Traffic Engineering Division
David C. Dryer, City Traffic Engineer

215 Martin Luther King, Jr. Boulevard
P.O. Box 2986
Madison, Wisconsin 53701-2986
(Phone) 608 266 4761
(TTY) 608 267 9623
(FAX) 608 267-1158

SUMMARY OF STAFF RECOMMENDATIONS
To PBMVC

December 12, 2005

1. Anderson Road and Hoffman Road: Recommend installation of a traffic signal conditioned on funding and additional area improvements by MATC.
2. Cottage Grove & Thompson: Recommend maintaining current stop sign control.
3. Watts Road & Wal-Mart/Sam's Club East Driveway; Recommend installation of a traffic signal.
4. Raymond & Whitney Way: Recommend maintaining current stop sign control.
5. Marshall, Ridge, & University: Recommend maintaining current stop sign control.

2005 TRAFFIC SIGNAL PRIORITY LIST
SPECIAL STUDIES FOR PBMVC SELECT INTERSECTIONS

Actions completed to date

1. **Anderson Road and Hoffman Road**
   Reviewed data collected in 2004

2. **Cottage Grove & Thompson**
   Collected 24 hour automatic hose counts.

3. **Watts Road & Wal-Mart/Sam's Club East Driveway**
   Reviewed the Traffic Analysis & Design, Inc. report and manual volumes collected for the Watts Road and Wal-Mart/Sam's East Driveway Traffic Impact Study Report.

4. **Raymond & Whitney Way**
   Collected 24 hour automatic hose counts.

5. **Marshall, Ridge, & University**
   Reviewed yearly hose count data collected on University Avenue, and performed field observations of the intersection during the a.m. and p.m. peak periods.

TRAFFIC SIGNAL PRIORITY LIST COMMENTARY

Anderson Road and Hoffman Road

The Anderson-Hoffman intersection is located on Anderson Street approximately 870 feet west of the signalized intersection of Anderson Street and Wright Street, and approximately 6,000 feet east of the signalized intersection of Anderson Street and International Lane. Anderson Street and Hoffman Street form a 3-leg intersection with Anderson Street having the right-of-way and Hoffman Street being stop controlled. Two large Madison Area Technical College parking lots are located in the northeast and northwest corners of this intersection. An industrial park area is located north of these parking lots.

Last year automatic hose and manual turning movement counts were collected. These traffic volumes at the intersection met or exceeded at least four of the eight minimum criteria for traffic signals. The majority (60 to 65 percent during peak traffic hours) of traffic on Hoffman approaching Anderson Street turns left onto eastbound Anderson Street.

Due to both increased commercial development to the north of the intersection not anticipated at the time of last year's TSPL report and interest shown by MATC during recent discussions in making traffic improvements to the area, Traffic Engineering is able to support a new traffic signal at Anderson-Hoffman conditioned that MATC agrees to the following:

- Fully fund improvements to the northeast corner of the Anderson-Hoffman intersection needed for buses to turn onto Hoffman
- Construct a parking lot exit onto Wright Street at a location between Anderson and the pedestrian crosswalk area.
- Provide funding to cover their proportional share of the cost for the new proposed traffic signal at Anderson-Hoffman.

Cottage Grove & Thompson

The Cottage Grove-Thompson intersection is located on Cottage Grove Road approximately 600 feet west of the bridge over Interstate Highway 90. It is approximately 4,400 east of the signalized intersection at Acewood Blvd. and approximately 5,300 west of the signalized intersection at Sprecher Road. The Cottage Grove-Thompson intersection forms a "T" intersection with Cottage Grove having the right-of-way and Thompson Road being stop controlled. A new Police station that is currently under construction will have an entrance on the north side of this intersection. A WisDOT bridge reconstruction project is scheduled for 2006. The entire east leg of the Cottage-Grove and Thompson intersection will be rebuilt as part of this project.

With current traffic volumes, none of the eight minimum criteria for traffic signals are met at the Cottage Grove-Thompson intersection.

The intersection crash rate is low. A total of four crashes have been reported during the past three years.

Staff recommends maintaining the current stop sign control. We will continue to monitor the Cottage Grove-Thompson intersection to assess changing conditions.

Watts Road & Wal-Mart/Sam's Club East Driveway

This driveway is located 1,100 feet to the east of the Gammon Road-Watts Road signalized intersection, and 2,900 feet from High Point-Watts signalized intersection. Another "West" driveway entrance to Wal-Mart/Sam's Club shopping center is located on Watts Road approximately 300 feet west of the "East" driveway. Traffic on Watts Road is heavy throughout weekdays and weekends.

The Minimum Vehicular Volume, Interruption of Continuous Traffic, Four-Hour Vehicular Volume, and Peak Hour minimum criteria for traffic signal installation are met at this intersection. A Traffic Impact Study performed this year by Traffic Analysis & Design, Inc., for a proposed Sam's Gas Station on the shopping center site, also found that these criteria for traffic signal installation are met by existing traffic conditions.

Although the number of crashes at the "East" driveway itself (four in 2004) does not meet the minimum criteria of the Crash Experience warrant, the combined number of crashes at both driveways (15 in 2004) does. Since all of the crashes at these driveways during 2004 involved a collision between a westbound

vehicle on Watts Road with a vehicle exiting from one of the driveways, a signal located at the "East" driveway would benefit both driveways since it would create gaps in the westbound vehicular traffic flow at the "West" driveway.

Staff recommends installation of a traffic signal at Watts Road and Wal-Mart/Sam's Club East Driveway conditioned that 100 percent of the funding for the traffic signal be provided by Wal-Mart/Sam's Club.

Raymond & Whitney Way

Traffic Volumes

- 2005 approach volume per weekday: 11,700 on Whitney Way and 12,350 on Raymond Road
- 2002 approach volume per weekday: 10,100 on Whitney Way and 12,950 on Raymond Road
- 1999 approach volume per weekday: 9,500 on Whitney Way and 11,800 on Raymond Road

Although these volumes meet the minimum numerical criteria for traffic signals, the present four-way stop control has served this intersection well for the past 20 years.

Crash History

- 1.9 per year for the 19 years since the four-way stop was installed in 1985
- 6.8 crashes were reported per year during the 5 years prior to four-way stop control

Experience finds traffic signalization can increase certain crash types, such as rear-end and run-red crashes. Crashes at this intersection may be expected to increase in both number and severity if traffic signals are installed. At the Raymond-McKenna intersection, for example, which was signalized December 7, 2001, approximately 2.4 crashes per year had been reported during the five-year period prior to traffic signals being installed with no year having more than five reported crashes. During the first year following installation of traffic signals, fourteen crashes were reported at this intersection.

Application of Traffic Signal Criteria

These volumes meet the minimum numerical criteria for traffic signals.

Additional Discussion

Computer modeling performed for a 1997 study of this intersection showed:

- Signal control would reduce vehicular delay during the a.m. peak traffic period (7:30 - 8:00 am) and during the p.m .peak traffic period (5:00 - 5:45)
- During the remaining 22+ hours of the day, signal control was expected to result in longer delays.
- Pedestrian delay is also estimated to increase significantly with signal control.

Although a signal would provide pedestrians with a defined crossing period, the large volume of right-turning and left-turning movements which will cross and conflict with the pedestrian movements are factors likely to reduce rather than improve pedestrian safety.

A decision between maintaining the all-way control or installing traffic signals involves, among other things, weighing the importance of responding to requests to have a signalized intersection to reduce delay during peak hours and to remove a "level" of decision making from motorists as to who has the right-of-way and assigning this to the signal controller thereby making it "easier" to navigate the intersection. This needs to be weighed with the importance of maintaining a traffic control that results in fewer and less severe crashes.

Marshall, Ridge, & University

This intersection is located on University Avenue 1,345 feet to the east of the signalized Hill-Shorewood-University intersection and 1,430 feet to the west of the signalized Farley-University Bay-University intersection. University Avenue is a primary arterial serving the region and downtown Madison. It carries about 57,000 vehicles per average weekday. Property to the north of University Avenue is within the Village of Shorewood Hills and south of University Avenue is within the City of Madison. The north leg of the intersection is Marshall Court, a private drive, which serves as an entrance to the University Station shopping plaza. Access to this area is also provided from the signalized intersection at University Bay Drive, via Marshall Court. Access via a pedestrian/bike path to the Shorewood tennis courts and swimming pool is available from Marshall Court. An eastbound bus stop is located just east of Ridge Street and a westbound bus stop is located just east of Marshall Court. The south leg of the intersection is Ridge Street that provides access to a residential neighborhood area. A zebra crosswalk is provided for the east leg crosswalk and a standard marked crosswalk is provided for crossing the west leg. Medians separating the eastbound and westbound lanes provide a narrow refuge area for pedestrians crossing

University Avenue. Two advance pedestrian crossing signs are placed in both the eastbound and westbound approaches to the intersection to alert vehicle operators to pedestrian crossings. Adequate sight distance is available for pedestrians/motorists in spite of the University Avenue curve and hill to the west and bushes in the median east of the intersection. Left-turns from Marshall Court are prohibited during 7-9 a.m. and 4-6 p.m. Sidewalks are provided continuously between the signalized intersections at Farley Street and Hill Street along the south side of University Avenue but not along the north side of University Avenue. A railroad corridor runs parallel to the north side of University Avenue. After completing a thorough review of the intersection, staff findings are:

1. None of the Criteria for signal installation are met. While a signal at this location would provide a reliable means for pedestrians and motorists to cross University Avenue, it would significantly impact and further congest vehicle traffic on University Avenue. As a result, traffic on parallel local residential streets like Kendall, Regent, and Bluff Streets would be expected to increase, as some drivers seek less congested routes.

2. Most pedestrians crossing University Avenue are adults and experience less delay than they would with a signalized intersection. With or without a signal, this intersection will not be appropriate for elementary school-age children to cross without adult assistance.

3. Widening the median island and eliminating outbound U-turns and outbound left-turns will help pedestrians in their crossing.

4. A sidewalk on the north side of University between Marshall Court and University Bay will improve opportunities for pedestrians wishing to reach the Marshall Court area. Such an improvement would be in the jurisdiction of the Village of Shorewood Hills and may require cooperation from the owner of the railroad corridor if highway right of way is not adequate for the sidewalk.

Crash History

A total of 16 crashes were reported during the three-year period 2002-2004. None of the 16 involved pedestrians. Eleven or 69% of the 16 reported crashes were types not considered to be correctable by traffic signals such as crashes involving eastbound/westbound left-turning vehicles with opposing westbound/eastbound through vehicles. During this same three-year period, 28 crashes were reported at the nearby signalized Campus-Farley-University Bay intersection. There haven't been any reported pedestrian crashes since December 1991. The most recent reported crash involving a bicyclist occurred on 6/16/98, with a Ridge Street right-turning motorist failing to yield to a westbound bicyclist in the south-leg crosswalk. Neither of these crashes would likely have been prevented with traffic signal control.

Field Data Collected

Extensive pedestrian and vehicular traffic data was collected in 1998 during the a.m., p.m. and midday traffic peak periods. Bi-annual traffic hose counts on University Avenue between Franklin and Farley shown in the Table-2 indicate that vehicular traffic volumes on University have remained fairly constant, therefore the gap study findings in 1998 remain valid. Spot checks were also conducted during both the a.m. and p.m. peak periods this year to verify that the 1998 pedestrian volumes crossing University as well as vehicle volumes on Marshall and Ridge have also remained steady. The 1998 data collected included manual counts of vehicles and pedestrians, a vehicle delay study of the southbound approach, and a vehicle gap study utilizing video recording equipment. The volume of pedestrians crossing University Avenue were observed to be highest between 4-5 p.m., 9/17/98, at which time 39 pedestrians/bicyclists crossed University at or near the intersection. About 85% of the pedestrians crossing University Avenue used the zebra striped crosswalk.

Table-1

Annual Vehicular Traffic Counts on University Avenue Between Franklin and Farley

Year	1997	1999	2001	2003	2005
Average Workday Traffic Volume (Vehicles per day)	52,100	51,400	55,500	53,000	51,300

Staff observed that pedestrians were using the available gaps to cross without excessive delay even during rush hours. Results of the gap study are summarized in Tables 2 through 5.

Application of Traffic Signal Criteria

None of the minimum threshold criteria for signals are met at this intersection. Recent hose counts and manual observations confirm that current traffic volumes on the Marshall and Ridge approaches appear consistent with past counts, and that the intersection remains at 38% below the minimum threshold for the Minimum Vehicular Volume criteria. The 1998 peak hourly pedestrian volume observed crossing University was 39, which was 79% short of the 190 pedestrians per one hour minimum threshold required by the Minimum Pedestrian Volume criteria.

Table-2
Pedestrian Crossing Observations: 7:30-8:00 am

Lanes Crossed	Average Number of Available Gaps Per Hour Based on Observations Recorded 7:30-8:00 am 8/18/98 For the Following Gap Sizes						Median Gap Size Accepted by Observed Pedestrians (Sec)
	7 sec	8 sec	9 sec	10 sec	11 sec	12 sec	
WB Univ. Lanes	262	214	185	155	137	122	7.65
EB Univ Lanes	96	73	48	34	31	27	8.4

Note: A traffic signal would provide 31 crossing opportunities per hour.

Table-3
Pedestrian Crossing Observations: 11:30 am - 1:30 pm

Lanes Crossed	Average Number of Available Gaps Per Hour Based on Observations Recorded 11:30 am -1:30 pm 8/18/98 For the Following Gap Sizes						Median Gap Size Accepted by Observed Pedestrians (Sec)
	7 sec	8 sec	9 sec	10 sec	11 sec	12 sec	
WB Univ. Lanes	172	136	108	88	72	60	11.2
EB Univ Lanes	161	118	95	76	62	47	8.0

Note: A traffic signal would provide 42 crossing opportunities per hour.

Table-4
Pedestrian Crossing Observations: 4-6 pm

Lanes Crossed	Average Number of Gaps Per Hour Available Based on Observations Recorded 4-6 pm 9/17/98 For the Following Gap Sizes						Median Gap Size Accepted by Observed Pedestrians (Sec)
	7 sec	8 sec	9 sec	10 sec	11 sec	12 sec	
WB Univ. Lanes	74	55	39	31	22	15	7.2
EB Univ Lanes	137	107	84	69	57	50	9.9

Note: A traffic signal would provide 36 crossing opportunities per hour.

Table-5
Effect of Traffic Signal on Delay Time for Pedestrians Crossing University Avenue

Time of Day	Total Pedestrian Delay Time* (Seconds) of pedestrians crossing EB and WB lanes	
	Average Delay of Observed Pedestrians	Average Delay Expected With a Traffic Signal
7:30-8:00 am	25.9	47.9
11:30 am-1:30 pm	28.6	33.1
4:00-6:00 pm	26.9	40.5

*Observed total pedestrian delay time consists of time waiting on curb plus time waiting in median.

Signal Coordination

A signal at Marshall-Ridge would fit poorly within the existing signal system on University Avenue. The eastbound and westbound platoons arrive at the Marshall-Ridge intersection at different points in time during the signal cycles. A time space diagram demonstrating this effect is displayed in Figure-1.

Computer modeling was used to simulate the p.m. peak hour with a traffic signal installed at the Marshall-Ridge intersection. A time-space diagram demonstrating this model is shown on Figure-2. Note from this figure, that while progression is maintained for the heavier outbound traffic flow (approximately 2,900 westbound vehicles per hour), the presence of the new signal at Marshall-Ridge will result in significant delay to inbound drivers (approximately 1,900 eastbound vehicles per hour), causing nearly all inbound traffic to have to stop first at Marshall-Ridge and then stop again at Farley-University Bay. Rear-end collisions are expected to increase due to the increased stops as well as the road curvature on the eastbound approach to Marshall-Ridge, which reduces motorists sight distance to see the expected queue of stopped vehicles east of the Marshall-Ridge intersection. Eastbound traffic approaching both the Ridge and the University Bay intersections will be encouraged to increase speed or race to the light since the green light will end as the front part of a platoon of vehicles arrives. As a result, red light running is expected to be a problem.

The effect a traffic signal at Marshall-Ridge would have on left-turning movements from University is not directly shown on Figures 1 and 2. Gaps which were available in the westbound flow of traffic on Figure-1 for the eastbound to northbound turning motorists would no longer be available for these motorists on Figure-2. Addition of a left-turn arrow phase for this movement would further degrade outbound progression.

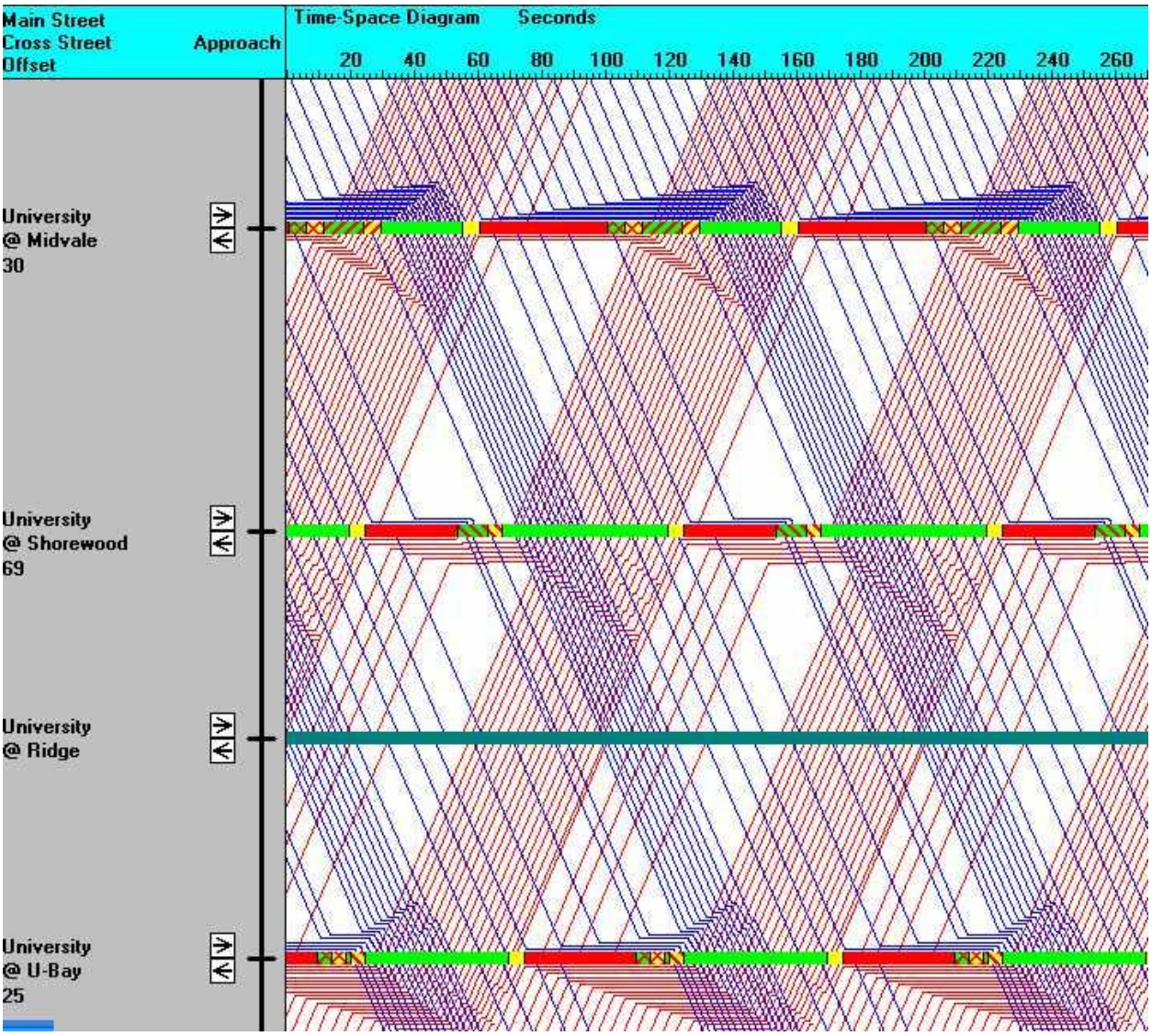

Figure-1: Time-Space Diagram showing existing PM peak traffic progression, i.e. No Signal at Ridge.

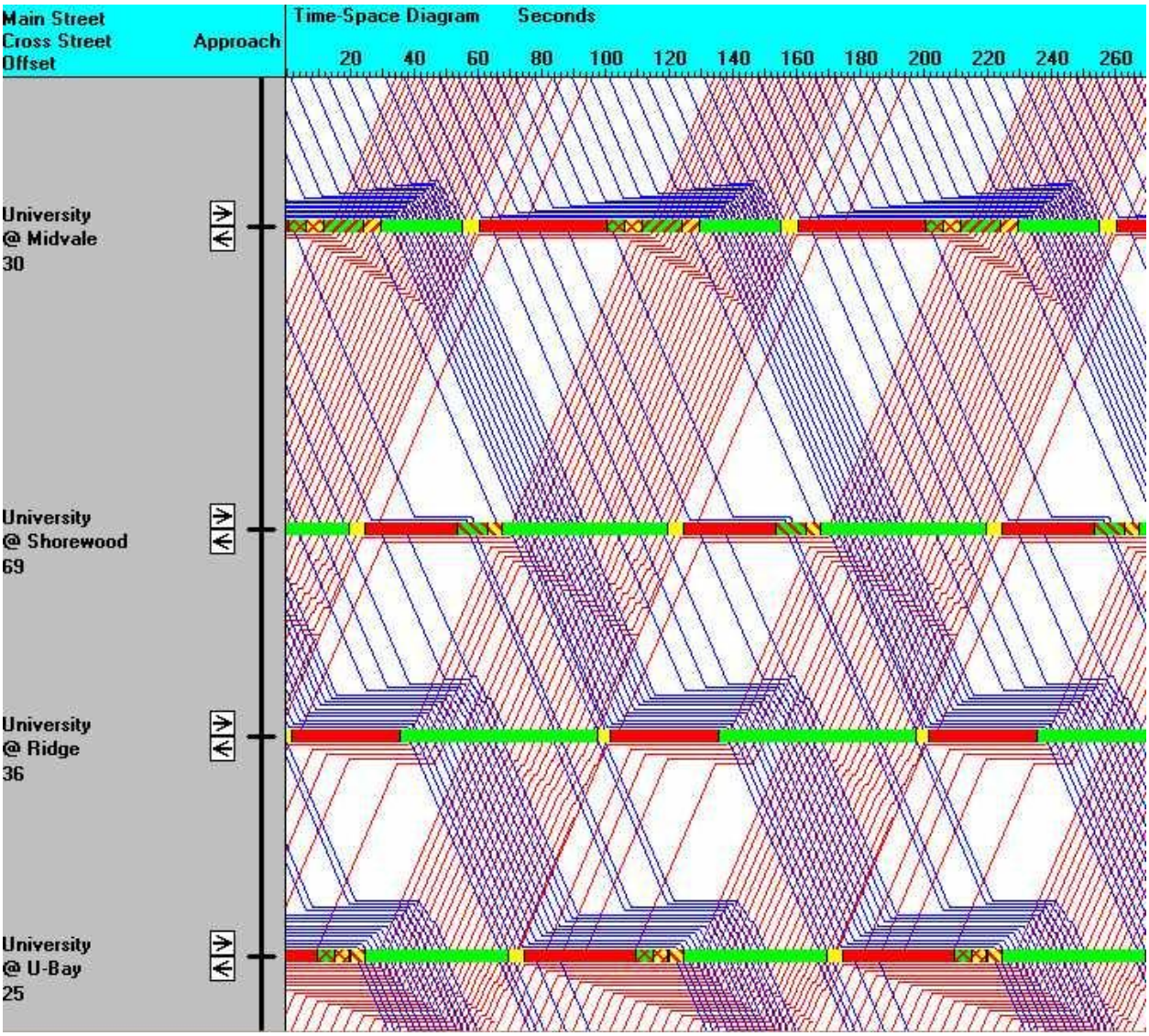

Figure-2: Time-Space Diagram showing PM peak traffic progression with a traffic signal at Ridge

In summary, the effects of placing a traffic signal at the Marshall-Ridge-University intersection are:

1. Provide a defined point in time for pedestrians and motorists to cross University Avenue at the Marshall-Ridge
2. Increased occurrences of rear-end crashes due to increased vehicle stops as well as the as well as the road curvature on the eastbound approach to Marshall-Ridge, which reduces motorists' sight distance to see the expected queue of stopped vehicles east of the Marshall-Ridge intersection.
3. Increased occurrences of run-red crashes, typically angle type crashes which are more likely to involve an injury.
4. Increase vehicular congestion and delay on University Avenue resulting in increased fuel consumption and auto exhaust emissions.

Recommendations
Retain the present two-way stop sign control.

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