ACTIVITY 41 Determining the Effect of the Minor Street Vehicle Extension Time on Intersection Operations

DISCOVERY

Purpose

The purpose of this activity is to help you to understand how timing parameters on the minor street affect the major street and overall intersection operations.

Learning Objective

- Determine the effect of the minor street vehicle extension setting on the efficiency of major street and intersection operations

Required Resource

- Movie file: A41.wmv

Deliverable

- Prepare a spreadsheet with the following information:

  Tab 1: Title page with activity number and title, authors, and date completed

  Tab 2: Answers to the Critical Thinking Questions and the data that you recorded in Table 20 through Table 24

Critical Thinking Questions

1. How do the eastbound and southbound approach queue lengths vary given the two vehicle extension time values used for the southbound approach?

2. How does an increase in the southbound approach vehicle extension time affect the eastbound green interval duration?

3. How does the increase in the southbound approach vehicle extension time affect the cycle length?

4. What effect does the vehicle extension time have on the delay experienced for these two cases?

Information

In this activity you will observe the operation of both approaches at the intersection of State Highway 8 and Line Street. An aerial view of the intersection is shown in Figure 145. State Highway 8 has a five to six lane cross section, while Line Street has a three lane cross section. In this activity, both approaches have stop bar presence detection with a zone length of 22 feet. The volumes are moderate, with 1400 vehicles per hour on the eastbound approach and 600 vehicles per hour on the southbound approach.

The intent here is to vary the vehicle extension time on phase 4 serving the southbound Line Street (minor street) approach and to observe the effect of each setting on the queuing experienced by motorists on both the major and minor streets. The minimum green time has been set to 5 seconds and will not be varied in this activity.

You will consider two different settings of vehicle extension time: 2 seconds and 5 seconds. Both queue length and green time duration will be considered in evaluating the performance of these alternatives. You will also learn about the relationship of green time duration and cycle length on the delay experienced by motorists at the intersection.

Figure 145. Aerial photo for State Highway 8 and Line Street

The movie (see Figure 146) shows side-by-side windows for the two different cases:

- Left window (case 1): the vehicle extension time for both the southbound approach and eastbound approach is 2 seconds
- Right window (case 2): the vehicle extension time for the southbound approach is set to 5 seconds whereas the vehicle extension time for the eastbound approach remains at 2 seconds

To assess the traffic operations quality in terms of queue length, duration of green time, and cycle length, you need to do the following:

- "Beginning of green" data collection: Once the signal indication for an approach turns green, pause the animation and record the length of the queue and the simulation time the signal indication turns green
- "End of green" data collection: Once the signal indication for the approach turns red, pause the animation and record the simulation time the signal indication turns red

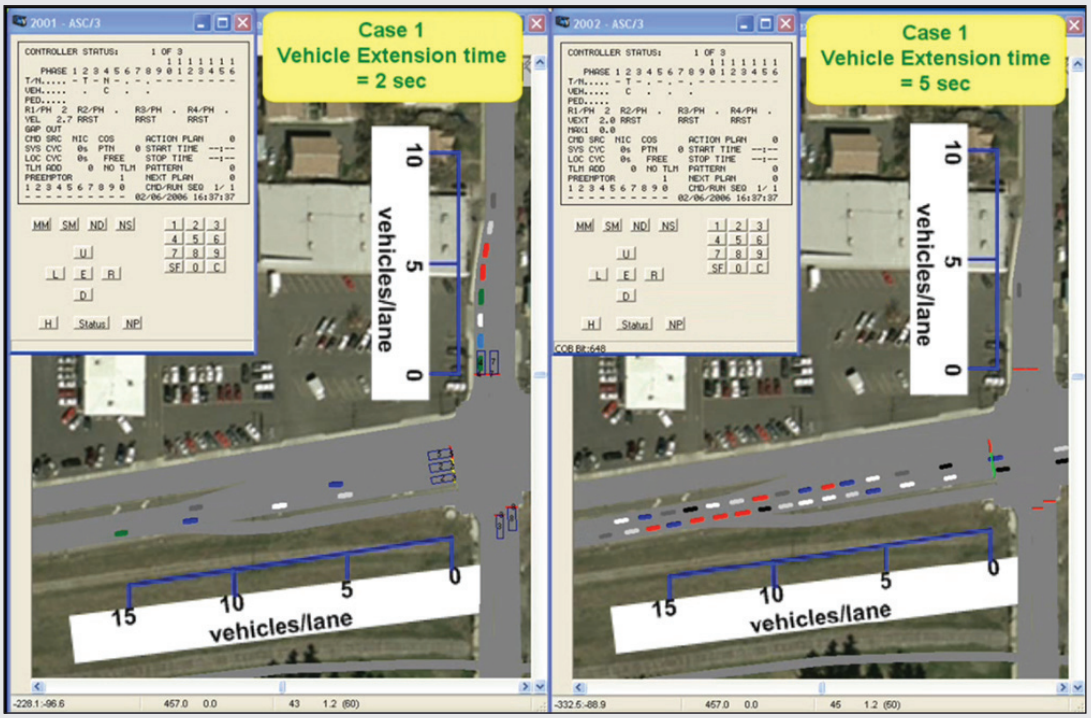

Figure 146. Side-by-side animation window

TASK 1

Open the file: "A41.wmv"

TASK 2

Observe the operation of both approaches at the intersection as well as the signal status data. Note that Case 1 is in the left window and case 2 is in the right window.

- Before starting the movie file, make sure you identify the simulation time clock in both windows (see circles in Figure 147). You will use this clock to record the beginning and ending of green. This animation starts at the simulation time of $t = 446.8$ seconds and ends at $t = 761.4$, a total time of a little more than five minutes.
- Figure 148 shows the side-by-side animation that you will observe. Scales have been provided to show the length of the queues (in vehicles) along the southbound and eastbound intersection approaches. The ASC/3 controller status windows are also shown so that you can follow the timing processes. Finally, notes will pop up periodically to point out things for you to observe. For example, for case 2, the note in Figure 148 shows that cycle 1 is timing, the eastbound green begins at 450.9 seconds, and there are 31 vehicles in the queue.

- Don't collect any data during this first observation. Just watch and observe. Note especially the differences that you see between case 1 (the left window) and case 2 (the right window). Make notes regarding your observations.

Figure 147. Simulation time in animation windows

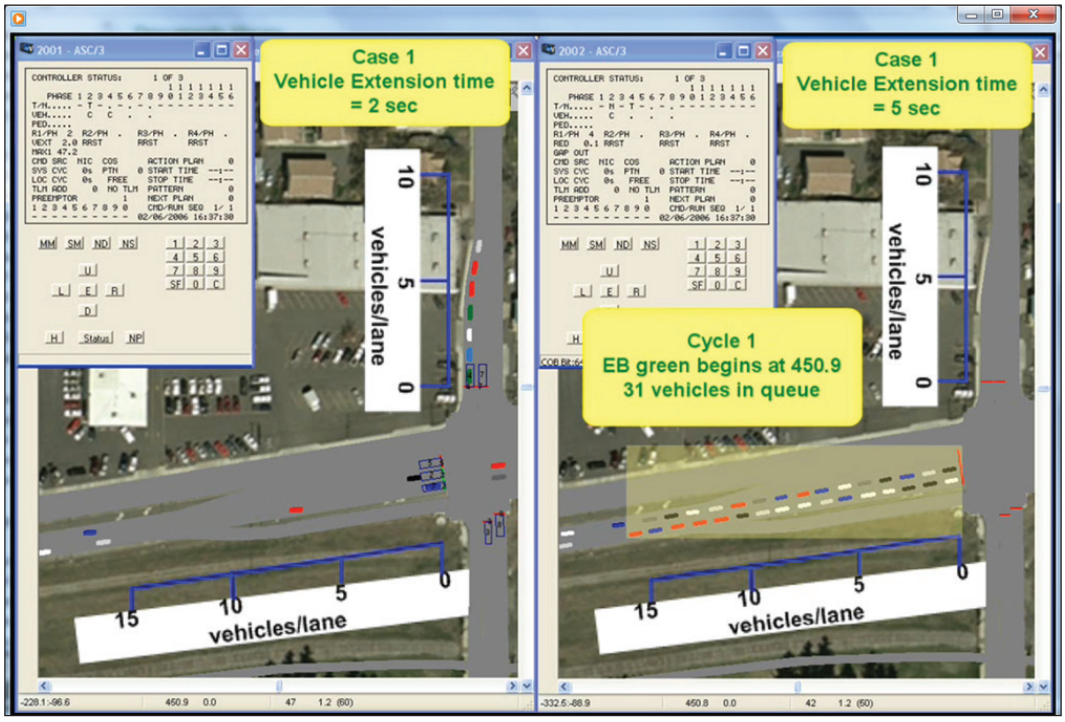

Figure 148. Case 1 and case 2 at t = 450.9

TASK 3

Observe and record the queue lengths and start/end of green intervals.

- Start the animation at the beginning. The VISSIM simulation time clock should read t = 446.8
- Record the queue length at the beginning of green and the simulation times for the beginning and ending of green for case 1 (in Table 20) and case 2 (in Table 21)
- For example, for case 2, the green indication for the eastbound approach turns green at t = 450.9 seconds (see Figure 148). If you pause the animation at this point you will see that there are 31 vehicles in the queue at the beginning of green. These two data points have been recorded for you in Table 3.
- Continue recording the queue length and the start and end of green time for each phase for both cases until the final SB phase ends at t = 752.8 seconds. You have space to record data for five cycles for case 1 and four cycles for case 2.
- Compute the green duration by taking the difference between the Green end and the Green begin times
- Compute mean values for the green duration and queue length and record these values in the last row of each table

Cycle	SB				EB			
	Green start, sec	Green end, sec	Vehicles in queue, start of green	Green duration, sec	Green start, sec	Green end, sec	Vehicles in queue, start of green	Green duration, sec
1								
2								
3								
4								
5								
		Mean →				Mean →		

Table 20. Data collection table for queue and display status for case 1 (SB vehicle extension time of 2.0 seconds) (Left window)

Cycle	SB				EB			
	Green start, sec	Green end, sec	Vehicles in queue, start of green	Green duration, sec	Green start, sec	Green end, sec	Vehicles in queue, start of green	Green duration, sec
1					450.9		31	
2								
3								
4								
5								
		Mean →				Mean →		

Table 21. Data collection table for queue and display status for case 2 (SB vehicle extension time of 5.0 seconds) (Right window)

TASK 4

Summarize your data.

- Copy the "green start" data for the southbound and eastbound approaches from Table 20 and Table 21 into the appropriate cells in Table 22 and Table 23. Compute the length for each cycle, by taking the

difference between the "green start" for each pair of consecutive cycles. Then compute the mean cycle length for each case.

- Based on the data that you recorded in Table 20, Table 21, Table 22, and Table 23, use Table 24 to summarize the average green duration, cycle length, and queue length for cases 1 and 2
- Study the results shown in the tables and prepare a summary of your observations

Cycle	Case 1		Case 2	
	Green start	Cycle length	Green start	Cycle length
1				
2				
3				
4				
5				
	Mean→		Mean→	

Table 22. Data summary, SB approach

Cycle	Case 1		Case 2	
	Green start	Cycle length	Green start	Cycle length
1				
2				
3				
4				
5				
	Mean→		Mean→	

Table 23. Data summary, EB approach

	SB		EB	
	Case 1	**Case 2**	**Case 1**	**Case 2**
Green duration, sec				
Cycle length, sec				
Queue length, vehicles				

Table 24. Mean values for Cases 1 and 2

Student Notes: