# Project Proposal

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We are interested in modeling traffic under various conditions such as the differences in the number of lanes and traffic jams. We will model vehicular traffic as a continuous flow of vehicles. This allows us to use the continuity equation

$$\frac{\partial k}{\partial t} + \frac{\partial q}{\partial x} = 0 \tag{1}$$

where $k$ is the concentration of traffic and $q$ is the flow rate of the traffic. We need a constitutive equation which reflects the vehicular traffic. One example of a constitutive equation is $q(k)$. Possible models for $q(k)$ include Greenshields' model and Greenberg's model. To find $q(k)$, we can find real life data and use curve fitting. A source of real life data include data collected from traffic count stations. If this is not possible, we will use reasonable assumptions and parameters to find $q(k)$.

Possible directions to expand on the continuity equation is to explore the cases when there are multiple on- and off-ramps, the change in the number of lanes, and traffic jams. We intend to do this by modifying the initial and boundary conditions or modifying the continuity equation.

We are also considering using the Lighthill-Whiteham-Richards model. This allows us to investigate the fundamental diagram which is about flow-density data. We can relate the diagram to phenomena in traffic such as shock waves and the solution to the equations of the Lighthill-Whiteham-Richards model.

To numerically solve the partial differential equation, we will use a finite differences method, specifically the FTCS scheme. We will also look at special cases and initial conditions qualitatively to find out where our numerical methods work and where they break down. We expect this method to be numerically unstable because the continuity equation is hyperbolic, so other numerical methods will be considered, including the lax scheme.