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# Ontario Must Prepare for Vehicle Automation: 14 FAQs, by Bern Grush

## 1. **What is the difference between a driverless car and a self-driving car?**

Driverless has no driver = fully automated

Self-driving can drive itself usually and eventually in most places = semi-automated

## 2. **Why will traffic get worse before it gets better?**

Semi-automated vehicles will make it easier to cope with longer and congested trips. When something is easier, better and cheaper, people will use it more often. Studies considering this all show an increase in trip count, trip length and a drop in vehicle occupancy. Only studies that model every trip in a robo-taxi reveal a drop in congestion. It will be a long time (actually never) before all trips are in robo-taxis, so traffic will get worse before it gets better. Also, robo-taxi simulations that show a drop in congestion set up their model using all the same origins and destinations and trips as actually occurred in the year or two prior to the time of the study. They do not consider population growth or the spatial redistribution (expansion) that automated vehicles will engender.

## 3. **Some say the GTHA's roads are already in crisis: how much worse will congestion get?**

The EU study that looked at this projected changes in trip length, trip count and vehicle occupancy ranging from 10% to 30%. But congestion is non-linear. A 10% increase in trip count would make no difference in lanes that are underutilized, but cause gridlock in lanes already at capacity. In some cases, a single driver slowing to gawk at something or swerve or slow while texting causes a delay. There is no simple answer.

## 4. **Safety is a big issue for these vehicles. What must happen to make them safe enough for Ontario roads?**

I am not concerned about fully automated vehicles. Semi-automation is riskier. We already know that drivers of semi-automated vehicles will trust the technology and can become distracted. I am more concerned about mixing non-automated and semi-automated vehicles together with cellphones and alcohol, and putting all that on the road with fully automated vehicles. A lot more needs to be done before these are ready around 2020.

The more interesting question is what does the insurance industry say? Their answer is: “We’re not lowering premiums until we have a chance to look at a lot of actuarial data.” They accept that automated vehicles will likely be safer, but they are unwilling to bet how much. I am also unwilling to guess. My report describes an approach that would lower the risk, but no one can make it zero.

**5. How do we know bicyclists, motorcyclists and pedestrians will be safe around AVs?**

Considering the sensors and systems involved, cyclists, motorcyclists and pedestrians will be far safer around automated vehicles. If there are errors, they might stem from semi-automated vehicles with automation switched off, but even then the vehicle could sense, warn and even override with automated braking. Automated braking systems should be understood, tested and mandated.

Some people are afraid that pedestrians and cyclists would play chicken with AVs once they have confidence that they are programmed to avoid them. I’m sure we’ll see some Darwin Awards during the 2020s, because there are still humans with some deeply foolish genes, but AVs should hit far fewer cyclists, motorcyclists and pedestrians than today’s drivers do.

**6. How will the rise of automated vehicles impact jobs for auto manufacturers and the transportation sector?**

It will be a job changer. The semi-automated market: modest job growth — making, selling, repairing, maintaining, driving — 2020-2040, then decline, as semi-automated vehicles will be for special purposes and hobby use.

The fully automated market: modest job growth between 2020 and 2030; stronger job growth 2030-2050, then decline as fleets will be increasingly manufactured (more likely printed) and managed by robots.

The net job change of these two markets will be modest growth until the robo-fleets dominate (2040), then expect relative job counts per kilometre travelled to gradually taper off.

Automobile manufacturers will produce more vehicles. Robo-taxis will run all day and rack up 200,000 km in a year. If travel is cheaper and easier and faster, we will consume car-travel more than ever. These robo-fleets may not need a driver in every vehicle but they need care, cleaning, repairs and other things that will employ workers. The total volume of person-travel will continue to increase, as automation comes on stream. Human ride consumption (world-wide) will demand machines and human labour and this consumption will continue to outpace the ability of robo-taxi optimization to keep up for the next few decades. One winner is the automotive industry, and Ontario would be smart to position itself for that.

The issue with transit is equivocal. If non-rail transit doesn't evolve, it will be disrupted by cheap robo-services by the mid- to late 2020s. If non-rail transit moves away from fixed-route, fixed-schedule, 50-passenger buses and toward flexible routes and schedules through robo-transit, it could grow transit ridership by a factor of five or 10 by the 2040s. This would double or quadruple transit job counts before that plateaued around 2050 or 2060. This is where policy and collaboration can create many jobs.

Of course, jobs will be affected as robo-fleets grow: parking, car washes, car repair, parking and traffic enforcement (and the court system), automotive retail, driver training, car accessories, and so on. This needs a much closer examination, but the usual clamour that all driving jobs will cease in the 2020s is certainly an exaggeration. This will unfold over 40 years or more.

**7. People are pretty attached to their cars: what must happen between now and 2050 to switch from ownership to using a network of self-driving cars (fully automated vehicles)?**

The abandonment of household ownership will be gradual. Not owning a vehicle must become a clearly better option than owning one. It is true today that a person with an excellent range of responsive, suitable and affordable travel choices is less likely to purchase a vehicle (I am talking about people who can afford a vehicle if they wanted one). Right now, only a minority of people find themselves in a situation where it would be advantageous to abandon vehicle ownership. Today, non-car owners still become car owners more eagerly than the other way around.

So the first thing that has to happen is the creation of substantial communities with the kind of robotic transit systems I describe in the report allowing households to move toward a lifestyle of having one less vehicle, then some gradually moving toward having no household vehicles. In others words, we must create the conditions that make not having a vehicle personally more desirable than owning one. Setting up great transit for the commute to work is not nearly enough. People own cars to do much more than that. I do not drive to work, yet I keep a car.

No one will give up car ownership to save the planet. They will give up ownership when it is more convenient not to own a car. Shared robo-vehicles must become dramatically more advantageous — range, speed, variety, safety, responsiveness, reliability and more — before non-ownership becomes the trend we want to see. That will take 30 to 40 years to completely unfold.

**8. What kind of infrastructure will we need to build to usher in an era of automated vehicles? How will that infrastructure change from semi-automated to fully automated?**

Semi-automated vehicles require a driver, even if she is looking at her iPad. These are effectively the same as the cars we have now, except they will self-drive for exceptionally long stretches. Because they will be the predominant form of automated vehicle manufactured for the first

couple of decades, they need more parking spots and more lane kilometres — i.e., more of what we have now.

Fully automated vehicles will cause a gradual change in this regime of lanes and parking for private vehicles toward an increasing number of publicly shared vehicles (I am considering this as infrastructure in the same way a city might consider its bus fleet to be infrastructure). There are two parts to this. First we need to “groom” the areas in which early robo-taxis and robo-shuttles will operate: signage, lanes markings, potholes, high-resolution mapping, etc. Second, we need to start building fleets. We have two examples of fleets: small, area-limited fleets of slow-moving taxis as being demonstrated in Singapore and Pittsburgh, and similarly constrained robo-shuttles as have been demonstrated in numerous places in the EU, the U.S. and Asia for first/last mile applications. As these become reliable (still in limited areas), we can grow pockets of populations within our cities that need fewer and eventually no household vehicles. As the technology improves, these pockets grow and merge so that within 30 years, very few people would need a private vehicle except for service people such as plumbers, or a disabled person needing special equipment.

The only way to short-circuit congestion during these next few decades while waiting for full-automation to mature is to start such pockets of automation soon; incentivize their use with frequency, convenience, flexibility, on-demand, well-maintained, safety, security, reliability, and cleanliness, then expand these services effectively.

**9. How much more parking are we going to need for these vehicles?**

About 10 to 30 percent would be my best guess. But this can be completely avoided (2020-2030) by deploying a lot of early first- and last-mile use of robo-shuttles: i.e., robo-shuttle to the GO station; take the train; then robo-shuttle (or taxi) to the office.

Policies to minimize parking in new developments are needed. I have already helped two developers envision how to plan parking to absorb the initial uptick and conserve value as demand tapers off. The entire matter of parking planning needs an overhaul already. And now it needs double the attention. The management of parked, standing and stopped vehicles in Toronto is a significant transportation management failure. We focus mostly on transportation as the coordination of safe movement of motorized vehicles and pay far too little attention to matters of parking, cycling and pedestrians. This may be starting to change but until now, our approach to parking policy is dismal.

**10. Which other countries are leading the way with pilot testing automated vehicles?**

Belgium, China, Finland, France, Germany, Greece, Italy, Japan, Netherlands, Singapore, Spain, Switzerland, UK., and the U.S. More are coming. Canada is far behind.

**11. What would you have to do to control a semi-automated car?**

(1) Drive normally until you wish the car to take over. (2) Turn on the automation function when you are ready to cede control. (3) Stay sufficiently attentive (awake) and ready to take over if the car asks you to. (4) Take back control when cars ask you to or when you wish to drive.

**12. Can you sleep while in your automated vehicle?**

In fully automated, yes. In semi-automated, no.

**13. What's the point in creating automated vehicles?**

Safety. Productivity. Environmental justice. Profit.

**14. What makes you an expert on this subject?**

I am trained in psychology, anthropology, human factors, artificial intelligence, geographic information systems and systems engineering – I have a Bachelor of Arts in Human Factors at the University of Toronto, and a Masters in Systems Design Engineering at University of Waterloo. I am versed in change management, market adoption and behavioural economics. I have spent the past 15 years working in transportation demand management. My research partner, John Niles, is a graduate of MIT and Carnegie Mellon, and has spent over 30 years in transportation. He has been an important mentor to me for the past three years. I have no financial interest in either semi- or fully automated vehicles.

All of my observations are fully described and open to examination. To date my descriptions of the expected acceptance and effects of automated vehicles have been confirmed by others, but we are all a long way from having complete confidence in these long-range, future-oriented projections. The purpose of this report is to kick-start an important dialogue on the potential ramifications of AVs for Ontario.