

# Multilane Traffic Model and Simulation



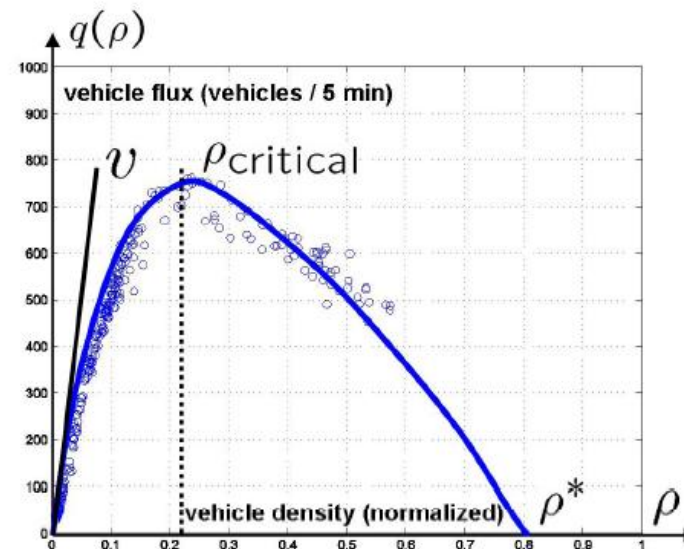
Matthew Rosa

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- ❑ Prepare a 10 minutes presentation that you will give to the class.
  - ❑ This presentation should summarize the work you have done, i.e. give an idea of the papers you have read,
  - ❑ the results you have derived,
  - ❑ the simulations you have done,
  - ❑ and the experiments you have done.
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- ❑ If you still have significant work to do on the project between your presentation and the end of the semester, indicate what you will do. If you plan to work on the project after the end of the semester, indicate what are your goals.

# Introduction

## □ LWR Model

$$\frac{\partial \rho(x, t)}{\partial t} + \frac{\partial (q(\rho(x, t)))}{\partial x} = 0$$

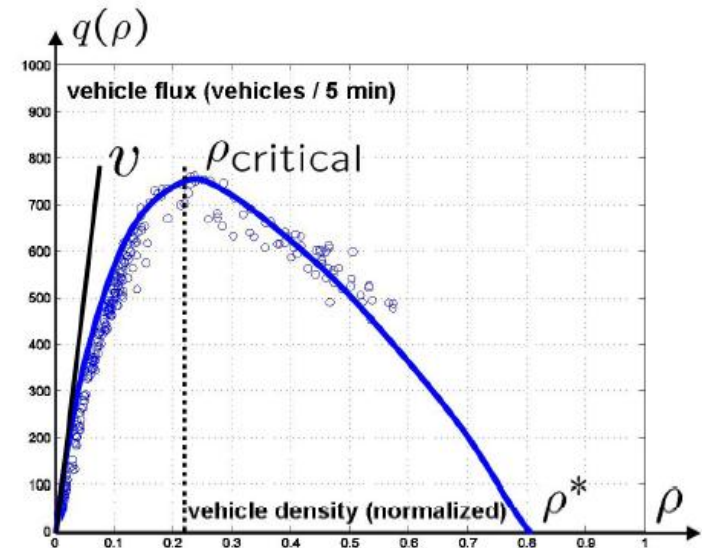


# Introduction

## □ Daganzo Cell Model

$$q = \min\{vk, q_{\max}, w(k_j - k)\}$$

$$\text{where } w \leq v \text{ and } q_{\max} \leq k_j/[1/v + 1/w]$$



$$y_i(t) = \min\{n_{i-1}(t), Q_i(t), (w/v)[N_i(t) - n_i(t)]\}$$

$n_{i-1}(t)$  , the number of vehicles in cell  $i - 1$  at time  $t$ ,  
 $Q_i(t)$  , the capacity flow into  $i$  for time interval  $t$ , and  
 $N_i(t) - n_i(t)$  , the amount of empty space in cell  $i$  at time  $t$ .

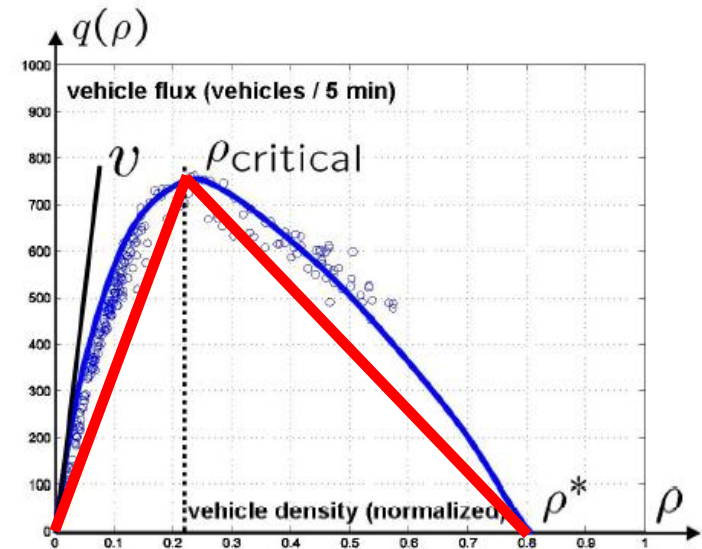
$$n_i(t + 1) = n_i(t) + y_i(t) - y_{i+1}(t)$$

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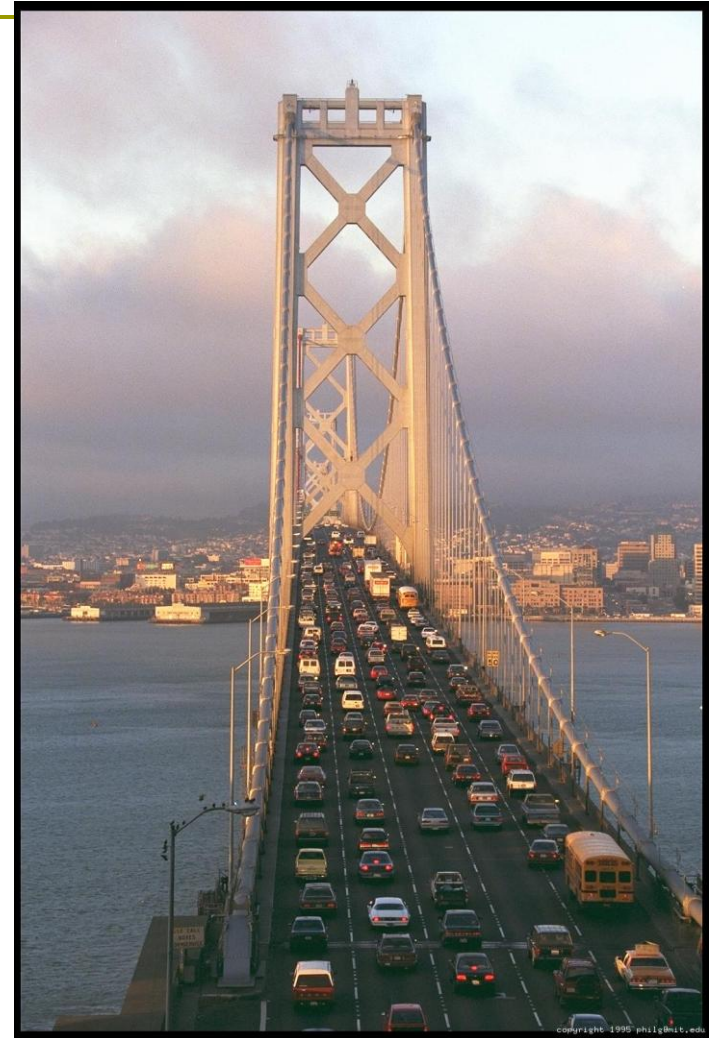
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- Daganzo Cell Model Simulations

# Rationale

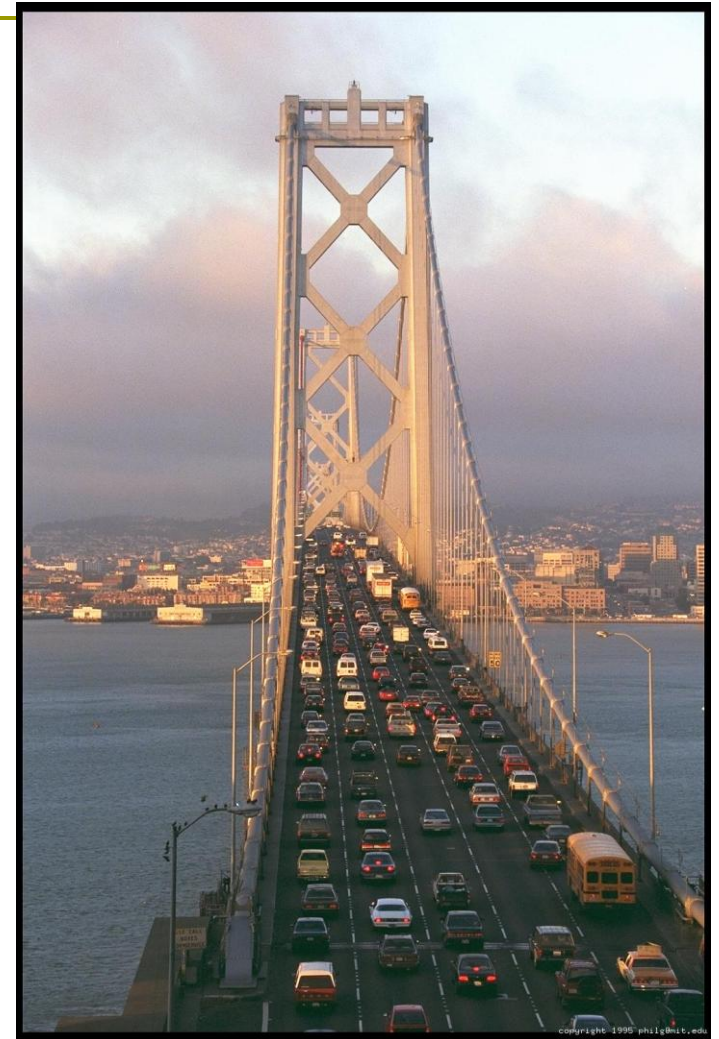
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- Multi-lane Highways



# Rationale

- Multi-lane Highways

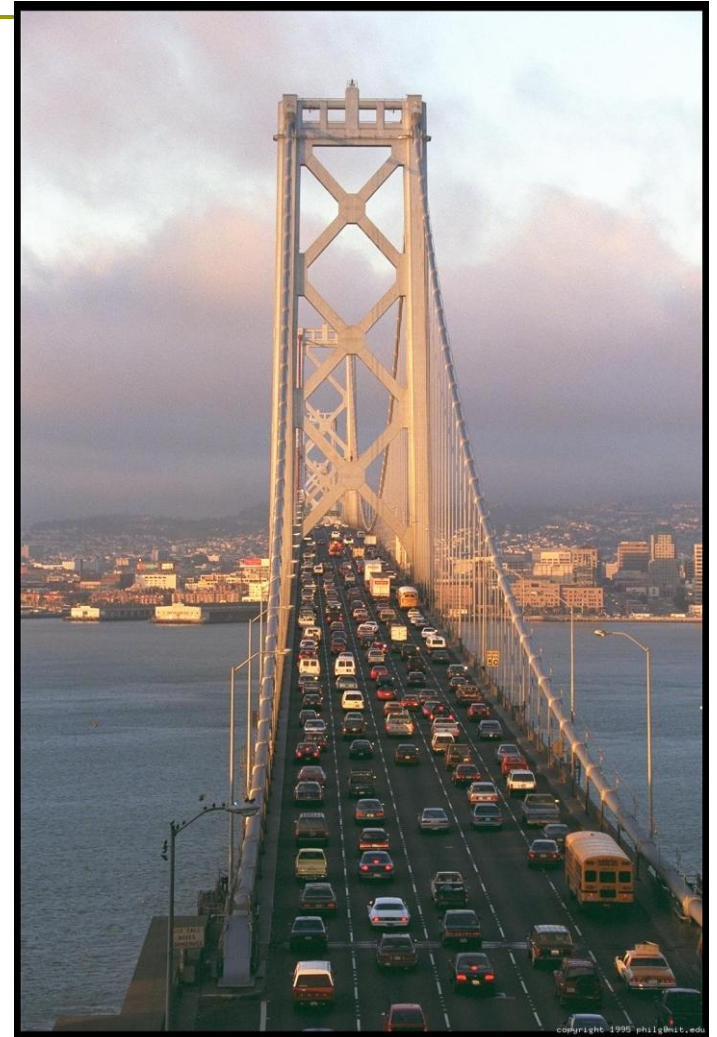
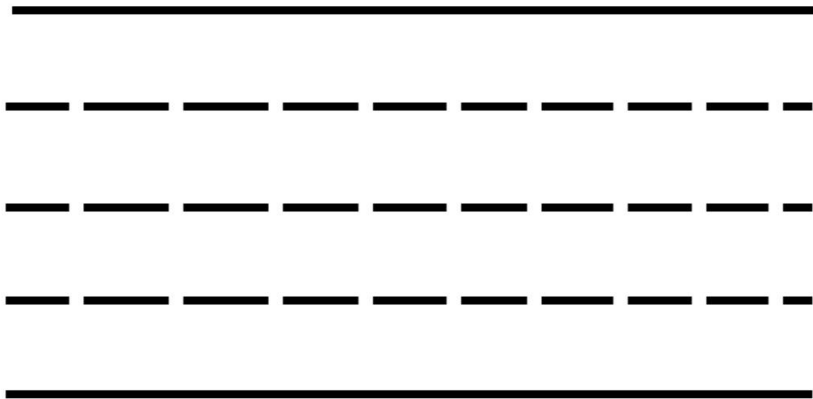




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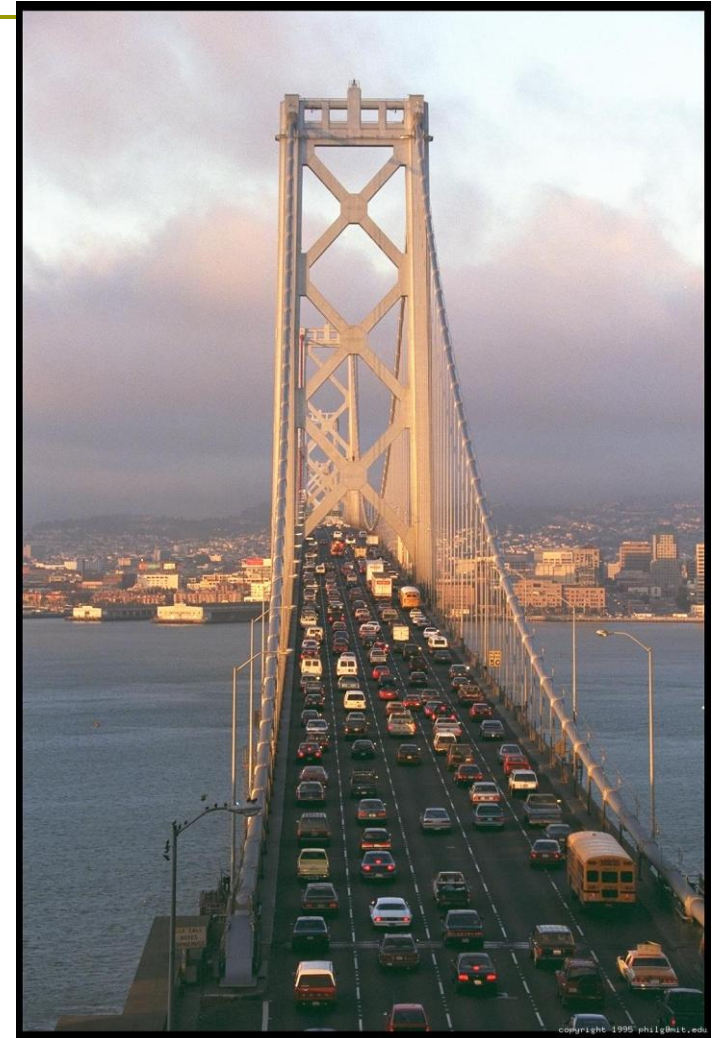
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- Multi-lane LWR



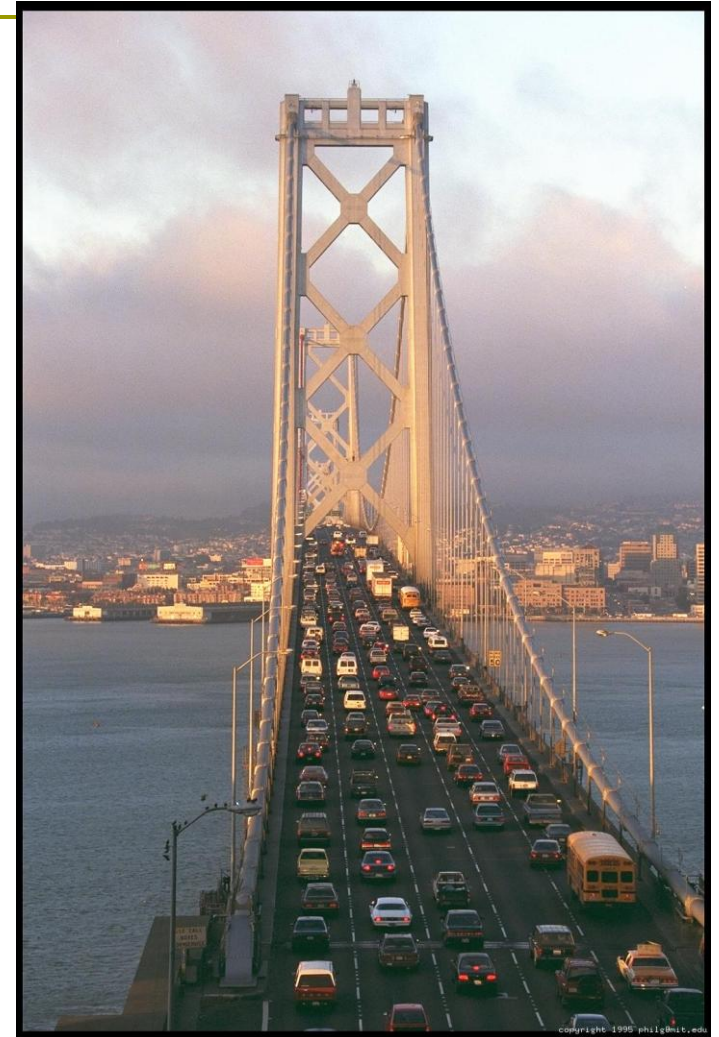
# Rationale

- Multi-lane LWR



# Rationale

## Real Multi-lane Highways



# Rationale

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## □ Multi-lane LWR with “Diffusion”

$$y_i(t) = \min\{n_{i-1}(t), Q_i(t), (w/v)[N_i(t) - n_i(t)]\}$$

$n_{i-1}(t)$  , the number of vehicles in cell  $i - 1$  at time  $t$ ,  
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$$n_i(t + 1) = n_i(t) + y_i(t) - y_{i+1}(t)$$

# Rationale

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## □ Modified Daganzo

$$y_i(t) = \min\{n_{i-1}(t), Q_i(t), (w/v)[N_i(t) - n_i(t)]\}$$

$n_{i-1}(t)$  , the number of vehicles in cell  $i - 1$  at time  $t$ ,  
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$$n_i(t + 1) = n_i(t) + y_i(t) - y_{i+1}(t)$$

# Benefits

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- ❑ Can capture phenomena not seen in Cell Model
  - Onramp created queues
  - Effect of stalled cars
- ❑ Simple iterative model
- ❑ Compatible with single lane Cell Model

# Limitations

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- ❑ Computation costs increase with number of lanes
- ❑ Simplified flux function reduces accuracy

# Simulations

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# Future Work

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- Add shear which would simulate rubber-necking.

# Questions?

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