Instructor Comments on
CE361 Introduction to Transportation Engineering Project 1
29 October to 19 November 2004

HIGHWAY SAFETY AND SIGNAL TIMING

1. (20 points) **Signal timing form.** Observe the traffic signal at Stadium and Northwestern. Complete a Traffic Signal Timing Form with the same format as FTE Table 8.4. Is the signal pre-timed or actuated? How did you decide this? If the signal is actuated, show the timing for one signal cycle or for an average of the cycles you observed, but make clear which it is.

Although the outline of detector loops could not be seen on the approaches, the signal was actuated, because the phase durations were variable. [What does "heavily actuated" mean?] Common mistakes and oversights: (a) Leaving out possible intervals that may not appear during every cycle, (b) how to show a permitted LT phase after a protected LT phase, (c) phase durations do not add up to the same sum for different approach/movements during the same cycle or set of intervals.

2. **Time Space Diagram.** Collect signal timing data for either South or Columbia Street between 2nd and 9th Streets in downtown Lafayette.

A. (10 points) Summarize your data in the formats shown in FTE Tables 8.5, 8.6, and 8.7. Include the date of your observations. *Some groups did not follow the prescribed Table formats. Are times of day AM or PM? Can an offset be longer than the cycle? Few groups determined the correct Green Offsets for Table 8.6, and no group showed its calculations for green offset, so the reason for the wrong offset values could not be established. Sample calculations with an 80-second cycle:*

Start green 15:34:02 at 6th St. master
Start green 15:12:21 at 3rd St.
Time differ. = 21:41 →→ 21:41/1:20 = 16.xx cycles; 16 cycles * 1:20 = 21:20
- 21:20
0:21 seconds before the master start of green
= (80-21) = 59 seconds after master start of green
= green offset at 3rd St.

B. (10 points) Create a TSD from your data. *Most TSDs were done well. Some groups did not use enough space to clearly show values of distance and time. One group spread its TSD over three pages, making it nearly impossible to fit max and min green wave paths through the TSD.*

C. (10 points) What range of speeds, if any, will enable a driver to travel along the street you chose without ever being stopped by a red light? Show the max and min green wave speed trajectories on your TSD and show your calculations clearly. *A few groups made mistakes by ignoring Figure 8.15. Also, the max green wave speed often begins somewhere other then the start of an upstream green phase. See Point D in Figure 8.14. If the calculated max green wave speed exceeds the speed limit, you must note this. Group results are summarized in Table 2, but note the warning below the table..*

Table 2. Green Wave Speeds

	EB South Street			*WB Columbia Street*	
Group	*Min*	*Max*	*Group*	*Min*	*Max*
L1	*18.13*	*32.02*	*L4*	*28.6*	*42.6*
L2	*17.22*	*1704.55*	*R1*	*14.4*	*∞ (25)*
L3	*8.60*	*52.0 (25)*	*R2*	*20.68*	*414.0*
L5	*14.3*	*409.1 (25)*	*R3*	*16.63*	*26.57 (25)*
L6	*19.4*	*(25)*	*R5*	*20.54*	*44.87*
L7	*17.46*	*369.94 (25)*			
R4	*20.3*	*40.46 (25)*			

Caution: Only Groups L5 and L7 chose correct min and max green wave paths in their TSD, while using correctly-calculated offsets. All other speeds are based on incorrect offsets and/or incorrectly drawn green wave trajectories.

3. (25 points) **Traffic Signal Logic.** Observe the intersection of Northwestern Avenue and Cherry Lane and create a summary of the Traffic Signal Logic shown in the box on FTE page 446. Include the time(s) of your observations. Make your observations at a time when traffic is moderately heavy, not during a peak period or when traffic is very light.

The signal is probably fully-actuated if the phase durations, because the phase durations are variable. Also, the outline of detector loops could be seen on all three street approaches and in the driveway on the intersection's east side. Any reasonable series of steps that you gave for the signal controller's "logic" was accepted. Some groups noted that the EB RT onto Northwestern appeared to have no impact on the signals. This may be because of the loop shown in FTE Figure 8.16(b), which turns off the "call" for green if the vehicle over it completes its right turn on red.

4. (25 points) **Average Stopped Delay.** For each approach (all lanes combined) to the intersection of Stadium and Northwestern during the PM peak period, estimate average stopped delay using the method shown in FTE Figure 8.18. Ten minutes of observations should be sufficient. You are permitted to change the interval between observations of stopped vehicles. If you change the interval from I = 15 seconds, explain why.

Most groups did well. A summary of the average delays, by approach, is given in Table 4 below.

Table 4. Average stopped delay, Northwestern and Stadium

		Average delay (sec), each approach			
Group	Time	NB	SB	EB	WB
L1	Wed. 1900	31.3	28.5	35.8	35.6
L2	Thurs. 1545	35.8	41.3	32.7	39.5
L3	???	46.3	44.0	34.2	53.4
L4	Thurs. 1730	25.8	17.8	27.5	30.8
L5	Mon. 1830	47.2	47.3	57.4	34.1
L6	Thurs. 1400			15.6	
L7	Wed. 1815	18.0	25.1	25.4	43.0
R1	Sat. 1745	39.3	38.6	32.0	40.1
R2	Sat. 1745	39.3	38.6	32.0	40.1
R3	Wed. 1800	35.8	50.5	42.1	52.5
R4	Tues. 1800	21.6	17.0	62.6	27.2
R5	Tues. 1730		45.3		