AUTOMATION AND OTHER MEANS OF ENDING CONGESTION

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Figure one is little known outside of the traffic engineering profession, yet it may be the best chart for helping people to understand congestion and how to fix it. It shows the number of passenger cars per hour counted on a freeway lane compared with the average speeds in that lane. Although this particular chart is based on Washington State Department of Transportation counts of traffic flows on a freeway in the Seattle area, many other agencies have made similar charts based on other urban highways.

The chart indicates that these particular freeway lanes can move a maximum of about 2,000 vehicles per hour when speeds are around 50 miles per hour. However, when more vehicles try to use the highway, traffic flows break down and speeds decline. Moreover, the throughput drops as well, so that at 25 miles per hour, only about 1,000 vehicles per hour can use the lane, and at 10 miles per hour, only about 500 vehicles per hour can make it through.

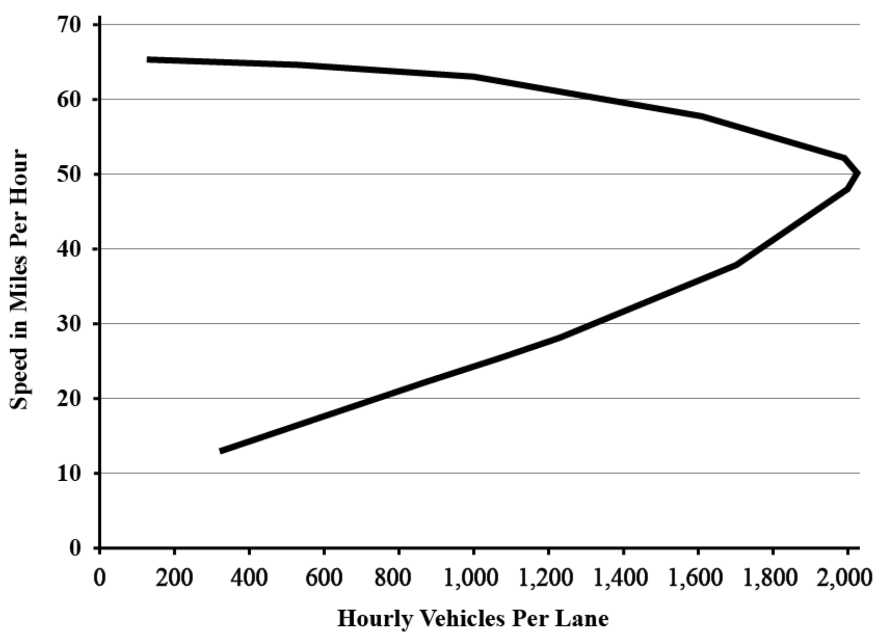

Figure 1

Highways are the only resource for which supply, as measured by vehicles per hour, declines when demand increases. Airplanes don't lose seats and hotels don't lose rooms during high travel seasons, but highway flows decline at just the times of day when people need them the most.

Once traffic flows have broken down, it can take hours for them to speed up again even if the amount of traffic trying to use the lane falls below 2,000 vehicles per hour. For example, if traffic has slowed to the point where only 1,000 vehicles per hour can use the lane, then it will remain slow until numbers fall below that amount. There may be only a few minutes in the morning or evening rush hour that traffic exceeds 2,000 vehicles per hour, but traffic will stay slow for several hours until the number of vehicles falls below 1,000 per hour, or whatever the throughput is based on traffic speeds.

This chart shows there are several things we can do to relieve congestion. One is to build more highways or lanes, but it seems silly to build roads with lanes capable of moving 2,000 vehicles per hour knowing that, when demand is highest, they will only move 1,000 or fewer vehicles per hour.

A second possibility is to make road improvements that can move the curve on the chart to the right. Very old highways such as Connecticut's Merritt Parkway, which was built in the 1930s, probably peak at around 1,700 or so vehicles per hour. New highways such as Los Angeles' Century Freeway might peak at around 2,300 vehicles per hour. Widening lanes, lengthening auxiliary lanes to on- and off-ramps, and reducing the curvature (and thus increasing speeds) of off ramps are all ways that could move the curve to the right.

Another idea is to make sure that traffic never reaches the levels where it is prone to break down. On a road whose maximum throughput is 2,000 vehicles per hour, that may mean limiting it to 1,800 or 1,900 vehicles per hour. By preventing traffic from slowing down to 20 miles per hour or less, this would nearly double the throughput of the road during peak periods.

Although traffic engineers have tried to limit flows through the use of ramp metering (stop lights at freeway on ramps), this has limited effect. The only certain way to keep flows below 2,000 or 1,800 vehicles per hour is congestion pricing, where tolls or fees are higher during high-traffic periods, thus encouraging some people to drive at other periods. Since a large percentage of vehicles on the road during rush hour are not people trying to get to or from work, such time-shifting is possible without severely impacting commuters' lives.

Opponents of road pricing often worry that it prices people off the roads. In fact, by keeping highway throughputs at 1,800 or 1,900 vehicles per hour instead of letting them fall to 1,000 or fewer vehicles per hour, road pricing actually tolls people *onto* the roads. It can allow roughly twice as many vehicles to use the roads during peak periods.

A third way of dealing with congestion is to change the shape of the curve so that it doesn't bend back at high traffic flows. The breakdown of traffic illustrated by the curve has something to do with driver responses to traffic. The usual rule of thumb is that drivers should have five car lengths between them at 50 miles per hour and two car lengths between them at 20 miles per hour. If all drivers followed this, highways would move just about the same amount of traffic at 20 miles per hour as at 50 miles per hour. Instead, drivers must become more cautious in congested traffic, resulting in the reduction in flows illustrated in the chart.

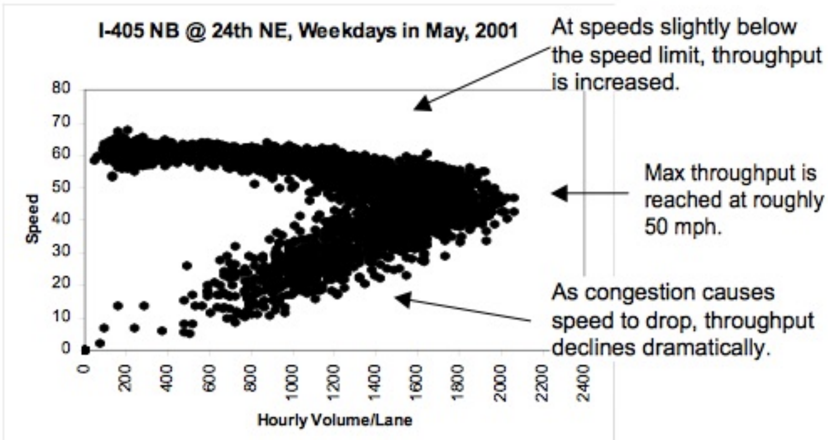

Figure 2

Automation can fix this because automated vehicles will be better able to maintain safe driving distances between vehicles regardless of speeds. Simulations suggest that congestion can dramatically decline if as few as 20 percent of vehicles on the road—one study even suggested 5 percent—are automated.

In this case, automation doesn't mean fully driverless cars. Simple adaptive cruise control, which is available on an increasing number of automobiles, can make a difference. I estimate that, if enough cars used adaptive cruise control, throughputs on freeway lanes could increase to as much as 2,800 vehicles per hour. However, some adaptive cruise control systems are more responsive than others and it would be worth doing some research to see which ones are most effective at relieving congestion.

Even more benefits could be obtained from platooning, which means allowing vehicles to electronically coordinate so that a change of speed by the vehicle in front is instantly mimicked by changes in the following vehicles. One study estimates that platooning could increase throughputs on a freeway lane to as high as 10,000 vehicles per hour.

Clearly, vehicle automation is an important long-run solution to traffic congestion. But in the short run, highway departments should consider shifting to congestion pricing, either using tolls or mileage-based user fees, and using the revenues from such pricing to increase highway throughputs by adding auxiliary lanes, widening lanes, and taking other steps to improve traffic flows.

Randal O'Toole is a senior fellow with the Cato Institute whose work focuses on transportation and land-use issues. His 2010 book, Gridlock: Why We're Stuck in Traffic and What to Do About It*, was one if the first to highlight how self-driving cars would reduce traffic congestion and change the world.*