CVEN 5364 Transportation Engineering and Traffic Analysis

Course Project

**Fall 2023**

This course project is designed for teamwork. The purpose of the project is to design a proper signal control timing plan for an arterial corridor with at least **two intersections**. You are encouraged to consider three intersections.

You are required to apply the knowledge from the section of signal design to this project. You need to download and install a simulation package called PTV VISSIM to run the traffic simulation based on the signal plan designed by you. By running the simulation, VISSIM will report the performance of the signal plan designed. Then based on the reported performance, you are asked to revise your design to improve the performance.

The project should include the following 6 tasks:

**Task 1:** Select the testbed. You are required to select a testbed in Beaumont or surrounding area (Port Arthur, Nederland, etc.). For the selected intersections, the major road should have at least two lanes. An intersection with a left-turn bay is preferred.

* Do NOT select one with only one lane at each approach (i.e., two-lane highway).
* Do NOT select one with more than 3 lanes at one approach.

**Task 2:** Onsite Observation.

**Subtask 2.1**: Use Google Earth to get an aerial view of the testbed. And then go to the testbed you selected, takes some photos of the selected testbed. Also, you will need to measure the width of the intersection for the signal design. You can measure it in Google Earth.

**Subtask 2.2**: At the selected testbed, observer the traffic (see below for the details). Do NOT go during nighttime. Be cautious all the time of onsite observation! **Your safety is the priority**.   
For each approach, records the 5-minute volume of traffic using the following table. You are required to observe twice for each movement at each approach, and then calculate the average.

**Table 1** Onsite Traffic 5-mimute Traffic Volume Observations

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Intersection I | | | |  | Intersection II | | | |
|  | **Volume (#veh/5-min)** | | | |  | **Volume (#veh/5-min)** | | | |
|  | Major Road | | Minor Road | |  | Major Road | | Minor Road | |
|  | EB | WB | NB | SB |  | EB | WB | NB | SB |
| LT |  |  |  |  | LT |  |  |  |  |
|  |  |  |  |  |  |  |  |
| Avg. |  |  |  |  | Avg. |  |  |  |  |
| TR |  |  |  |  | TR |  |  |  |  |
|  |  |  |  |  |  |  |  |
| Avg. |  |  |  |  | Avg. |  |  |  |  |
| RT |  |  |  |  | RT |  |  |  |  |
|  |  |  |  |  |  |  |  |
| Avg. |  |  |  |  | Avg. |  |  |  |  |
|  | Intersection III (Optional) | | | | **Note**: (1) LT – left turn, TR – through, RT – right turn; (2) record 5-minute volume twice for each movement; (3) ignore the difference of vehicles, i.e., simply count all types of vehicles  Also, you are required to have at least two intersections as your testbed. If you add additional one, extra bonus (20%) will be given. To get that bonus, you need to make sure the calculations and the following simulations are correct. | | | | |
|  | **Volume (#veh/5-min)** | | | |
|  | Major Road | | Minor Road | |
|  | EB | WB | NB | SB |
| LT |  |  |  |  |
|  |  |  |  |
| Avg. |  |  |  |  |
| TR |  |  |  |  |
|  |  |  |  |
| Avg. |  |  |  |  |
| RT |  |  |  |  |
|  |  |  |  |
| Avg. |  |  |  |  |

**Subtask 2.3**: Based on the average 5-min volumes calculated from Subtask 2.1, estimate the hourly traffic, and complete Table 2.

**Table 2** Estimated Hourly Traffic Flow Rate based on 5-min Traffic volumes from Onsite Observations

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Intersection I | | | |  | Intersection II | | | |
|  | **Flow Rate (#veh/hr)** | | | |  | **Flow Rate (#veh/hr)** | | | |
|  | Major Road | | Minor Road | |  | Major Road | | Minor Road | |
|  | EB | WB | NB | SB |  | EB | WB | NB | SB |
| LT |  |  |  |  | LT |  |  |  |  |
| TR |  |  |  |  | TR |  |  |  |  |
| RT |  |  |  |  | RT |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Intersection III (Optional) | | | |
|  | **Flow Rate (#veh/hr)** | | | |
|  | Major Road | | Minor Road | |
|  | EB | WB | NB | SB |
| LT |  |  |  |  |
| TR |  |  |  |  |
| RT |  |  |  |  |

**Note**: LT – left turn, TR – through, RT – right turn

Report me the selected testbed, and your observations and estimates (Tables 1 and 2)

After checking your data, **I will send you the traffic saturation flow rates for each direction at each intersection**. You will need to design the signal timing plans based on your estimate flow rates and saturation flow rates.

**Task 3**: Design the signal timing plan for the selected testbed.

**Subtask 3.1**: For each intersection, determine the number of phases. Equivalently, you need to determine *if a left-tern phase is needed for each left turn traffic*.

**Subtask 3.2:** For each intersection, determine the lane group. For example, if a left-turn phase is needed, you need to give a specific left-turn lane. If a left-turn phase is not necessary, then the lane can be used for a mixed flow of through traffic and left-turn traffic.

**Subtask 3.3:** For each intersection, determine the cycle time.

**Subtask 3.4:** For each intersection, determine the green time for each phase.

**Subtask 3.5:** For each intersection, determine the yellow time and all-red time (if necessary). You can use Google Earth to determine the widths of each direction at the selected intersection.

**Subtask 3.6:** Consider the signal coordination between these two intersections, determine the optimal offset.

**Task 4:** Run the simulation in VISSIM based on your design. The demand is based on the hourly flows you estimate. Record the travel delay from the simulation results.

**Task 5:** Based on the performance reported by PTV VISSIM, try to make changes to your original design. Re-run the simulation to see if the performance could be improved. Record the travel delay based on the simulation results on the revised design.

**Task 6:** Prepare a PowerPoint which should include all tasks above. Make a presentation on all tasks you complete. You will also need to rum simulation in the presentation.

**About Presentation Time:**

The project presentation time will be the end of the semester. The time before the end of semester is preferred. However, if you need more time, we can arrange some time in the final week (anyway it should be **no later than 12/4 Monday**). We will discuss later about the details.

**Timeline of Project**

**Task 1 and Task 2**:

Report your testbed (with some initial information such as map, onsite photos, etc.) by **10/23 Monday before the class** by email. Put all information in a Word document (by email). Please remember to copy all group members when emailing me. You may use the class on 10/18 for onsite inspections.

Report me your testbed properties and the collected traffic data in Tables 1 and 2 no later than **10/30 Monday before the class**. Submit a Word document (as an initial report on testbed selection) with the following materials **to Blackboard** (the folder of Course Project) (NOT BY EMAIL):

* The aerial view of the testbed (from Google Earth)
* Onsite photos of the testbed
* Table 1 and Table 2
* Some description sentences, including the description of the testbeds (street names, number of lanes at each approach, design speeds, etc.), the description of onsite observation (when and where, and who).

**Note**: One submission per group. Please do NOT submit multiple identical documents. Please make sure that your report is readable, not just a bunch of pictures and tables. I do not want to guess your meaning. **This initial report accounts for 25% of the total grade of the course project**. Also, **check carefully the submission instruction** posted on Blackboard.

**Task 3**:

Initial design of the signal plan for your testbed should be completed no later than 11/03 Friday 11:59 pm, submitted to Blackboard. **This design report accounts for 35% of the total grade of the course project. Also, check the submission instruction on Blackboard.**

In this report, you should give the detailed calculation of each step, and clearly show your results on your design: Green Time, Red Time, Yellow Time, All-red Time of each phase, and Offset.

**Task 4 - 5**: Show me your simulations (based on the initial design and adjustment, respectively). At least, you should run one simulation at one intersection of your testbed in the class on **11/13 Monday**. **The simulations accounts for 30% of the course project (including how you revise the initial design to reduce the travel delay).**

**Task 6**: Presentation. We will discuss the time of final presentation. In any case, it should not be later than **12/04 Monday**. Each student in one group should present, and also should specify his/her contribution to this project. **This task accounts for 10% of the project**.

During the presentation, you will be asked to run the simulation, and explain why you adjust the design, and how much delay is saved based on your revision.

The students in one group may receive different grades based on his/her contribution, and presentation performance.