

## Conceptual Model Summary:

- Two types of traffic flow models: Macroscopic and Microscopic
  - Macroscopic: models the average behavior of a system
    - Looks at things like flux, flow, and totals
    - There is a loss of detail when looking at macroscopic models
    - Modeled with PDEs
  - Microscopic: models the behavior of individual vehicles/drivers
    - Looks at functions of position, velocity and acceleration
    - The behavior of the cars are determined by the lead car
    - Looks at driver-driver and driver-road interactions
    - Density dependent
    - Many different kinds of models
    - Each vehicle requires its own ODE for the model
- Microscopic models seem to be a better conceptual model for our uses.
- Good summaries of different microscopic models:
  - <http://nptel.ac.in/courses/105101087/downloads/Lec-34.pdf>
  - [http://victorknoop.eu/research/papers/chapter\\_vanwee.pdf](http://victorknoop.eu/research/papers/chapter_vanwee.pdf)
  - One of the most common models is follow-the-leader, where the lead/front car determines the behavior of all subsequent cars
- Most models have some concepts of driving states—the different states that individual cars are in
  - Good explanation of these states:  
<http://home2.fvcc.edu/~dhicketh/DiffEqns/Spring11projects/ScottMiller/Project.pdf>
  - Similar concepts are found in most microscopic follow-the-leader models, although they are called by different names
- The lead is not influenced by other drivers (this also happens when there is low density)—they can travel at their desired velocity
- The follow cars can only go as fast as the car in front of them—the ODE that describes them involves information from the car directly in front of them—they have to adjust their speed so they are traveling a safe distance from the car in front of them
- Follow cars can be in equilibrium traffic or breaking state
  - Equilibrium traffic is when vehicles are able to keep a steady velocity and equal spacing from the car in front of them
  - Breaking state is when a vehicle approaches a slowed or stopped vehicle and must break to avoid collision
    - Many models cannot handle collisions, so no collisions is a common assumption in these models
- Microscopic modeling can be split into discrete time based and discrete event based models:
  - Discrete time based: divided time into small fixed intervals and looks for state changes within the interval
  - Discrete event based: scanning is preformed based in some abrupt change in the system

- Discrete time based seems to fit our model best
- A main difference between traffic flow and particle flow is drivers can slow down their cars in response to other slowed or stopped vehicles, but particles can't—there are more collisions with the particles as they are not self-determining and cannot adjust their velocity to the environment