Simulating traffic

Cars go from one side of a grid to one of the three other sides. (See figure 1 for the grid.) There is a stochastic distribution of the starting place and finishing point for each car. Most of the time it starts in the same side and finishes at the same side every time. This simulates that most people drive more or less the same direction/route every day.

The amount of cars is a parameter that can be adjusted making it possible to make it more or less busy in the road.

Drivers usually observe the traffic rules. Important one here are:

1. Cars coming from the right have right of way.
2. Keep enough distance to the car before you (you can stop in time if the car in front makes an emergency stop)
3. Stop for traffic lights
4. Don't speed

Cars can drive with two speeds, at speed limit and too quick.

When cars get to a crossing they can observe the cars coming from the other three sides. They can calculate which cars can stop in time when they cross and they can calculate whether a car has to brake (decelerate) to let him cross.

We suspect that an aggressive driving style can be disruptive to traffic. Examples of aggressive driving include driving as fast as possible, tailgating, or refusing to yield forcing other vehicles to make an emergency brake and give way. You will need to consider whether these choices are binary, or based on some property of the driver (e.g. her experience, or age), and whether they are influenced by random noise.

As a guideline you can assume that a normal stop takes 10m from speed limit and 13m when driving too quick. An emergency stop takes 7m resp. 10m.

An aggressive driver will cross if it thinks that all cars that have right of way can stop with a normal stop to let him pass, while cars that have no right of way could stop in time with an emergency stop. A norm abiding driver will make sure that cars that have right of way do not have to decelerate while other drivers could stop with a normal stop.

These choices are not binary but based on a normal distribution that is adjusted based on experience. The longer a driver has to wait for a crossing the more aggressive he will get. But an aggressive driver has a distribution that is leaning more to the aggressive choices than a norm abiding driver.

When cars collide they block the crossing for a relatively long period (check for a reasonable time) and then disappear for that round. Their driving time is set to the time between the first car starting and the last one finishing.

Every round (all cars going from start to finish) the total average throughput is calculated and all drivers get this information and also keep their own driving time. Based on the difference between the two they can become more or less aggressive next time or choose to try a different route from start to finish.

Questions will be:

1. How big does the percentage of aggressive drivers have to be to start causing accidents and increasing general throughput?
2. How much do drivers change their routes?
3. How many drivers start using the traffic light and when are they avoiding it again? (if the line gets very long it might be easier to cross the roads in other places)
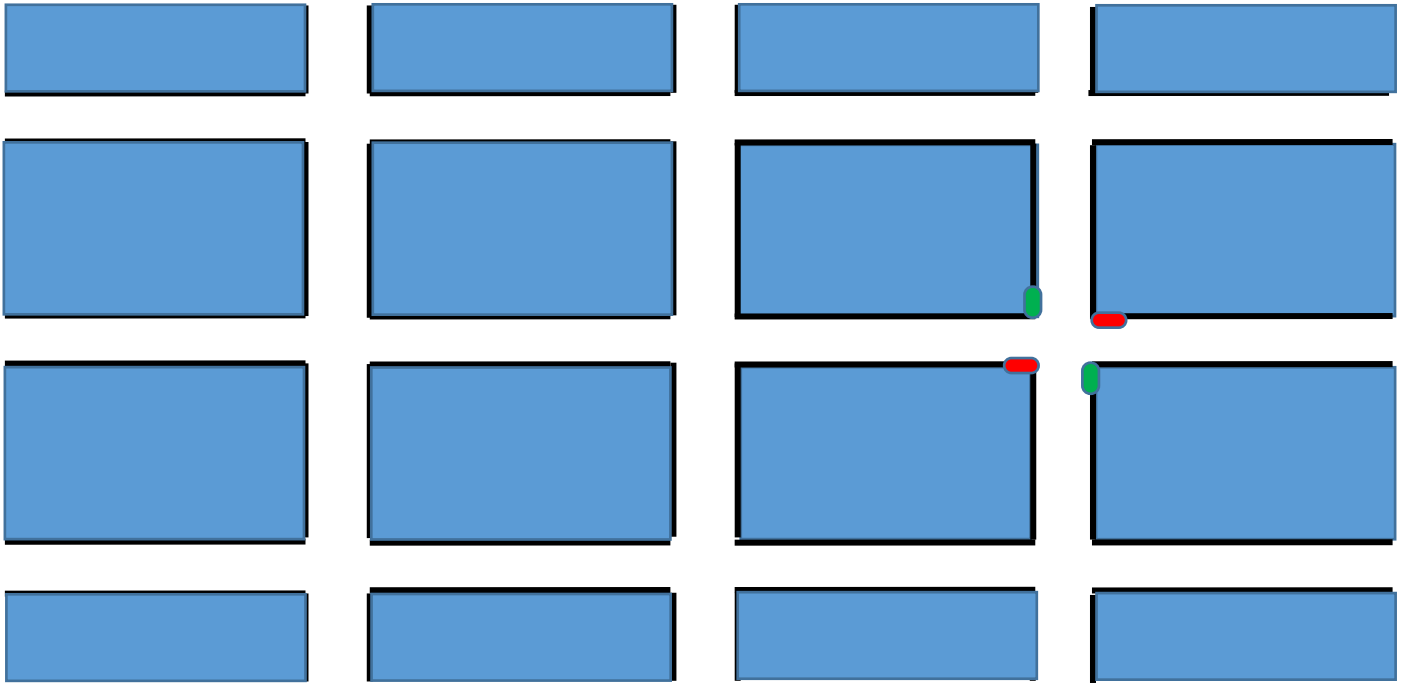
Road grid

Figure 1
The red and green figures denote traffic lights.