**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.

1. 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

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

1. 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.

PM Peak hour

A AM Peak hour

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 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 =$\frac{1.5\*3\*3+5}{1-0.43}= 32.4 s \~ 35s$

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 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 |  |  |