIP GENERATION ASSUMPTIONS**

Land Use	Peak Hour Trip Generation Rate			AM		PM		SATURDAY	
				IN	OUT	IN	OUT	IN	OUT
Mid Rise Apartments 142 Units	Weekday AM .3 trips per DU	Weekday PM .4 trips per DU	Saturday .5 trips per DU	31%	69%	58%	42%	58%	42%
Subtotal	43	57	71	13	30	33	24	41	30
Library 20,000 Square Feet (sf)	Weekday AM .1 trip per 1,000 sf	Weekday PM 7.1 trips per 1,000 sf	Saturday 6.8 trips per 1,000 sf	72%	28%	48%	52%	53%	47%
Subtotal	20	142	136	14	6	68	74	72	64
Specialty Retail 19,000 sf	N/A	PM 2.7 trips per 1,000 sf	Saturday 4.2 trips per 1,000 sf	N/A		44%	56%	50%	50%
Subtotal	0	52	80	0		23	29	40	40
Total Trips Generated	63	251	287	27	36	124	127	153	134
(10%) Linked Trips	-6	-25	-28	-3	-3	-12	-12	-15	-13
(10%) Pass By Trips	-6	-25	-28	-3	-3	-12	-12	-15	-13
Total New Trips	51	201	231	21	30	100	103	123	108
Existing Trips								-79	-70
Net Additional Trips								44	38

## Appendix B

### Level of Service

Level of Service (LOS) is a term that refers to the quality of traffic flow at an intersection and is measured in seconds of delay per vehicle utilizing an intersection during hours of peak volume. The levels range from LOS "A", which represents an excellent flow, to LOS "F", which represents a very poor flow. The levels and corresponding descriptions are listed below:

- LOS "A" – This represents the optimum level of service which can be obtained. Under this condition, intersection approaches appear quite open, turns are easily accomplished, and almost all drivers enjoy freedom of operation. At signalized and unsignalized intersections, drivers experience delays of fewer than 10 seconds on the average.
- LOS "B" – This signifies a generally stable level of service. At signalized intersections, vehicle delays are generally 10-20 seconds on average. At unsignalized intersections, delays of 10-15 seconds on average.
- LOS "C" – This indicates a stable level of service, although backups may occur periodically behind turning vehicles. At signalized intersections, the vehicle delays are between 20-35 seconds on average, and between 15-25 seconds on unsignalized intersections.
- LOS "D" – This designates increasing traffic that is approaching instability. Vehicles may experience more substantial delays for short times during the peak period, but long lines are cleared periodically, which prevents excessive backups. Average vehicle delays at signalized intersections range from 35-55 seconds, and unsignalized intersections experience delays between 25-35 seconds.
- LOS "E" – This indicates the intersection is flowing at capacity. The average vehicle delays are between 55-80 seconds at signalized intersections and 35-50 seconds at unsignalized intersections.
- LOS "F" – This represents conditions where the intersection is over capacity and acceptable gaps for unsignalized intersections in the mainline traffic flow are minimal. Average vehicle delays at signalized intersections exceed 80 seconds and 50 seconds at unsignalized intersections.

Appendix C

2006 Peak Hour Traffic Counts

# Intersection Turning Movement Counts



Project ID: 2176  
 Performed By: JAL  
 Count Date: 5/27/2006

Intersection: Midvale and Tokay Blvd  
 Location: City of Madison  
 County: Dane

Time Begin	Midvale Blvd North Approach				Tokay Blvd East Approach				Midvale Blvd South Approach				Tokay Blvd West Approach				HOUR TOTAL	HOUR TOTAL	
	Left	Through	Right	Peds	Left	Through	Right	Peds	Left	Through	Right	Peds	Left	Through	Right	Peds			
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	504
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	504
4:30 PM	5	245	12	0	28	15	5	0	6	125	2	0	9	32	20	0	0	504	504
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	5	245	12		28	15	5		6	125	2		9	32	20				

# Intersection Turning Movement Counts



Project ID: 2176  
 Performed By: Reed  
 Count Date: 13-Jun-06

Intersection: Tokay Blvd and Caromar Drive  
 Location: Windsor Township  
 County: Dane

Time Begin	Caromar Drive North Approach				Tokay Blvd East Approach				South Approach				Tokay Blvd West Approach				HOUR TOTAL	HOUR TOTAL
	Left	Through	Right	Peds	Left	Through	Right	Peds	Left	Through	Right	Peds	Left	Through	Right	Peds		
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	292
4:15 PM	2	0	14	0	0	25	3	0	0	0	0	0	19	30	0	0	93	397
4:30 PM	7	0	7	0	0	30	2	0	0	0	0	0	23	30	0	0	99	304
4:45 PM	5	0	11	0	0	37	1	0	0	0	0	0	14	32	0	0	100	205
5:00 PM	1	0	11	0	0	41	1	0	0	0	0	0	10	41	0	0	105	105
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	15	0	43	0	0	133	7	0	0	0	0	0	66	133	0	0	9 bikes	11 U turns

Appendix D  
Level of Service Analysis  
2006



HCS+™ DETAILED REPORT												
General Information						Site Information						
Analyst	JAL					Intersection	Midvale Blvd and Tokay Blvd					
Agency or Co.	SAA					Area Type	All other areas					
Date Performed	6/9/2006					Jurisdiction	Madison					
Time Period	4 <sup>00</sup> - 5 <sup>00</sup> PM					Analysis Year	2006					
						Project ID	Midvale Plaza Redevelopment					
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N <sub>i</sub>	0	1	0	0	1	0	1	2	0	1	2	0
Lane Group		LTR			LTR		L	TR		L	TR	
Volume, V (vph)	27	128	80	112	60	20	36	500	6	20	980	36
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, I <sub>1</sub>		2.0			2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green, e		2.0			2.0		2.0	2.0		2.0	2.0	
Arrival Type, AT		3			3		3	3		3	3	
Unit Extension, UE		3.0			3.0		3.0	3.0		3.0	3.0	
Filtering/Metering, I		1.000			1.000		1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q <sub>b</sub>		0.0			0.0		0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	20	0	0	10	0	0	5	0	0	20
Lane Width		12.0			12.0		12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N <sub>m</sub>												
Buses Stopping, N <sub>b</sub>		0			0		0	0		0	0	
Min. Time for Pedestrians, G <sub>p</sub>		3.2			3.2			3.2			3.2	
Phasing	EW Perm	02	03	04	NS Perm	06	07	08				
Timing	G = 30.0	G = 0.0	G = 0.0	G = 0.0	G = 50.0	G = 0.0	G = 0.0	G = 0.0				
	Y = 4.5	Y = 0	Y = 0	Y = 0	Y = 4.5	Y = 0	Y = 0	Y = 0				
Duration of Analysis, T = 1.00							Cycle Length, C = 89.0					
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		239			202		40	557		22	1107	
Lane Group Capacity, c		583			402		198	2032		445	2028	
v/c Ratio, X		0.41			0.50		0.20	0.27		0.05	0.55	
Total Green Ratio, g/C		0.34			0.34		0.56	0.56		0.56	0.56	
Uniform Delay, d <sub>1</sub>		22.7			23.5		9.6	10.1		8.8	12.3	
Progression Factor, PF		1.000			1.000		1.000	1.000		1.000	1.000	
Delay Calibration, k		0.11			0.11		0.11	0.11		0.11	0.15	

Incremental Delay, $d_2$		0.5			1.0		0.5	0.1		0.0	0.3	
Initial Queue Delay, $d_3$		0.0			0.0		0.0	0.0		0.0	0.0	
Control Delay		23.2			24.6		10.1	10.2		8.8	12.6	
Lane Group LOS		C			C		B	B		A	B	
Approach Delay		23.2			24.6		10.2			12.6		
Approach LOS		C			C		B			B		
Intersection Delay		14.2			$X_c = 0.53$		Intersection LOS			B		

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAL			Intersection	Tokay Blvd and Caromar Dr.			
Agency/Co.	SAA			Jurisdiction	City of Madison			
Date Performed	6/13/2006			Analysis Year	2006			
Analysis Time Period	4:00-5:00 P.M.							
Project Description 2176								
East/West Street: Tokay Blvd				North/South Street: Caromar Drive				
Intersection Orientation: East-West				Study Period (hrs): 1.00				
Vehicle Volumes and Adjustments								
Major Street	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	66	133			133	7		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00		
Hourly Flow Rate, HFR (veh/h)	66	133	0	0	133	7		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Raised curb							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration	LT						TR	
Upstream Signal		0			0			
Minor Street	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				15		43		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00		
Hourly Flow Rate, HFR (veh/h)	0	0	0	15	0	43		
Percent Heavy Vehicles	0	0	0	0	0	0		
Percent Grade (%)	0			0				
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT					LR		
v (veh/h)	66						58	
C (m) (veh/h)	1456						821	
v/c	0.05						0.07	
95% queue length	0.14						0.23	
Control Delay (s/veh)	7.6						9.7	
LOS	A					A		

Approach Delay (s/veh)	--	--		9.7
Approach LOS	--	--		A

Copyright © 2005 University of Florida, All Rights Reserved

HCS+™ Version 5.2

Generated: 6/14/2006 8:02 AM

Appendix E  
Level of Service Analysis  
2008

### HCS+™ DETAILED REPORT

General Information	Site Information
Analyst <span style="float: right;">JAL</span>	Intersection <span style="float: right;">Midvale Blvd and Tokay Blvd</span>
Agency or Co.	Area Type <span style="float: right;">All other areas</span>
Date Performed 6/9/2006	Jurisdiction <span style="float: right;">Madison</span>
Time Period <span style="float: right;">4<sup>00</sup> - 5<sup>00</sup> PM</span>	Analysis Year <span style="float: right;">2003</span>
	Project ID <span style="float: right;">Midvale Plaza Redevelopment</span>

Volume and Timing Input													
	EB			WB			NB			SB			
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
Number of Lanes, N <sub>i</sub>	0	1	0	0	1	0	1	2	0	1	2	0	
Lane Group		LTR			LTR		L	TR		L	TR		
Volume, V (vph)	47	130	82	137	80	25	40	550	10	25	1000	38	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l <sub>i</sub>		2.0			2.0		2.0	2.0		2.0	2.0		
Extension of Effective Green, e		2.0			2.0		2.0	2.0		2.0	2.0		
Arrival Type, AT		3			3		3	3		3	3		
Unit Extension, UE		3.0			3.0		3.0	3.0		3.0	3.0		
Filtering/Metering, I		1.000			1.000		1.000	1.000		1.000	1.000		
Initial Unmet Demand, Q <sub>b</sub>		0.0			0.0		0.0	0.0		0.0	0.0		
Ped / Bike / RTOR Volumes	0	0	20	0	0	10	0	0	5	0	0	20	
Lane Width		12.0			12.0		12.0	12.0		12.0	12.0		
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N	
Parking Maneuvers, N <sub>m</sub>													
Buses Stopping, N <sub>b</sub>		0			0		0	0		0	0		
Min. Time for Pedestrians, G <sub>p</sub>		3.2			3.2			3.2			3.2		
Phasing	EW Perm	02	03	04	NS Perm	06	07	08					
Timing	G = 30.0	G = 0.0	G = 0.0	G =	G = 50.0	G = 0.0	G = 0.0	G = 0.0					
	Y = 4.5	Y = 0	Y = 0	Y =	Y = 4.5	Y = 0	Y = 0	Y = 0					
Duration of Analysis, T = 1.00							Cycle Length, C = 89.0						

Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		265			258		44	617		28	1131	
Lane Group Capacity, c		558			384		190	2029		411	2027	
v/c Ratio, X		0.47			0.67		0.23	0.30		0.07	0.56	
Total Green Ratio, g/C		0.34			0.34		0.56	0.56		0.56	0.56	
Uniform Delay, d <sub>1</sub>		23.3			25.3		9.8	10.3		8.9	12.4	
Progression Factor, PF		1.000			1.000		1.000	1.000		1.000	1.000	
Delay Calibration, k		0.11			0.24		0.11	0.11		0.11	0.16	

Incremental Delay, $d_2$	0.6	4.6	0.6	0.1	0.1	0.3
Initial Queue Delay, $d_3$	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay	23.9	29.9	10.5	10.4	9.0	12.8
Lane Group LOS	C	C	B	B	A	B
Approach Delay	23.9	29.9	10.4	12.7		
Approach LOS	C	C	B	B		
Intersection Delay	15.2	$X_c = 0.60$	Intersection LOS	B		

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAL			Intersection	Tokay Blvd and Caromar Dr.			
Agency/Co.	SAA			Jurisdiction	City of Madison			
Date Performed	6/13/2006			Analysis Year	2008			
Analysis Time Period	4:00-5:00 P.M.							
Project Description 2176								
East/West Street: Tokay Blvd				North/South Street: Caromar Drive				
Intersection Orientation: East-West				Study Period (hrs): 1.00				
Vehicle Volumes and Adjustments								
Major Street	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	75	135			135	30		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00		
Hourly Flow Rate, HFR (veh/h)	75	135	0	0	135	30		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Raised curb							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration	LT					TR		
Upstream Signal		0			0			
Minor Street	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				26		87		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00		
Hourly Flow Rate, HFR (veh/h)	0	0	0	26	0	87		
Percent Heavy Vehicles	0	0	0	0	0	0		
Percent Grade (%)		0			0			
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	75						113	
C (m) (veh/h)	1426						811	
v/c	0.05						0.14	
95% queue length	0.17						0.48	
Control Delay (s/veh)	7.7						10.2	
LOS	A						B	



Approach Delay (s/veh)	--	--		10.2
Approach LOS	--	--		B

Appendix F  
Level of Service Analysis  
2008 With Improvements

HCS+™ DETAILED REPORT													
General Information						Site Information							
Analyst JAL Agency or Co. Date Performed 6/9/2006 Time Period 4:00 - 5:00 PM						Intersection Midvale Blvd and Tokay Blvd Area Type All other areas Jurisdiction Madison Analysis Year 2008 Project ID Midvale Plaza Redevelopment with lane improvement							
Volume and Timing Input													
	EB			WB			NB			SB			
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
Number of Lanes, N <sub>i</sub>	0	1	1	1	1	0	1	2	0	1	2	0	
Lane Group		LT	R	L	TR		L	TR		L	TR		
Volume, V (vph)	47	130	82	137	80	25	40	550	10	25	1000	38	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l <sub>i</sub>		2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0		
Extension of Effective Green, e		2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0		
Arrival Type, AT		3	3	3	3		3	3		3	3		
Unit Extension, UE		3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0		
Filtering/Metering, I		1.000	1.000	1.000	1.000		1.000	1.000		1.000	1.000		
Initial Unmet Demand, Q <sub>b</sub>		0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0		
Ped / Bike / RTOR Volumes	0	0	20	0	0	10	0	0	5	0	0	20	
Lane Width		12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0		
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N	
Parking Maneuvers, N <sub>m</sub>													
Buses Stopping, N <sub>b</sub>		0	0	0	0		0	0		0	0		
Min. Time for Pedestrians, G <sub>p</sub>		3.2			3.2			3.2			3.2		
Phasing	EW Perm	02	03	04	NS Perm	06	07	08					
Timing	G = 30.0	G = 0.0	G = 0.0	G =	G = 50.0	G = 0.0	G = 0.0	G = 0.0					
	Y = 3.5	Y = 0	Y = 0	Y =	Y = 3.5	Y = 0	Y = 0	Y = 0					
Duration of Analysis, T = 1.00						Cycle Length, C = 87.0							
Lane Group Capacity, Control Delay, and LOS Determination													
	EB			WB			NB			SB			
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
Adjusted Flow Rate, v		196	69	152	106		44	617		28	1131		
Lane Group Capacity, c		593	557	368	639		194	2076		415	2074		
v/c Ratio, X		0.33	0.12	0.41	0.17		0.23	0.30		0.07	0.55		
Total Green Ratio, g/C		0.34	0.34	0.34	0.34		0.57	0.57		0.57	0.57		
Uniform Delay, d <sub>1</sub>		21.1	19.5	21.8	19.8		9.0	9.5		8.2	11.5		
Progression Factor, PF		1.000	1.000	1.000	1.000		1.000	1.000		1.000	1.000		
		0.11	0.11	0.11	0.11		0.11	0.11		0.11	0.15		

Delay Calibration, k											
Incremental Delay, $d_2$	0.3	0.1	0.8	0.1		0.6	0.1		0.1	0.3	
Initial Queue Delay, $d_3$	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay	21.4	19.6	22.5	19.9		9.6	9.6		8.3	11.8	
Lane Group LOS	C	B	C	B		A	A		A	B	
Approach Delay	20.9		21.5			9.6			11.7		
Approach LOS	C		C			A			B		
Intersection Delay	13.2		$X_c = 0.50$			Intersection LOS			B		

<b>HCS+™ DETAILED REPORT</b>													
<b>General Information</b>						<b>Site Information</b>							
Analyst JAL Agency or Co. City of Madison Date Performed 6/9/2006 Time Period						Intersection Midvale Blvd and Tokay Blvd Area Type All other areas Jurisdiction Madison Analysis Year Project ID Midvale Plaza Redevelopment with Improvements							
<b>Volume and Timing Input</b>													
	EB			WB			NB			SB			
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
Number of Lanes, N <sub>l</sub>	0	1	1	1	1	0	1	2	0	1	2	0	
Lane Group		LT	R	L	TR		L	TR		L	TR		
Volume, V (vph)	47	130	82	137	80	25	40	550	10	25	1000	38	
% Heavy Vehicles, %HV	0	0	0	0	0	0	0	0	0	0	0	0	
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A	
Start-up Lost Time, l <sub>1</sub>		2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0		
Extension of Effective Green, e		2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0		
Arrival Type, AT		3	3	3	3		3	3		3	3		
Unit Extension, UE		3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0		
Filtering/Metering, I		1.000	1.000	1.000	1.000		1.000	1.000		1.000	1.000		
Initial Unmet Demand, Q <sub>b</sub>		0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0		
Ped / Bike / RTOR Volumes	0	0	20	0	0	10	0	0	5	0	0	20	
Lane Width		12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0		
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N	
Parking Maneuvers, N <sub>m</sub>													
Buses Stopping, N <sub>b</sub>		0	0	0	0		0	0		0	0		
Min. Time for Pedestrians, G <sub>p</sub>		3.2			3.2			3.2			3.2		
Phasing	WB Only	EW Perm	03		04		NS Perm	06		07		08	
Timing	G = 10.0	G = 20.0	G = 0.0	G = 0.0	G = 50.0	G = 0.0	G = 0.0	G = 0.0	G = 0.0	G = 0.0	G = 0.0	G = 0.0	
	Y = 4.5	Y = 4.5	Y = 0	Y = 0	Y = 4.5	Y = 0	Y = 0	Y = 0	Y = 0	Y = 0	Y = 0	Y = 0	
Duration of Analysis, T = 1.00								Cycle Length, C = 93.5					
<b>Lane Group Capacity, Control Delay, and LOS Determination</b>													
	EB			WB			NB			SB			
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
Adjusted Flow Rate, v		196	69	152	106		44	617		28	1131		
Lane Group Capacity, c		361	345	393	684		170	1932		382	1929		
v/c Ratio, X		0.54	0.20	0.39	0.15		0.26	0.32		0.07	0.59		
Total Green Ratio, g/C		0.21	0.21	0.37	0.37		0.53	0.53		0.53	0.53		
Uniform Delay, d <sub>1</sub>		32.7	30.2	20.8	19.7		11.7	12.2		10.5	14.7		
Progression Factor, PF		1.000	1.000	1.000	1.000		1.000	1.000		1.000	1.000		
		0.14	0.11	0.11	0.11		0.11	0.11		0.11	0.18		

Delay Calibration, k											
Incremental Delay, $d_2$	1.7	0.3	0.6	0.1		0.8	0.1		0.1	0.5	
Initial Queue Delay, $d_3$	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay	34.4	30.5	21.5	19.9		12.6	12.3		10.6	15.2	
Lane Group LOS	C	C	C	B		B	B		B	B	
Approach Delay	33.4		20.8			12.3			15.1		
Approach LOS	C		C			B			B		
Intersection Delay	17.0		$X_c = 0.60$			Intersection LOS			B		

TWO-WAY STOP CONTROL SUMMARY									
<b>General Information</b>				<b>Site Information</b>					
Analyst	JAL			Intersection	Tokay Blvd and Caromar Dr.				
Agency/Co.	SAA			Jurisdiction	City of Madison				
Date Performed	6/13/2006			Analysis Year	2008 w/ Impr & Alt Access				
Analysis Time Period	4:00-5:00 P.M.								
Project Description 2176									
East/West Street: Tokay Blvd				North/South Street: Caromar Drive					
Intersection Orientation: East-West				Study Period (hrs): 1.00					
<b>Vehicle Volumes and Adjustments</b>									
<b>Major Street</b>		Eastbound			Westbound				
Movement	1	2	3	4	5	6			
	L	T	R	L	T	R			
Volume (veh/h)	101	135			135	32			
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00			
Hourly Flow Rate, HFR (veh/h)	101	135	0	0	135	32			
Percent Heavy Vehicles	0	--	--	0	--	--			
Median Type	Raised curb								
RT Channelized			0			0			
Lanes	0	1	0	0	1	0			
Configuration	LT						TR		
Upstream Signal		0			0				
<b>Minor Street</b>		Northbound			Southbound				
Movement	7	8	9	10	11	12			
	L	T	R	L	T	R			
Volume (veh/h)				22		107			
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00			
Hourly Flow Rate, HFR (veh/h)	0	0	0	22	0	107			
Percent Heavy Vehicles	0	0	0	0	0	0			
Percent Grade (%)	0			0					
Flared Approach		N			N				
Storage		0			0				
RT Channelized			0			0			
Lanes	0	0	0	0	0	0			
Configuration					LR				
<b>Delay, Queue Length, and Level of Service</b>									
Approach	Eastbound	Westbound	Northbound			Southbound			
Movement	1	4	7	8	9	10	11	12	
Lane Configuration	LT						LR		
v (veh/h)	101						129		
C (m) (veh/h)	1423						818		
v/c	0.07						0.16		
95% queue length	0.23						0.56		
Control Delay (s/veh)	7.7						10.2		
LOS	A						B		

Approach Delay (s/veh)	--	--		10.2
Approach LOS	--	--		B

Copyright © 2005 University of Florida, All Rights Reserved

HCS+™ Version 5.2

Generated: 6/14/2006 9:53 AM



TWO-WAY STOP CONTROL SUMMARY								
<b>General Information</b>				<b>Site Information</b>				
Analyst	JAL			Intersection	Tokay Blvd and Caromar Dr.			
Agency/Co.	SAA			Jurisdiction	City of Madison			
Date Performed	6/13/2006			Analysis Year	2008 w/ Impr & Alt Access			
Analysis Time Period	4:00-5:00 P.M.							
Project Description 2176								
East/West Street: Tokay Blvd				North/South Street: Caromar Drive				
Intersection Orientation: East-West				Study Period (hrs): 1.00				
<b>Vehicle Volumes and Adjustments</b>								
<b>Major Street</b>	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	101	135			135	32		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00		
Hourly Flow Rate, HFR (veh/h)	101	135	0	0	135	32		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Raised curb							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration	LT					TR		
Upstream Signal		0			0			
<b>Minor Street</b>	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				22		107		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00		
Hourly Flow Rate, HFR (veh/h)	0	0	0	22	0	107		
Percent Heavy Vehicles	0	0	0	0	0	0		
Percent Grade (%)	0			0				
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	0	0	0	1	0	1		
Configuration				L		R		
<b>Delay, Queue Length, and Level of Service</b>								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT					L		R
v (veh/h)	101					22		107
C (m) (veh/h)	1423					566		901
v/c	0.07					0.04		0.12
95% queue length	0.23					0.12		0.40
Control Delay (s/veh)	7.7					11.6		9.5
LOS	A					B		A

Approach Delay (s/veh)	--	--		9.9
Approach LOS	--	--		A

Copyright © 2005 University of Florida, All Rights Reserved

HCS+™ Version 5.2

Generated: 6/14/2006 9:53 AM