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MEMORANDUM

TO: Elgie L. Noble
FROM: Tom Lynch
DATE: March 1, 2000
RE: Monona Grove Traffic Study Supplement

1.01 BACKGROUND

This report is a product of various events and concerns regarding traffic patterns around Monona Grove High School. The following list briefly describes these events.

- In the winter of 1997, Strand Associates prepared a traffic study for the Monona Grove High School expansion that recommended locating the high school's main entrance on Cold Spring Avenue. That report also recommended signalizing the Cold Spring intersection when Monona Drive was reconstructed based on warrants 6 (school) and 11 (peak hour).

- The City of Monona planning commission later made the signalization of Cold Spring a precondition for construction of the high school expansion and stated that the building addition could not be occupied until the signals had been installed. The commission has since allowed occupation of the building addition with the understanding that signals would be installed as soon as possible.

- In the spring/summer of 1999, residents in the neighborhood east of Monona Grove High School petitioned Madison's Board of Public Works to eliminate access from the high school to the neighborhood. School traffic through the neighborhood is their concern. This concern was forwarded by Madison DOT to the school board.

- In the winter of 1999, several high school parents expressed a strong desire to have a signal installed at the Cold Spring intersection to address pedestrian safety at the intersection as well as vehicle safety for left-turning vehicles. These parents' concerns have received much attention from the news media and elected officials.

1.02 TRAFFIC SUPPLEMENT STUDY PURPOSE

This traffic study is a supplement to the previous study prepared in 1997. The study reviews traffic conditions in the surrounding streets after the high school building expansion has been occupied. Specifically, the study:

3.03 MEDIAN REFUGE AREA

This option constructs a median in the center of Monona Drive that can be used as a pedestrian refuge. The option would involve purchasing right of way and construction cost would range from $70,000 to $110,000.

This refuge should make crossing Monona Drive substantially easier. Instead of needing a gap in both directions of Monona Drive traffic, a student would need to only find a gap in one direction of Monona Drive traffic. The pedestrian also would only have to travel half as far before obtaining refuge from traffic.

The median would not make left turns from Cold Spring onto Monona Drive easier unless it was large enough to harbor a vehicle.[5] Obtaining enough right of way on Monona Drive to construct a median this large may prove difficult.

Since the intersection operation would likely be unaffected by the median refuge, traffic diversion would still occur through the neighborhood east of the high school. However, since a signal is not installed, Monona Drive through vehicles would not experience greater delay and the crash rate for the intersection would likely remain unchanged.

3.04 TRAFFIC-CALMING MEASURES FOR LAKEVIEW

Traffic-calming measures are roadway modifications implemented to slow travel speeds through neighborhood streets and/or divert through traffic away from neighborhood streets. Typical traffic-calming measures include speed humps, round-a-bouts, and roadway closures. This report does not go into detail exploring different traffic-calming measures that could be installed but rather states that they are an alternative that could be implemented to control diversion through the neighborhood.

Most traffic-calming measures would have the effect of slowing traffic through the neighborhood, yet they would not remove school-generated traffic from the neighborhood. If no signal is installed at the Cold Spring/Monona Drive intersection, traffic will continue to seek the signalized Dean/Monona Drive intersection. The only measure likely to prevent this would be blocking Lakeview Avenue so that it was no longer a continuos route. Blocking Lakeview Avenue would direct more traffic to the Cold Spring/Monona Drive intersection. This in turn could result in longer queues and delays at the intersection.

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[5] If the median is able to harbor a vehicle, the left-turning maneuver can be performed in two steps. The vehicle would first cross northbound traffic; the vehicle would then merge into southbound traffic.

cars will often switch to the other through lane not knowing there is a pedestrian crossing the roadway. Because of the queuing cars, this vehicle often does not see the student which leads to another hazardous situation. This crossing concern is illustrated in Figure 2.01-1.

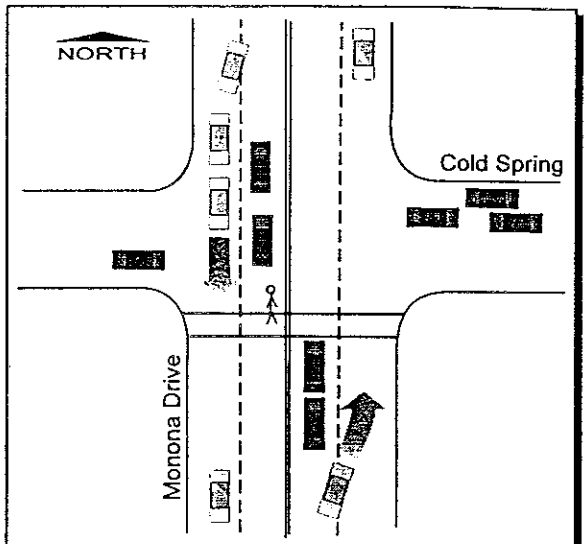

Figure 2.01-1 Pedestrian Crossing Concern

B. Motor Vehicle

Motor vehicle operation is often described in levels of service (LOS). Levels of service range from A, very good operation, to F, very poor operation and correspond to seconds of delay. Most communities use an overall intersection LOS D as their minimum level of acceptable delay, yet specific movements at an intersection often experience poorer operation. Also, most larger communities have intersections that regularly operate at LOS E or below during rush hours.

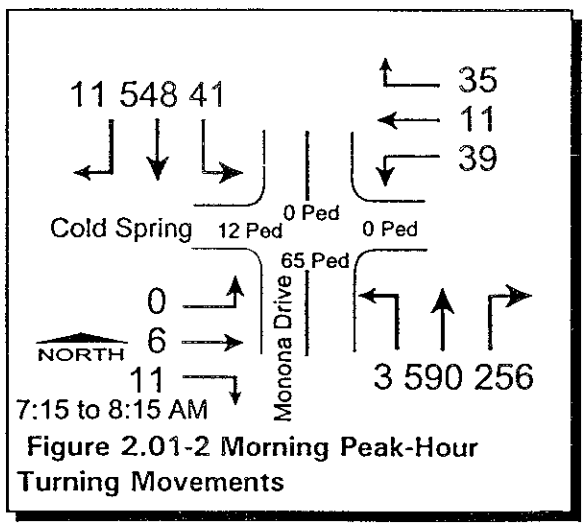

Figure 2.01-2 Morning Peak-Hour Turning Movements

At the Cold Spring/Monona Drive intersection, only yielding movements such as left turns from Cold Spring Road experience any delay and therefore have a level of service. Other movements, such as the Monona Drive through movement, do not have a stop sign or a stop light and therefore do not experience any delay.

Currently making a left turn or crossing Monona Drive from the Cold Spring Avenue east approach is very difficult. According to Highway Capacity Manual Software, this movement operates at LOS F with 53 seconds of delay during the morning peak hour. In the afternoon, when school lets out, this movement operates at LOS F with 58 seconds of delay[2]. According to comments made on a survey of student and parent

[2] HCM software analysis assuming a 2 lane east approach.

drivers queued behind the stopped vehicle would often speed around the stopped vehicle and barely miss the turning vehicle from the parking lot.

3.01 ALTERNATIVES REVIEWED

With the Monona Grove High School expansion, several alternatives have been suggested to remedy the traffic impacts surrounding the school. Three of these suggestions are reviewed by this report. They are:

- Signalizing the Cold Stream Avenue/Monona Drive Intersection.
- Installing a median refuge area on Monona Drive for pedestrians.
- Implementing some type of traffic calming measures along West Lakeside Avenue.

The following paragraphs briefly evaluate these alternatives.

3.02 TRAFFIC SIGNALS

Installing traffic signals at the Cold Spring Avenue/Monona Drive intersection would cost from $80,000 to $110,000. The signals would provide opportunities for pedestrians to cross Monona Drive safely. The signals would also make it easier for vehicles to make a left turn onto Monona Drive from Cold Spring Avenue. Because of this, neighborhood traffic diversion would be greatly reduced. The survey indicates that up to 90 percent of the school-generated traffic that currently travels on the "Lakeview Loop" would instead use the signalized Cold Spring Avenue/Monona Drive intersection.

If a signal were installed, operation on Monona Drive would deteriorate. Where Monona Drive through vehicles now have essentially no delay associated with this intersection, with a signal they would periodically have to stop during the red phase of the signal. Also, the installation of a signal typically increases crash frequencies at intersections, though the severity of crashes often decreases.

Before signals are installed, a warrant analysis is generally performed to determine if the signals are justified. There are up to 15 different warrants justifying a signal, and normally it is desirable to meet multiple warrants before a signal is installed. This study performed a warrant analysis for eight different warrants. Currently the intersection only meets Warrant 6, the school crossing warrant, and falls substantially below the threshold for the other

- Traffic counts taken during the morning rush hour on Friday February 25, when school was not in session, show that the east approach of Cold Spring Avenue had 74 fewer vehicles than the previous day. This represents an 87 percent decrease.

These numbers suggest that the high school generates about 1100 trips per day. Roughly 400 to 500 of these trips are student drivers, with the remainder being parents and faculty. Also, the majority of traffic at the Cold Spring/Monona Drive intersection, during the peak hours, appears to be school generated. Up to 90 percent of the traffic that this intersection experiences during the peak hours could be school-oriented.

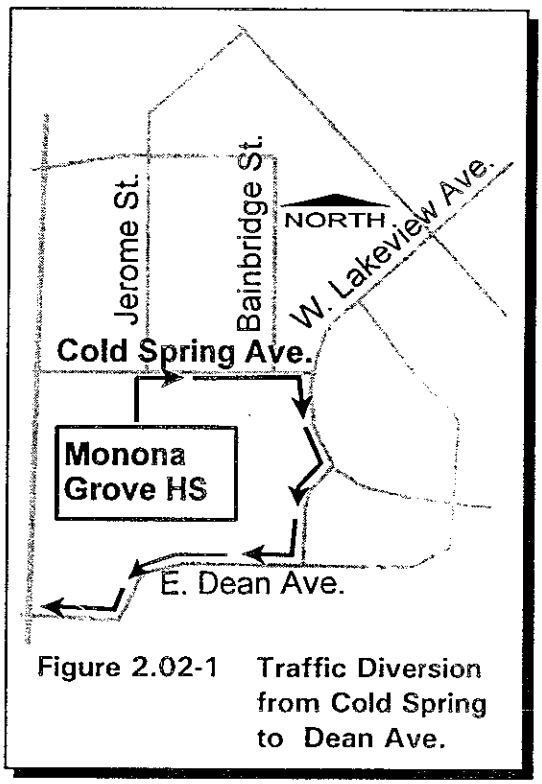

Figure 2.02-1 Traffic Diversion from Cold Spring to Dean Ave.

B. Travel Patterns

Because of the difficulty associated with making a left turn from Cold Spring onto Monona Drive, many parents and students make a loop through the adjacent neighborhood and use the Dean/Monona Drive signalized intersection. This "Lakeview Loop" takes traffic onto West Lakeview Avenue and then onto East Dean Avenue and is illustrated in Figure 2.02-1.

Of the surveys distributed to parents and students, 35 percent of travelers stated that they used this route to gain access onto Monona Drive. An additional 41 percent continue to use the Cold Spring/Monona Drive intersection, with the remainder using other routes. Figure 2.02-2 shows routes used by parents and students who completed this portion of the survey.

The survey results appear to agree with turning-movement volumes collected along neighborhood streets when school was released. These turning-movement counts show that roughly half of the traffic leaving the Monona Grove parking lot travels west toward the Cold Spring/Monona Drive intersection while the remaining half travels east through the neighborhood. This could result in over 90 school-generated vehicles traveling the "Lakeview Loop" during the morning peak hour and over 110 school-generated vehicles during the hour

that school is released. Of these figures, almost none of the "Lakeview Loop" drivers were students during the morning peak hour and about half of the "Lakeview Loop" drivers were students in the afternoon peak hour. Figures 2.02-3 and -4 show turning-movement counts for adjacent driveways and intersections taken during morning rush hour and when school is released.

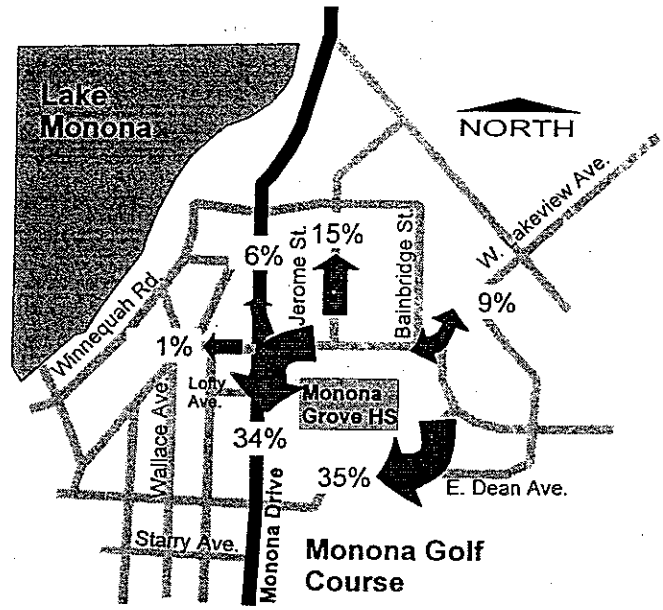

Figure 2.02-2 Traffic Routes Taken by Vehicles Leaving the High School.

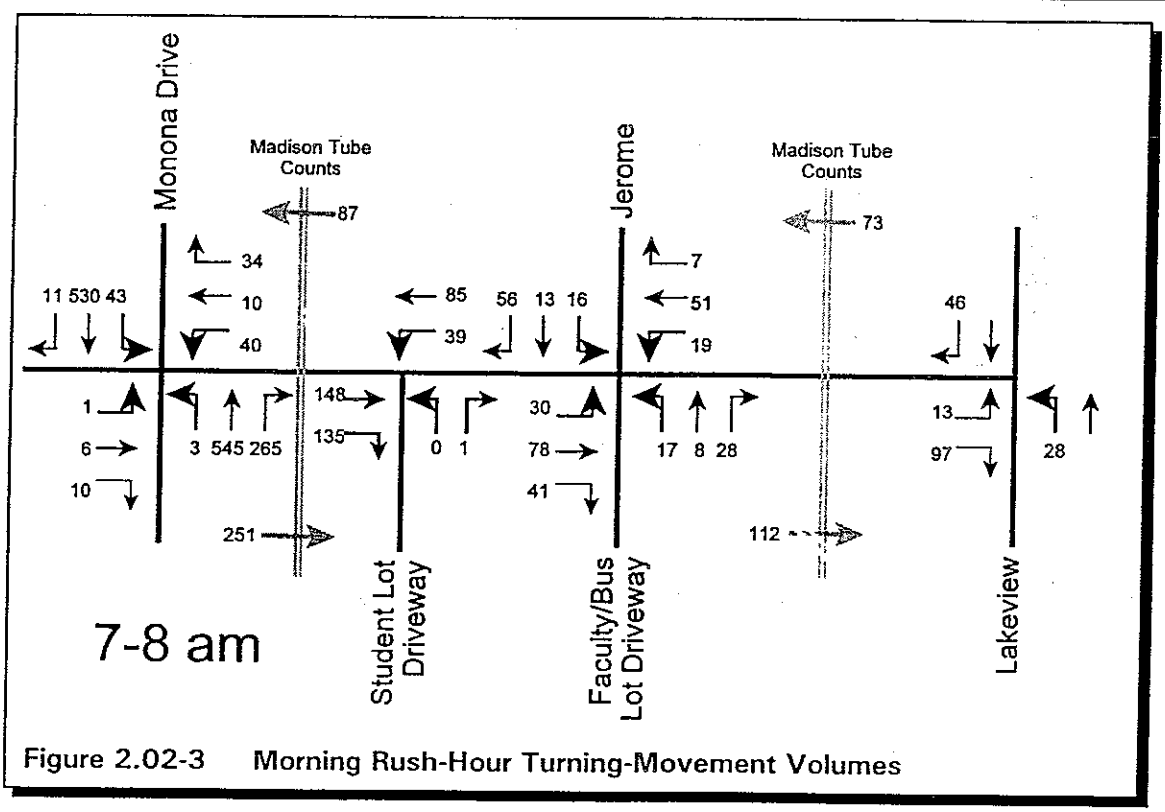

Figure 2.02-3 Morning Rush-Hour Turning-Movement Volumes

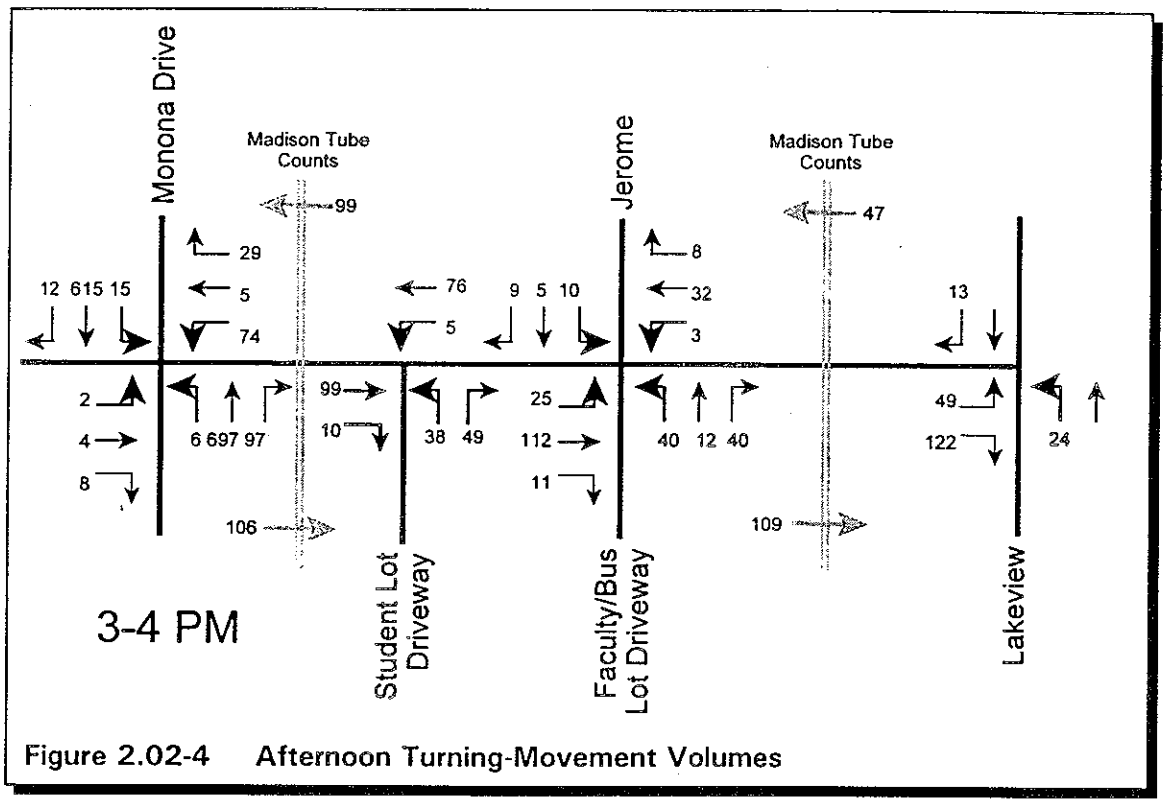

Figure 2.02-4 Afternoon Turning-Movement Volumes

C. Travel Behavior

Concerns raised by neighborhood residents regarding school-generated traffic seem to be founded. Our staff viewed numerous examples of discourteous driving behavior and excessive speeds by student drivers in the neighborhood surrounding the high school. Most of these problems occurred in the afternoon peak hour. Observations include:

- Student drivers often traveled at speeds that appeared to range from 30 to 40 mph on Lakeview. Rapid accelerations were also characteristic of these drivers.

- Student drivers routinely ignored the stop sign on the west approach of the Cold Spring and Lakeview intersection.

- Student drivers often ignored pedestrian crossings, particularly at the Cold Spring/Jerome Street intersection.

- Students exhibited discourteous driving behavior, particularly at the Cold Spring/Jerome Street intersection. At this intersection, Cold Spring vehicles sometimes stop and allow left-turning vehicles into and out of the parking lot entrance. When this occurred, student

drivers of Monona Grove High School[3], many parents prohibit their children from making this maneuver onto Monona Drive. The difficulty associated with this movement contributes to the traffic diversion through the neighborhood east of Monona Grove High School that is discussed in the next section. The morning and evening traffic counts used for this analysis were taken on February 24, 2000, and are shown in figure 2.01-2 and -3.

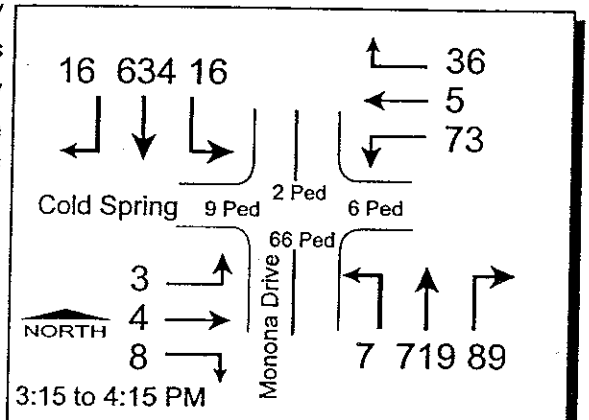

Figure 2.01-3 Afternoon Peak-Hour Turning Movements

2.02 REVIEW OF NEIGHBORHOOD TRAFFIC EFFECTS

A. Quantity of Traffic

It is difficult to determine exactly how many trips the high school generates and how many of these trips are student drivers. There are a few pieces of information, however, that provide a framework for estimation. They include the following.

- According to the ITE trip generation manual, a high school with 800 students would roughly generate about 1,430 trips a day. About 336 of these trips would occur during the morning rush hour, and 240 of these trips would occur when school is released.

- On February 24 when traffic counts were taken, there were 125 cars parked in the student lot, 40 cars parked along Cold Spring east of Monona Drive, 10 cars parked along Jerome, 5 to 10 cars parked along Lakeview, and 10 cars parked along Cold Spring west of Monona Drive. This amounts to about 195 vehicles. Other streets were not surveyed for parked cars.

- About 148 students hold a Monona Grove High School parking permit.

- During the hour that school begins, about 186 vehicles entered the student and faculty parking lots and 54 vehicles exited the parking lots.

- During the hour school was released, about 174 vehicles exited the student and faculty parking lots, while 21 vehicles entered these lots.

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[3] Over 800 surveys were sent to students and parents of students of Monona Grove High School during a two week period in February of 2000. Of these 800 surveys, 104 were returned. Of the 104 returned, 93 to 97 contained useful route information.

warrants.[4] If a signal were installed at this intersection, it would receive diverted traffic from Lakeview Avenue. With this diverted traffic, we project that the intersection would also just meet Warrant 11, the peak-hour volume warrant. While this intersection meets one warrant and could meet one other warrant, this warrant analysis would generally be regarded as providing weak justification for a signal.

Table 3.02-1 shows the warrants evaluated and the margin that the intersection falls short in meeting the warrant.

	Analysis Method		
	W/ Right Turns & 2 Lane Approach	**W/O Right Turns & 1 Lane Approach**	**W/Diverted Traffic**
Warrant 1 Min. Veh. Volume (8hrs) 17 low to 108 high w/right 12 low to 79 high w/o right	No (46-92% Low over 8 hrs)	No (47-92% low over 8 hrs)	
Warrant 2 Interruption of Continuous Traffic	No (Up to 83% Low 7 hrs)	No (Up to 84% low over 7 hrs)	
Warrant 3 Min. Pedestrian Volume	No 65% Low		
Warrant 4 School Crossing	Yes (Using 10 or 15 Second Gap)		
Warrant 6 Accident Experience	No (From Previous Report)		
Warrant 8 80% of combination of Warrants 1&2 over 8 hrs	No 0 hrs met	No 0 hrs met	
Warrant 9 4 Hour Volumes	No (6-67% low over 4 hrs)	No (1-65% low over 4 hrs)	
Warrant 11 Peak Hour Volume	No (46% low)	No (27% low)	Yes (just at)

Table 3.02-1 Signal Warrant Analysis

[4] Note, the previous study stated that the intersection also currently met warrant 11. This however, was based on a single-lane approach with all of the right-turning vehicles included. A more appropriate approach would be to view the east approach as having two lanes or discounting right turns and having it as a single-lane approach.

- Reviews pedestrian needs at the Cold Spring/Monona Drive intersection.
- Performs a signal warrant analysis for the Cold Spring/Monona Drive intersection
- Estimates school traffic through the neighborhoods east of Monona Drive.
- Reviews calming needs in neighborhoods east of Monona Drive.

2.01 REVIEW OF INTERSECTION NEEDS

A. Pedestrian

1. Volumes

According to traffic counts taken February 24, 2000, between 60 and 66 pedestrians per hour cross Monona Drive at Cold Spring during the three peak periods of the day. These crossings are experienced between 7 to 8 A.M., from 11 to 12 A.M., and from 3 to 4 P.M. Less than 10 pedestrians per hour cross Monona Drive during other times of the day. These numbers are very similar to pedestrian counts performed in the fall of 1997.

2. Crossing Method

Most students do not wait for acceptable traffic gaps before they cross Monona Drive. Instead they enter the traffic stream with the assumption that traffic will stop for them. Crossing in this manner probably results from the lack of adequate gaps in the traffic stream for them to cross. One November of 1997 gap study showed that only one to four adequate gaps in traffic occurred in the 15-minute period when school got out. Yet at that time the pedestrian crossing demand was 60 pedestrians.[1] The students, not having adequate gaps to cross, create their own gap by moving into the traffic stream. In most instances, vehicles do stop for the students, yet this crossing pattern has occasionally led to near hits. These near hits are probably what is prompting the current call for a signal.

A second problem occurs as pedestrians cross. Often one lane of the traffic stream on Monona Drive will stop and develop a queue as a pedestrian crosses. To avoid this queue,

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[1] 4 gaps if using a 10 second crossing time, 1 gap if using a 15 second crossing time.

This alternative does not directly address pedestrian crossing at Monona Drive or traffic operation at the Cold Spring/Monona Drive intersection.

3.05 SUMMARY OF ALTERNATIVES

Table 3.05-1 summarizes the three alternatives reviewed and how they address traffic and pedestrian needs surrounding the high school.

Criteria	Signals	Median Refuge	Traffic Calming
Approx Costs	80,000 - 110,000	70,000 - 110,000	5,000 - 25,000
Aids Ped Crossing	Yes	Yes	No
Aids Left Turning Movements	Yes	Probably not	Nc
Addresses Traffic Diversion	Yes	No	Yes
Increases Monona Drive Traffic Delay	Yes	No	No
Increases Intersection Crash Rate	Probably	No	No
Other concerns	Will students obey signal for crossing? If so, their overall delay could increase. Will traffic heed a signal primarily used for school traffic?	Will students look for gaps, or will they continue their current crossing patterns?	Lack of curb and gutter on streets makes some traffic-calming measures difficult to implement.

Table 3.05-1 Alternative Review Summary