ACTIVITY

10 Using High Resolution Field Data to Visualize Traffic Flow

DISCOVERY

Purpose

The purpose of this activity is to give you the opportunity to see how queuing system models relate to high resolution field data.

Learning Objectives

- Connect your observation of traffic flow at a signalized intersection with a model framework
- Represent and interpret queuing diagrams for a range of traffic flow and control conditions

Required Resource

- Spreadsheet file: A10.xlsx

Deliverables

- Prepare an Excel worksheet that includes the following information:

  Tab 1: Title page with activity number and title, authors, and date completed

  Tab 2: Original data

  Tab 3: Time-space diagram plot with answers to questions from Task 2

  Tab 4: Cumulative vehicle diagram plot

  Tab 5: Uniform delay calculation

  Tab 6: Summary and answers to Critical Thinking Questions

Critical Thinking Questions

1. Consider the two estimates of delay from Tasks 4 and 5. Why are they different? How would you refine your calculation method from Task 4 to reduce this difference in the two delay estimates?

2. Compare the cumulative vehicle diagram that you prepared in Task 3 with the one that you sketched in Task 1 of Activity #9. Describe and explain any differences in these two diagrams.

INFORMATION

While the models that we considered in the reading (Activity #8) provide an excellent framework for understanding traffic flow at a signalized intersection, they lack an important ingredient that we observe in the real world. The models are deterministic and the real world is stochastic. In this activity we consider a very high resolution data set that was collected in Los Angeles that will allow us to consider the messiness, or stochasticity, that is ever present in the real world.

In 2006, the Federal Highway Administration published the results of a study of traffic flow characteristics along a four-block section of Lankershim Blvd. in Los Angeles. The study was based on very high quality video that was taken from a 30-story building located adjacent to Lankershim Blvd. Video image processing software extracted data on position, velocity, and acceleration for vehicles traveling along the arterial for a 30 minute period at time intervals of 0.1 second. This is by far the most detailed study of vehicle trajectories ever compiled.

Figure 46 shows an aerial view of one of the four signalized intersections included in this study. It is the intersection of Lankershim Blvd., Campo de Cahuenga Way and Universal Hollywood Drive, located near Universal Studios. Figure 47 shows the entire arterial. You took a video tour of this arterial using the file a03.wmv (See Activity #3 in Chapter 1).

Figure 46. Aerial view of Lankershim Blvd. intersection

Figure 47. Lankershim Blvd. study area

You are given field data for one lane of a signalized intersection in the Excel spreadsheet. The data in the “field data tab” give the location of eight vehicles over a period of three minutes at one foot resolution, and the time that each vehicle passes each one foot point. The data in the “arrival-departure data” tab includes the arrival time at a given point and the departure time from a given point.

TASK 1

Using the field data, prepare a time-space plot for the eight vehicles, placing distance on the y-axis and time on the x-axis. Note that the location of the stop bar for the subject intersection is at a distance of $y = 346$ feet. The stop bar should be shown on your plot.

TASK 2

Change the chart settings to show the range $y = 200$ feet to 400 feet and $x = 20$ seconds to 120 seconds. Answer the following questions:

1. Is there movement in the queue while the vehicles are supposedly stopped?

2. Which vehicles are directly affected by the red display?

3. Which vehicles are affected only by the behavior of their leading vehicles?

4. Which vehicles are not affected by either the red display or their leading vehicles?

5. How far upstream does the queue extend?

TASK 3

Review the data on the "arrival-departure tab." Using the maximum extent of the queue upstream from the stop bar as the system entry point to your queuing system, prepare a cumulative vehicle diagram showing the arrival time into the system and the departure time from the system.

TASK 4

Using the cumulative vehicle diagram that you prepared in Task 3, show on the diagram the time that each vehicle is in the system (delay time). Compute the average delay (average time in system) per vehicle. Remember that this delay does not consider free flow travel time.

TASK 5

Using the uniform delay equation from Activity #8, compute the average delay per vehicle for this system. For the uniform delay calculation, make the following assumptions: $C = 102$ seconds, $g = 35$ seconds, and $s = 1681$ vehicles per hour of green. Use your diagram to determine any other data needed for this calculation.

Student Notes: