CE 34500: Transportation Engineering
Homework 4

1. A minor road carrying 75 veh/h on each approach for eight hours of an average day crosses a major road carrying 145 veh/h on each approach for the same eight hours, forming a four-leg intersection. There are an average of two crashes per year that may be corrected by a multiway stop control. Determine whether a multiway stop sign is justifies at this location. If not justified, estimate when do you need the stop sign based on traffic volume? Assume traffic growth rate is 2%.

   - Total vehicular volume entering the intersection from the major approach = 145+145 = 290 veh/h < 300 veh/h. So, volume criteria is not satisfied.
   - Total vehicular volume entering the intersection from the minor approach = 75+75 = 150 veh/h < 200 veh/h. So, volume criteria is not satisfied.
   - 2 crashes per year < 5. Crash criteria is not satisfied.

   So, multiple stop sign is not required.

   Considering traffic growth is 2%: After 1st year, traffic on major road would be = 290*1.02 = 295.8 < 300;
   After 2nd year: 295.8* 1.02 = 301.7 > 300. After 2nd year, multiple stop sign should be installed.

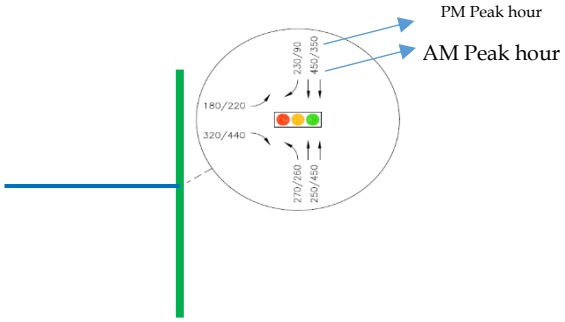
2. The table below shows 15-minute volume counts during the peak hour on an approach of an intersection. Determine the PHF and the design hourly volume of the approach.

Time	Volume
6-6:15 pm	375
6:15-6:30 pm	380
6:30-6:45 pm	412
6:45-7:00 pm	425
7:00-7:15 pm	390
7:15-7:30 pm	350

1. 6 to 7: V= 375+380+412+425 = 1592 veh/hour
2. 6:15 to 7:15 = 1607 veh/hour
3. 6:30 to 7:30 = 1577 veh/hour

$$PHF = \frac{1607}{4 * 425} = 0.945$$

3. Using Webster method, determine a suitable signal timing for the following intersection. Traffic volume are given during AM/PM peak hour. Assume PHF=0.95, Saturation flow for left turn is 1615 veh/hour and through/right 3700 veh/hour. Assume numbers if not given using your engineering judgement.



Signal Timing for AM

Phase	Lane Group	AM Flow	Flow/PHF, q	Saturation Flow, s	q/s	Yi	Green Time
A	Left turn	180	189	1615	0.12	0.12	7.3
	Right Turn	320	337	3700	0.09		
B	Right turn	230	242	3700	0.07	0.13	7.9
	Through	450	474	3700	0.13		
C	Left turn	270	284	1615	0.18	0.18	10.9
	Through	250	263	3700	0.07		
					Total Y =	0.43	26

Optimum cycle time	32.4561	~ 35
Green time	26	

Time lost = 3s/phase

Optimum cycle length $= \frac{1.5*3*3+5}{1-0.43} = 32.4\,s \sim 35s$

Signal Timing for PM

Phase	Lane Group	PM Flow	Flow/PHF, q	Saturation Flow, s	q/s	Yi	Green Time
A	Left turn	220	232	1615	0.14	0.14	8.9
	Right Turn	440	463	3700	0.13		
B	Right turn	90	95	3700	0.03	0.1	6.3
	Through	350	368	3700	0.10		
C	Left turn	260	274	1615	0.17	0.17	10.8
	Through	450	474	3700	0.13		
					Total Y =	0.41	26

Optimum cycle time	31.35	~ 35
Green time	26	