

**CE 3500: Group Assignment 2** (30 points)  
Due Friday, March 25

Being impressed with the bus routes you designed, the city of Laramie has hired your engineering firm to try to improve their signals. Most signals use more or less the same timing throughout the day, but delay could be reduced by adjusting the phase pattern and phase lengths by time of day.

So, here are the tasks you must complete:

1. Choose a signalized intersection in Laramie, obtain turning movement volumes for all approaches, for 15 minutes (sometime between 7:30 AM and 7:30 PM if a weekday, or between noon and 8:00 PM if a weekend), and record the current signal phasing pattern, and the length of the green, yellow, and all-red time for each phase.
2. Calculate the current level of service for the signal at the time you observed it.
3. Improve the signal's design by changing the phasing pattern and/or durations of green, yellow, and all-red time.
4. Calculate the predicted level of service for your improved design.

You might need the following information as well:

- Use a design vehicle 20 feet long and with a braking rate of  $11.2 \text{ ft/s}^2$ .
- Assume 1 second of PIJR time.
- In the interest of safety, you can calculate intersection width and lane width from Google Maps or Google Earth, even if the resulting measurements are a little fuzzy.
- When measuring the lengths of green, yellow, and all-red time for current conditions, it is a good idea to take several measurements and average them.
- One possible way to make the measurement of the current conditions is to have one person timing signal phases with a stopwatch, and two others recording the turning movements.

Turn in your answers to the above tasks, along with any supporting documents (spreadsheets can be sent to me via email). Members of the team reducing the delay by the highest absolute amount each receive five bonus points. Second and third place receive three bonus points and two bonus points, respectively. If there is a tie, the winning team is the one whose analysis is most thorough and correct<sup>1</sup>. If there is still a tie, the team presenting their results most professionally will win.

**Please don't go to the city of Laramie telling them that your professor says their signals are poorly timed. It takes more than just fifteen minutes of measurements on one day to properly design a signal.**

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<sup>1</sup>That is to say, you still have a chance at selecting the best alternatives even if you make a calculation mistake somewhere along the way.