

Unit 0.5: People Flux: A Preliminary Exercise

Introduction

In the next few weeks, you will be learning to measure how things flow. First, you will learn to measure the flow of water through tubes, and then you will extend these concepts to measuring the flow of electrons through wires, which is commonly called electric current. To help bridge between your first semester of physics, which was largely concerned with the motion of individual (or at least a countable number of) objects to the consideration of a continuum as we generally conceptualize fluids or electric currents, we will follow the workshop physics spirit of dealing first with very concrete and familiar objects. To be specific, you will measure the flow of people in and out of the building.

The notion is the following: how does the rate of people flow in and out of the science building behave as a function of time? Clearly the most activity occurs around the ten minutes between classes. But exactly when is the rate of people motion highest? What would you predict? How could you go about testing your hypothesis?

Guidebook Entry 0.1: Making a Model and Designing a Test

First, make a guess of what the rate of people flow might look like as a function of time from 8:45 am until 9:05 am. Describe this both in words and as a graph.

How might this depend on the direction (in or out of the building) that people are going? How would it be different if you measured an hour earlier?

How would you make use of your measurement at the doors if you wanted to know how crowded the halls were likely to be at any time? How would you use your measurement if you wanted to know the net change in the number of people in the building? Explain what data you need and how you would analyze it carefully in words, and then talk your method over with your instructor.

Now design and describe below a measurement method that you will use with your group to measure the people flow through one of the doors of the science building. You may use one of the stopwatches if you wish. Make sure to consider the question of time intervals over which you will be counting people (which is better, longer or shorter; or is there an optimal time interval?).

Now you will actually put your method to use. Each group should take one entrance, and use their method to measure the people flow.

Guidebook Entry 0.2: Measuring people flow.

With the instructor's help divide up the building entrances, and measure the people flow rate at the critical 20 minutes. Make sure to take data that will tell both the activity (i.e. number of people passing through the doors at any time), and the net flow (i.e. rate of increase or decrease in the number of people in the building). Put your data in a table, and then graph that data using Excel. Sketch your resulting graph.

Table:

Graph

Now that you've actually made this measurement, it is time to combine your data with the rest of the class, and find out the busiest time, and the net effect on the building population.

Guidebook Entry 0.3: Combining and comparing data.

First, discuss with the other groups your methods of data taking. Are the data compatible? Are there things you would do differently if you had to do this over?

When is the busiest time? How does that compare with your prediction?

What is the net effect on the population of the building over these twenty minutes? How is this net effect related to any of the graphs that you developed?