

ESD.86

# Pedestrian Crossing Problem

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# Learning Objectives

- ◆ Problem Framing, Formulation and Solution
- ◆ Review of conditional probability
- ◆ Review of Poisson Processes
- ◆ Introduction to Random Incidence
- ◆ Reference: *Urban Operations Research*, Chapter 2, Sec. 2.14

[http://web.mit.edu/urban\\_or\\_book/www/book/chapter2/2.14.html](http://web.mit.edu/urban_or_book/www/book/chapter2/2.14.html)

# Problem Framing, Formulation and Solution

# *Frame:*

**"To shape, fashion or form"**

**"To put together the parts of"**

**"To enclose in a border"**

*New World Dictionary*

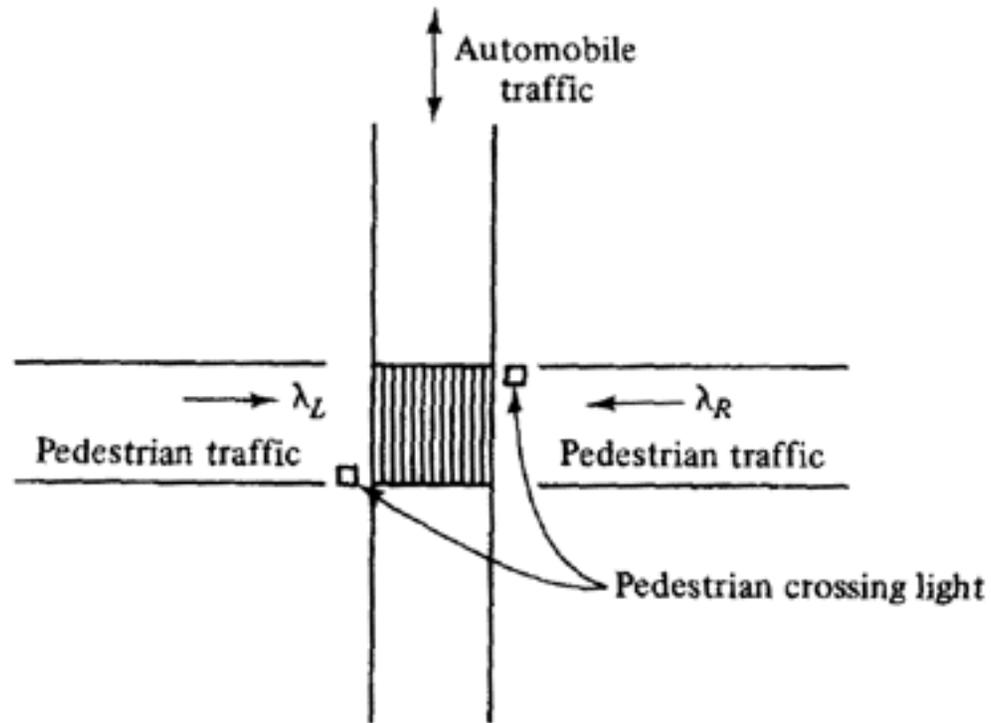


FIGURE 2.14 Pedestrian crossing problem.

## A Rough Model of 77 Massachusetts Avenue

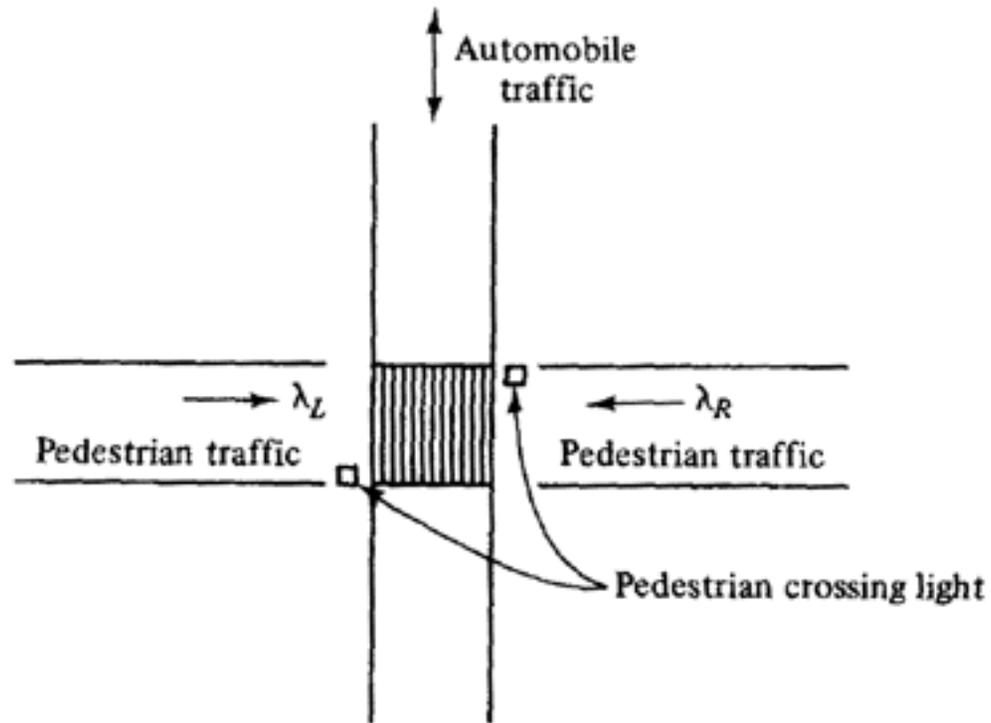


FIGURE 2.14 Pedestrian crossing problem.

**Rule A: Dump Every T Minutes (open loop control)**

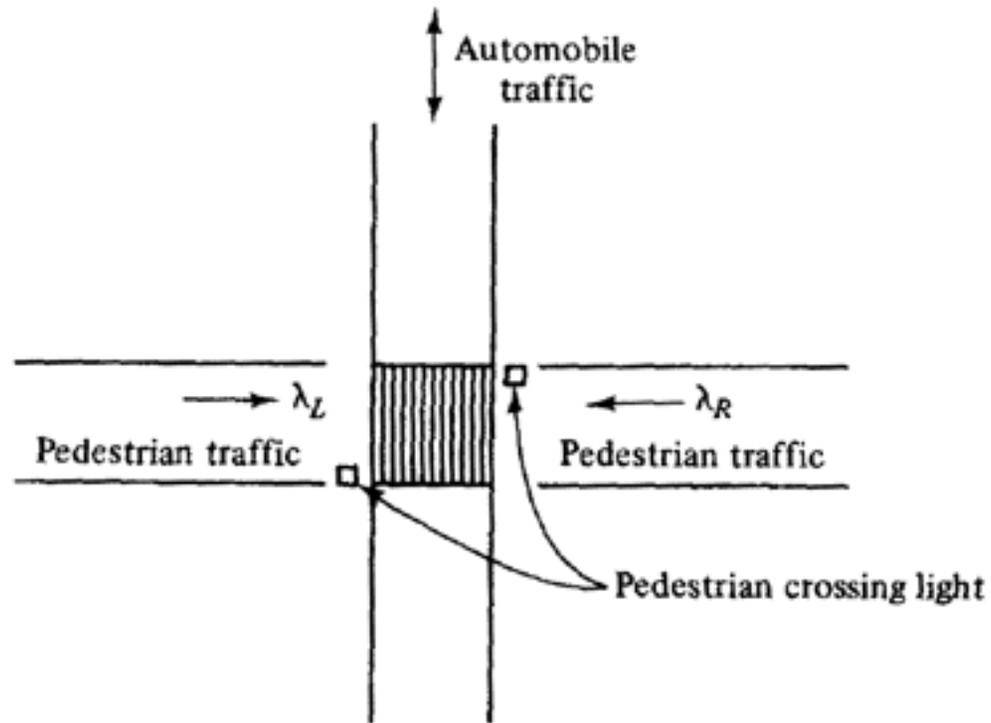


FIGURE 2.14 Pedestrian crossing problem.

**Rule B: Dump When Pedestrian Count =  $N_0$**   
(closed loop control)

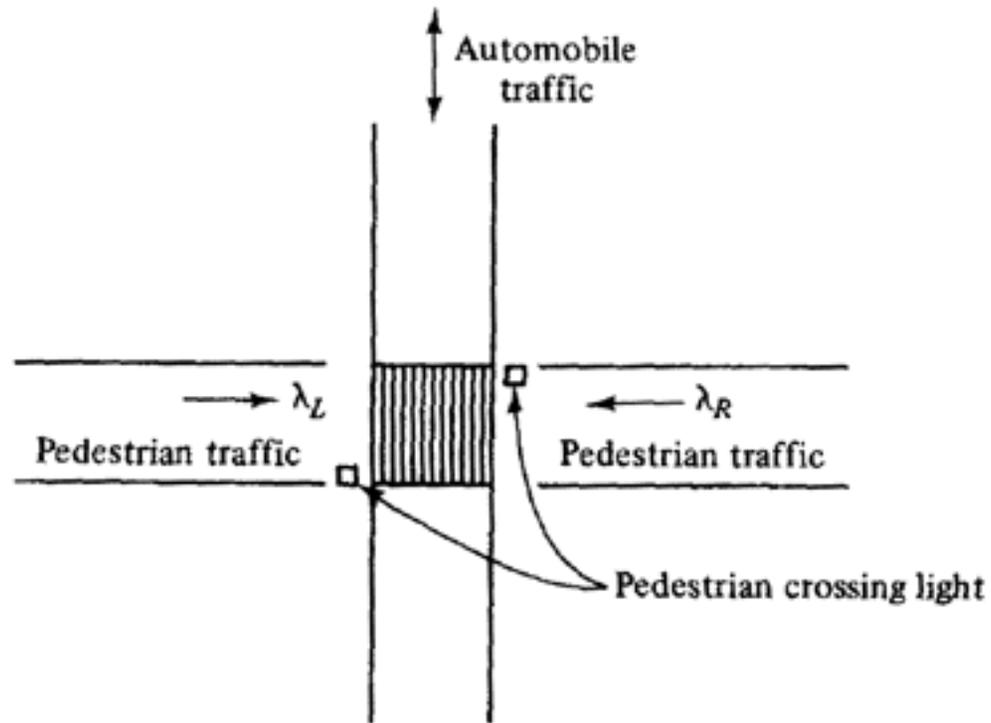
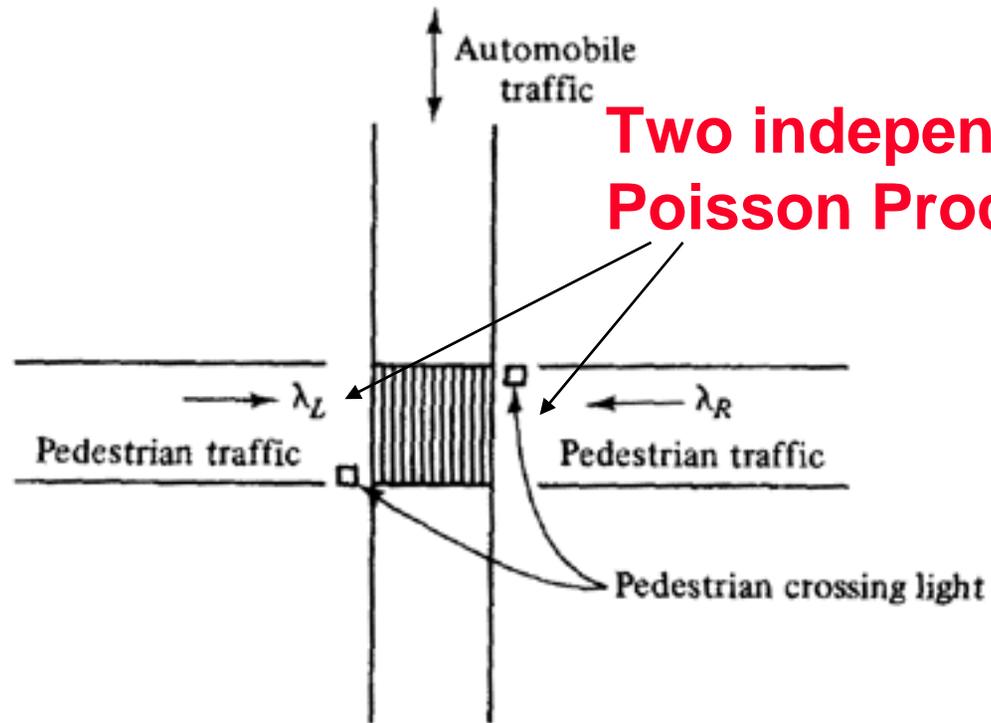


FIGURE 2.14 Pedestrian crossing problem.

**Rule C: Dump Whenever Longest Wait =  $T_0$  Min.  
(again closed loop control)**



**Two independent  
Poisson Processes**

FIGURE 2.14 Pedestrian crossing problem.

**A Rough Model of 77 Massachusetts Avenue**

● = waiting pedestrian  
= “queuer”

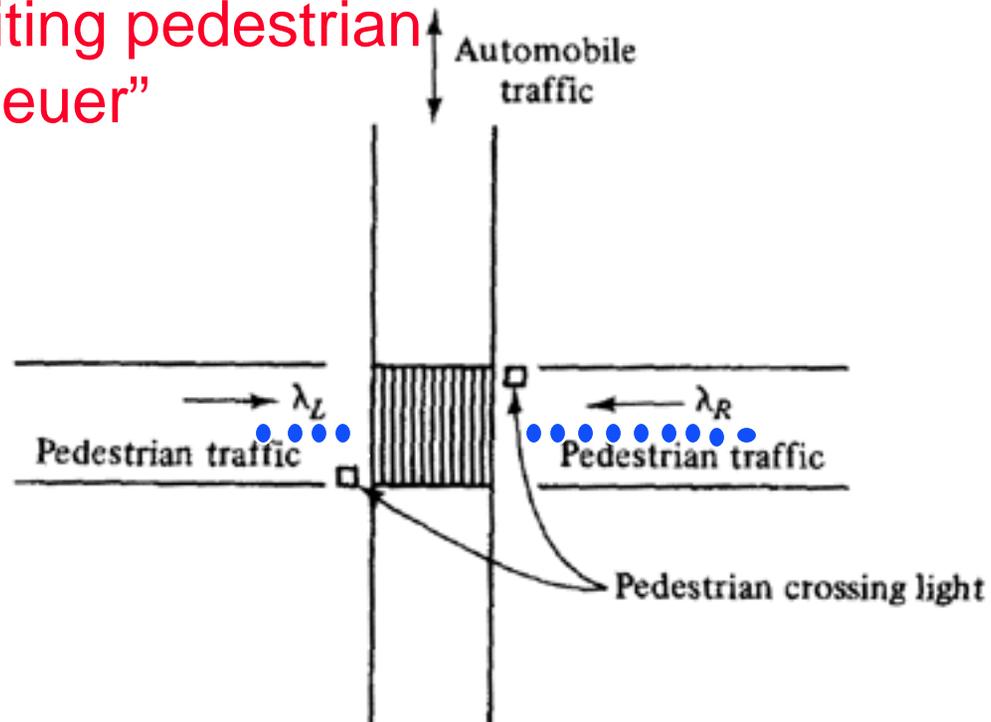


FIGURE 2.14 Pedestrian crossing problem.

A Rough Model of 77 Massachusetts Avenue

# For each decision rule, determine:

1. Expected number of pedestrians crossing *left to right* on any dump
2. Probability that zero pedestrians cross left to right on any dump
3. The pdf for time between dumps
4. Expected time that a randomly arriving customer must wait until crossing
5. Expected time that a randomly arriving observer, who is not a pedestrian, will wait until the next dump

1. Expected number of pedestrians crossing *left to right* on any dump

Today we work out  
the answers  
together on the  
blackboard!

2. Probability that zero pedestrians cross left to right on any dump

### 3. The pdf for time between dumps

4. Expected time that randomly arriving customer must wait until crossing

5. Expected time that a randomly arriving observer, who is not a pedestrian, will wait until next dump