ENG H191: Hands on Labs

Lab 2: Spot Speed Study

Engineering Disciplines Explored: Civil

This lab exposes students to disciplines of Civil Engineering, but the topics apply to many majors. The Civil Engineering fundamentals of traffic flow and surveillance are explored in the spot speed study. To interpret the traffic data, students will use statistical analysis which is important to any major. In Electrical Engineering there are classes which examine signals and waves in traffic systems. In automated traffic monitoring systems, engineers design data acquisition systems and GPS-based instrumentation. Also, there exist interdisciplinary programs in Traffic and Transportation Engineering at many schools.

Background

A spot speed study is conducted to determine speeds of vehicles passing a point. It is useful in evaluating:

- Aspects of the geometric design of highways (curvature, grade, super-elevation),
- Application of traffic control devices (sight distance, no passing zones, speed limits, traffic-sign location),
- Accident locations,
- Effectiveness of traffic improvements (additional lanes, lane widening),
- Needed enforcement.

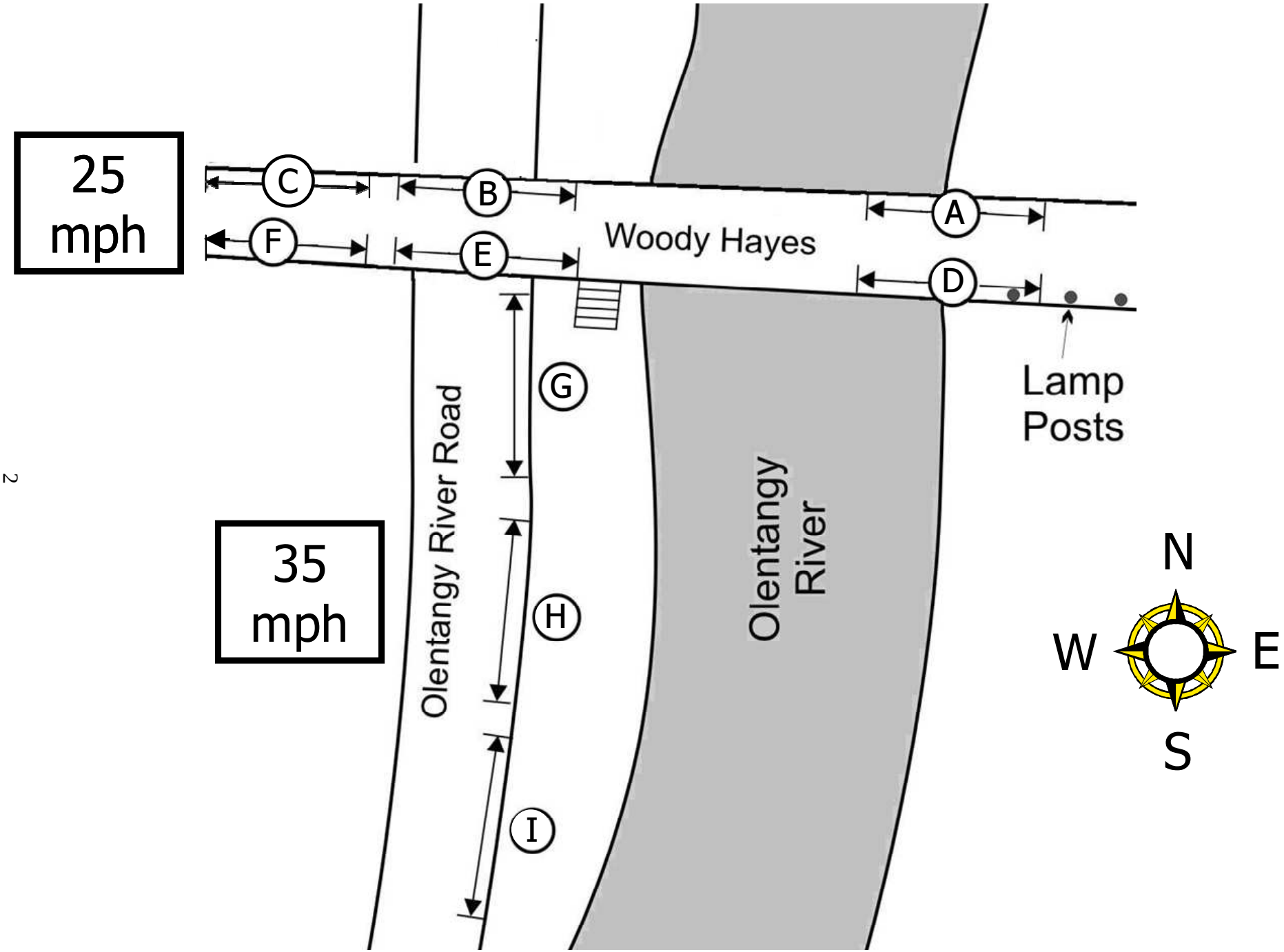
Purpose

The purpose of this lab is to give students experimental experience in how to conduct a spot speed study to model and evaluate traffic flow in a local area.

Lab Experience

In this lab, you will collect and analyze speed data associated with a specific location on Woody Hayes Drive or Olentangy River Road. A stopwatch will be provided in order to time vehicles as they pass through a measured length of road. You will use a simple field sheet like that in Figure 7-5 of the lab handout to record the data. It is important that everyone stay back from the road and remain reasonably inconspicuous to keep from affecting traffic speeds and to decrease the risk of an accident. The speed trap will be 176 feet in length. The locations for the studies and the groups assigned to each location are indicated on the attached map.

Collect your data while standing well back from the road. Do not stand in the road. Safety is a major concern. THINK ABOUT WHAT YOU ARE DOING.


25 mph
C
B
A
F
E
D
Woody Hayes
Lamp Posts
G
Olentangy River Road
Olentangy River
35 mph
H
I
N
W
E
S

Due: beginning of next lab period

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Post-Lab Worksheet

Instructions:

- Answer the questions in each section. Use complete sentences unless specified otherwise.
- Everything you submit should be typed unless specified otherwise.
- **Treat this assignment as if you have performed an experiment and you are reporting your results from an experiment.**
- All answers should be written in third-person past tense.
- E-mail your GTA if you have questions.
- Include a title page as described on page 19 of the FEH Guide to Lab Reports and Memos (http://feh.osu.edu/Labs/labs.html)

Section 1: Introduction and Experimental Setup

1. Why did you perform this experiment?
2. Describe how the experiment was setup and performed. You should provide enough detail so that another group could exactly reproduce the experiment.
3. List information specific to the experiment when you performed it. Include: date, time, weather, road conditions, location, and the names of the persons who performed the experiment including their jobs during the experiment.

Section 2: Results

4. Create a data table in MS Excel or equivalent spreadsheet software that includes your experimental data and the results of the calculations as shown in the example data table below. Your data table should look very similar to the table below except with more rows and numbers filled into the blank cells. Include an appropriate table caption using the formatting described on pages 21 and 22 of the FEH Guide to Lab Reports and Memos.

Table 1: Pick a Descriptive Title and Put It Here

Speed Group		Middle Speed (mph)	Number of Vehicles in Group	Vehicles in Group (%)	Cumulative Vehicles (%)
Lower Limit (mph)	Upper Limit (mph)				

5. Using your experimental data, create a figure like Figure 7-6 on page 161 of Analysis Writeup (http://feh.osu.edu/Labs/spotspeeds/traffic%20book.pdf). You must draw this plot by hand. Do not use MS Excel or equivalent software to make this plot. Include an appropriate figure caption using the formatting described on pages 20 and 21 of the FEH Guide to Lab Reports and Memos.
   Note the following:
   - The top curve is the frequency distribution and the bottom curve is the cumulative frequency distribution.
   - The scale of the abscissa should be the same for both curves and they should be oriented and aligned one on top of the other as shown in Figure 7-6.
   - The lines DO NOT have to go through every point. The curve should be smooth and should be as close to the points as possible. Do not just connect-the-dots.
   - Make sure to label all axes with names and units.

6. Use the figure you created in step 5 to graphically determine the 6 values below. Include dashed lines and label the values on the figure you created in step 5 as shown in Figure 7-6. Include the equation(s) or a description of the method you used to determine each value and a sample calculation if appropriate.
   - Mode (mph)
   - 50^{th} percentile speed (mph)
   - 10 mph Pace (x to y mph)
   - Percent of vehicles in Pace (%)
   - 15^{th} percentile speed (mph)
   - 85^{th} percentile speed (mph)

7. Using your data, calculate the following values. Include the equation you used to determine each value and a sample calculation for each value.
   - Average speed (mph)
   - Estimated standard deviation (mph)
   - Calculated standard deviation (mph)

8. Make a table of the 9 values that you determined in steps 6 and 7. Make sure to include units. Label the table "Table 2" and include an appropriate table caption using the formatting described on pages 21 and 22 of the FEH Guide to Lab Reports and Memos.

Section 3: Discussion

9. Define "central tendency" in relation to this experiment. Why does your data exhibit central tendency?

10. Define and discuss "dispersion" in relation to this experiment. Include the terms "standard deviation" and "percent of vehicles in pace" in this discussion. Make sure to answer:
    - What caused the dispersion in your data?
    - How would you expect the dispersion of the following datasets to be different:
        1. Race cars at the Indy 500 in normal green flag conditions.
        2. Vehicles traveling on High Street on Saturday evening in the spring. Assume moderate pedestrian traffic, many stop lights and no rain.

11. Identify and discuss at least three different accuracy problems associated with this experiment. Describe how each of the problems affected your data.

Section 4: Conclusions

12. First, describe the changes to the experiment that could be made to reduce the three inaccuracy problems that you identified in step 11. Second, imagine you have $200 to purchase equipment to improve the experiment your group performed. What would you purchase and how would you use the new equipment to improve the experiment?

13. Write a short summary of your data then based on that data make a conclusion. Note, the summary of the data is not a conclusion.