

## MEMORANDUM

**DATE:** March 16, 2010  
**TO:** John Lewis, City of Oregon City  
**FROM:** Pamela O'Brien, P. E., PTOE, Peter Coffey, P. E.  
**SUBJECT: Traffic Signal Operations Analysis:  
Beavercreek Road/Meyers Road**

P10016-000

The purpose of this memorandum is to summarize the operational analysis of the traffic signal located at Beavercreek Road and Meyers Road in Oregon City. The memorandum provides documentation of the existing operations of the traffic signal, recommended modifications to the traffic signal operation and general comments on the Oregon High School internal parking lot circulation. Figure 1 shows the project location.

### Key Findings

- The existing traffic signal timing at Beavercreek Road and Meyers Road serves the traffic adequately, given the existing geometry and the short intense traffic peak associated with the school.
- The majority of students access the high school via the school bus, parent drop off or personal auto. Only three pedestrians were counted at the traffic signal during the a.m. peak and school dismissal peak hours.
- The existing parking lot internal circulation does not allow for efficient entering and exiting, which affects the traffic flow on the surrounding streets. A separate study could be conducted to evaluate, in detail, the internal circulation and how it relates to the adjacent public roadways.
- Minor modifications were identified that may provide more efficient flow for entering and exiting vehicles at the driveways.



Figure 1 – Project Location

## Project Background and Existing Traffic Operation

### Data Collection

Intersection turn movement counts were collected on February 4, 2010 during the a.m. peak (6:30 a.m. to 8:30 a.m.), the school dismissal peak (2:00 p.m. to 4:00 p.m.) and the p.m. peak (4:00 p.m. to 6:00 p.m.). Figures 2 and 3 show the peak hour turn movements for the a.m. peak (7:00 a.m. to 8:00 a.m.) and the school dismissal peak (3:00 p.m. to 4:00 p.m.). The p.m. peak volumes are not shown, since the peak does not have a significant amount of school traffic associated with it.

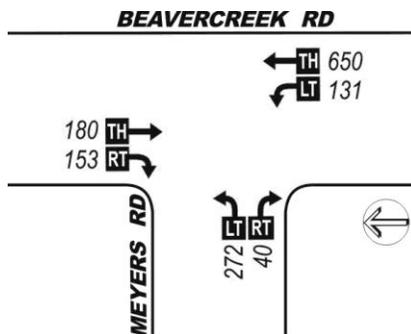


Figure 2 – AM Peak Turn Movement Volumes

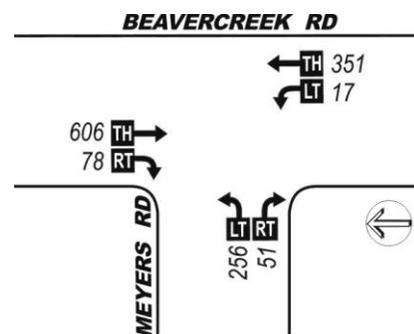


Figure 3 – School Dismissal Turn Movement Volumes

### Field Conditions Observed

Field observations were conducted to provide a complete understanding of the existing traffic signal operations<sup>1</sup>. Oregon City, Clackamas County and Oregon City School District staff also provided input based on past experience, observations, and input from citizens. Key operational issues included the following:

#### General Observations

- School Speed Zone (20 mph – 7AM to 5PM School Days) is posted on Beaver Creek Road and Meyers Road along the school frontage.
- A Right In-Right Out access is located on Beaver Creek Road on the north end of the school property, approximately 1,000 feet north of Meyers Road. All the buses coming from the north must enter the site via this driveway. A majority of passenger vehicles coming from the north also use this driveway. Drivers must make a decision to turn right or left approximately 125 feet after turning into the site. The length of the buses and the number of turns needed to get into the site reduce the speed of entering vehicles, which causes southbound vehicles to back up on Beaver Creek Road during the AM peak arrival period.
- The main full access driveway is located on Meyers Road approximately 400 feet southwest of Beaver Creek Road. Most of the northerly-destined vehicles (buses and

<sup>1</sup> Field observations were undertaken by DKS Associates on February 2 and 18, 2010.

autos) exit here and progress through the traffic signal at the Beaver Creek Road/Meyers Road intersection.

- The parking lot internal circulation is not efficient. Buses must enter the site at the right in-right out driveway in order to access an exclusive pick up and drop off lane in front of the school. Automobiles have a separate drop off/pick up area that runs parallel to the bus pick up/drop off lane. The bus drop off lane leads directly to the exit driveway on Meyers Road, but autos must navigate through the parking aisles in order to exit the site.
- The traffic signal at Beaver Creek Road/Meyers Road operates in “free” mode, meaning it has no fixed cycle length instead, serving the traffic according to demand.

### *AM Peak*

- School starts at 7:55 a.m. (“early bird<sup>2</sup>” period starts at 6:40 am).
- According to the traffic count data, three pedestrians crossed Meyers Road at the traffic signal during the a.m. peak. No students on bicycles were observed during the arrival period.

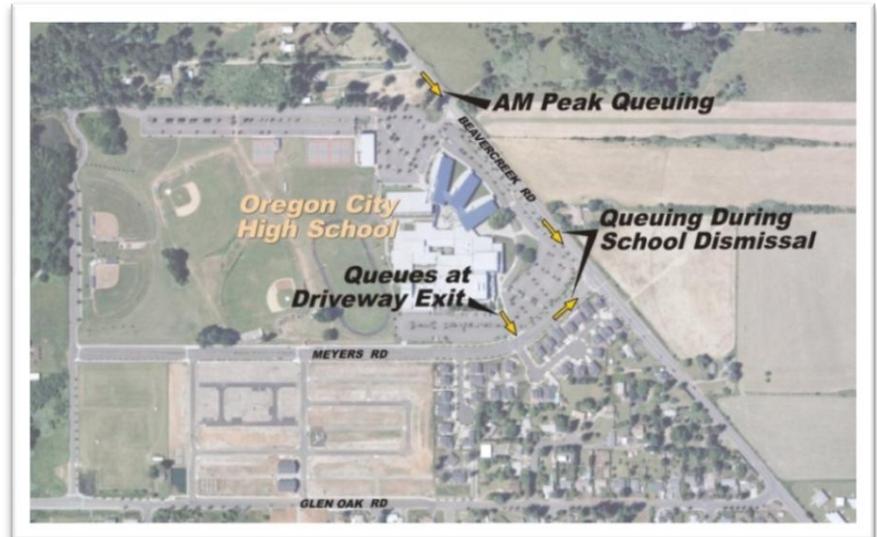


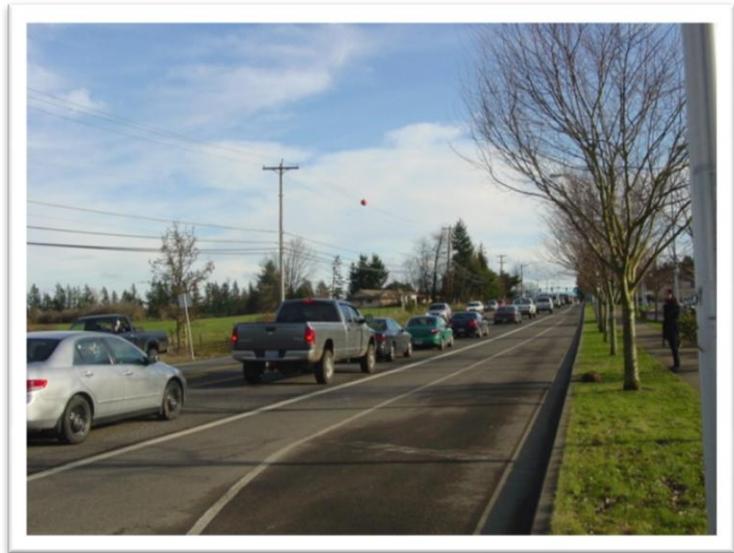
Figure 4 – Queuing Locations

- Southbound traffic on Beaver Creek backed up approximately 600 feet north of the right in-right out driveway, due to the large right turn volume at the driveway.
- Most buses started to arrive between 7:10 a.m. and 7:20 a.m. Students and parents arrived between 7:40 a.m. and 7:55 a.m. Buses and autos were mostly separate during the arrival period.
- All buses and the majority of autos exit the site onto Meyers Road, which causes queuing on site as vehicles wait to exit. The internal parking lot queuing at the driveway started around 7:50 a.m. and was cleared by 7:58 a.m.
- The traffic signal operated adequately given the relatively short traffic peak (between 7:45 a.m. and 8:00 a.m.). Vehicles on Meyers Road waiting for the signal to turn green cleared out within one cycle. Queuing from the traffic signal did not seem to be a problem on Beaver Creek Road. However, vehicles were queued back from the right in-right out driveway, which is located 600 feet north of the traffic signal.

<sup>2</sup> “Early Bird” is an extra period prior to the official First period of school. Buses drop students off for First period, not early bird.

### *School Dismissal Peak*

- School dismisses at 3:00 p.m. (early dismissal on Wednesdays is at 2:00 p.m.).
- Buses started arriving at 2:40 p.m.
- Students exited the building starting at 3:01 p.m.
- According to the traffic count data, three pedestrians crossed Meyers Road at the traffic signal during the peak hour associated with the afternoon school dismissal. No students on bicycles were observed during the school dismissal.
- Cars started to exit the site shortly after school dismissal (3:02 p.m.). The buses started to exit at 3:11 p.m. and were all gone by 3:18 p.m. School staff provided assistance to the buses as they exited the lot by holding cars in parking lot until a majority of the buses had exited.
- As vehicles exited the parking lot, they queued up on Meyers Road between the traffic signal and the driveway. The vehicles queued on Meyers Road between the traffic signal and the school driveway were typically served within one signal cycle. If the side street did not clear, it was because buses were still exiting the parking lot and were slow to get to the signal (they were served during the next signal cycle).
- The traffic signal operated adequately given the relatively short intense traffic peak (between 3:08 p.m. and 3:20 p.m.). It appeared to balance the needs of both roadways.
- Southbound Beaver Creek traffic backed up past the right in-right out driveway on the north end of the property (approximately 1,100 feet) as shown in Figure 5. Southbound traffic progressed as a slow moving queue. The back of the queue did not come to a complete stand still.



**Figure 5 – Eastbound queue on Beaver Creek Road in front of school**

### **Traffic Signal Operational Analysis**

The existing operating condition of the traffic signal was determined for the a.m. peak, the school dismissal peak and the p.m. peak based on the 2000 Highway Capacity Methodology for signalized intersections<sup>3</sup>. Table 1 include the estimated average delay, level of service (LOS), and volume-to capacity (V/C) ratio for the intersection. As shown in the table, the intersection

<sup>3</sup> 2000 Highway Capacity Manual, Transportation Research Board, 2000.

currently operates at LOS C or better. It should be noted that the delay shown in the table does not account for delay experienced by vehicles queued in the parking lot prior to turning onto Meyers Road.

**Table 1 – Existing Peak Hour Intersection Operational Summary**

Time Period	Average Delay (sec)	LOS	Volume/Capacity (V/C)
AM Peak (7:00a.m. – 8:00a.m.)	14.7	B	0.78
School Dismissal (3:00p.m. – 4:00p.m.)	28.3	C	0.90
PM Peak (4:45p.m. – 5:45p.m.)	10.3	B	0.75

*Notes: LOS = Level of Service*

*Delay = Average vehicle delay in the peak hour for entire intersection in seconds.*

The operational analysis uses hourly volumes to determine the operating condition of the traffic signal. The analysis also uses a Peak Hour Factor which adjusts the hourly volume to take into account the busiest 15-minute period during the hour. The adjusted volumes replicate the traffic flow during the peak interval. Since the school arrival and dismissal peaks are relatively short, the peak 15 minutes during the a.m. peak and school dismissal peak operate worse than the remaining 45 minutes of the peak hour. The values in Table 1 represent the hourly average that has been adjusted to reflect the peak. According to the analysis the traffic signal is able to adequately serve the traffic, given the peak traffic volumes and existing geometry.

The traffic signal operates in a “free” mode, which provides green time based on demand. The maximum green time given to Beavercreek Road is 45 seconds and to Meyers Road is 40 seconds. If traffic on Meyers Road is heavy, the traffic signal can provide up to 40 seconds of green. If traffic on Meyers Road is lighter, the traffic signal will “gap out” when the demand diminishes, returning the signal to the Beavercreek Road signal phase.

Based on the field observations, the traffic signal provided 40 seconds of green to Meyers Road during two or three cycles right after school dismissal. The rest of the time, the demand on Meyers Road was not high enough to require the full 40 seconds of green. Several options of adjusting the traffic signal timing were evaluated and it was found that the existing signal timing provides the best balanced operation for the traffic signal.

- Increasing the amount of green time given to Meyers Road would essentially have no impact on the operation, since the side street typically doesn’t use all the green time allotted. Field observation confirmed that the signal gaps out when there is no demand.

The Meyers Road phase of the traffic signal adequately serves the traffic that is queued between Beaver Creek Road and the driveway and some additional traffic that exits the driveway during the green phase of the signal. During the Beaver Creek phase of the signal, traffic exits the driveway and queues up at the signal, which is then served during the next cycle. If additional time were given to Meyers Road (and there was demand), it would result in increasing the delay and queues on Beaver Creek Road.

- Increasing the amount of green time given to Beaver Creek Road may reduce the delay and queues on Beaver Creek, but would increase the delay and queues on Meyers Road (and into the parking lot). Additional green time for Beaver Creek equals additional red time for Meyers Road. The signal would serve the same number of vehicles per cycle on Meyers Road, but additional time for Beaver Creek would increase the time between the green phases on Meyers Road.

The existing signal timing at Beaver Creek Road and Meyers Road balances the needs of both roadways and serves the traffic adequately, given the existing geometry and the short intense traffic peak associated with the school.

### ***Parking Lot Circulation***

The existing parking lot internal circulation does not allow for efficient entering and exiting, which affects the traffic flow on the surrounding streets. A separate study could be conducted to further evaluate the internal circulation in detail. A few minor modifications were identified that may provide more efficient flow for entering and exiting vehicles at the driveways are described below:

- Closing the end of the drive aisle closest to Meyers Road (in the main parking lot) will reduce one conflict point and provide additional storage space for exiting vehicles.
- Modifying the entrance at the right in-right out access driveway to allow more efficient flow into the parking lot may reduce the queuing on Beaver Creek Road. This may include adding an southbound right turn lane on Beaver Creek Road or changing the alignment of the driveway on-site.

A separate parking lot circulation study could include items such as: evaluating the direction that buses arrive and depart the school (which may involve rerouting buses); evaluating the locations where staff, students and visitors park; evaluating alternate exits to the parking lot (possibly use back ring road); and internal drive aisle alignment and parking space locations.