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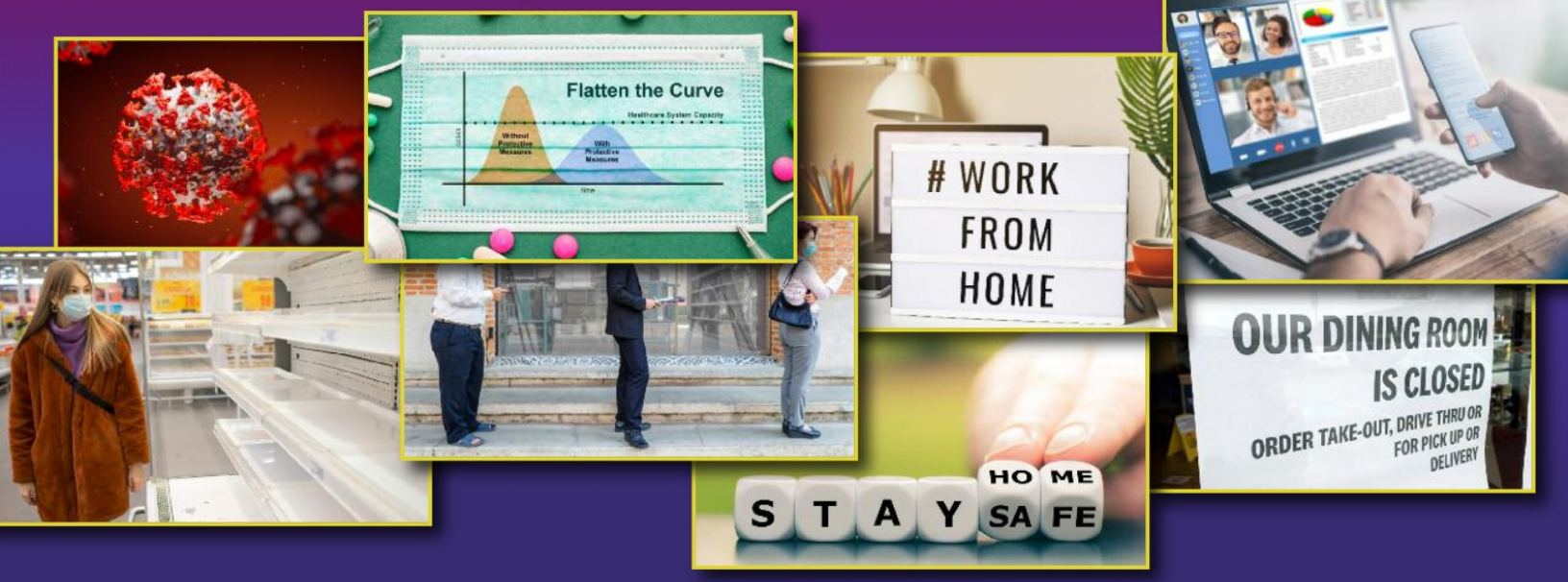
2019-2020 An Unprecedented Year!



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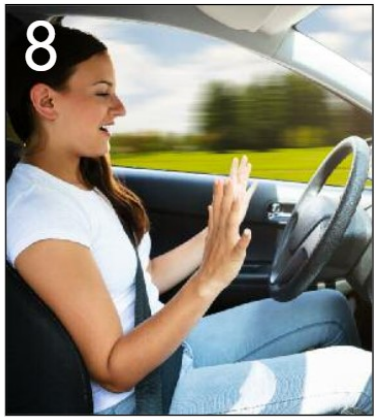

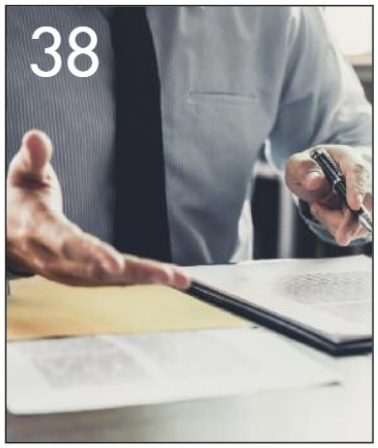

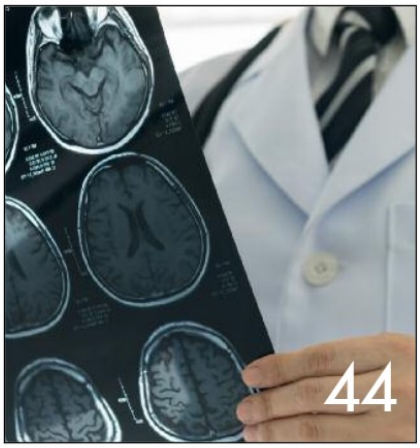

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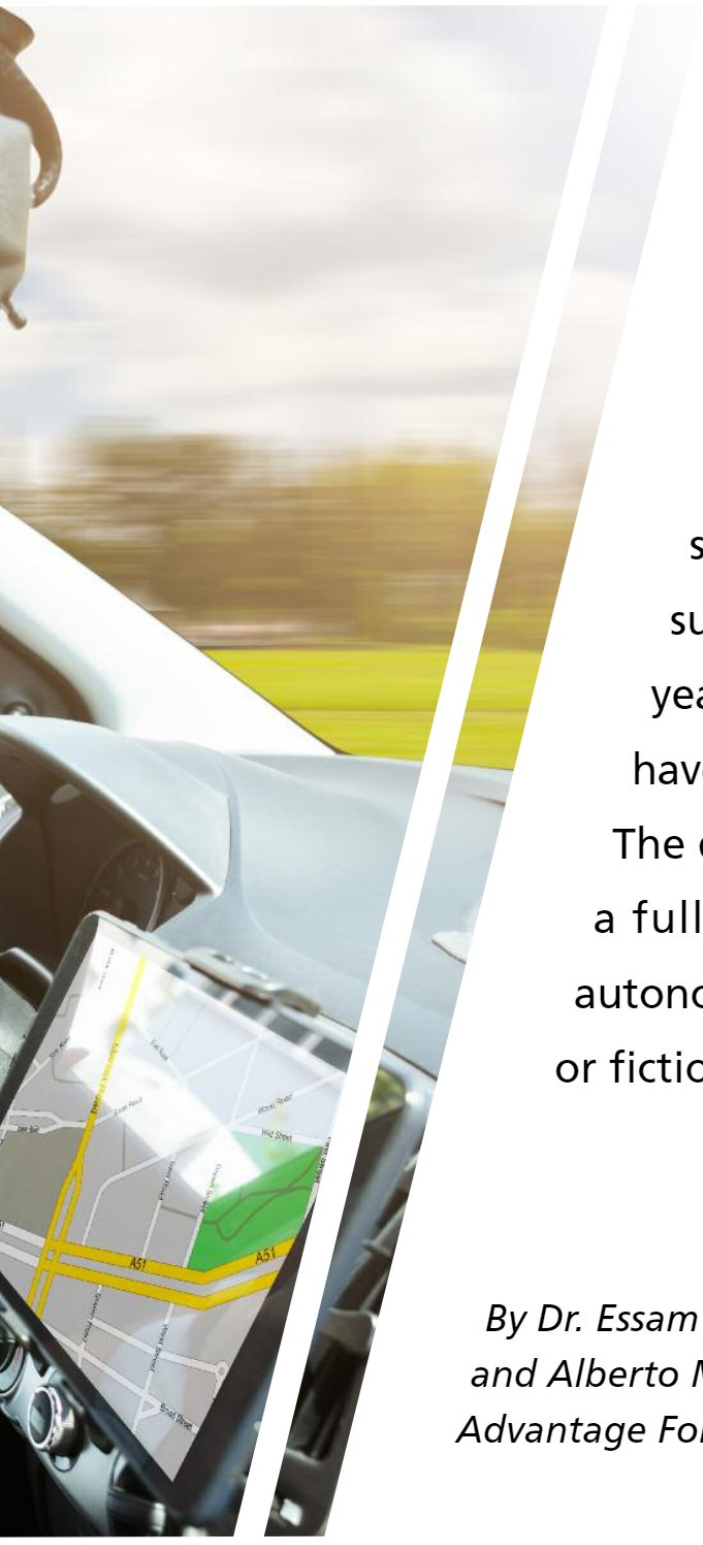
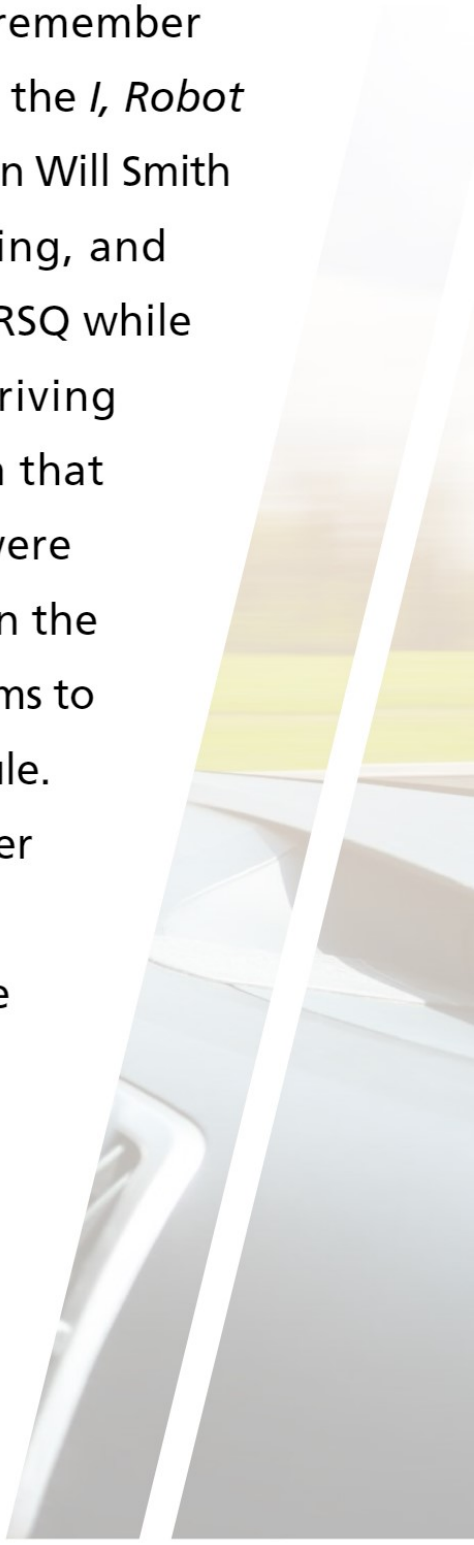
The Science and Fiction of

Autonomous Vehicles



Many of us still remember those scenes from the *I, Robot* movie in 2004, when Will Smith was reading, relaxing, and sleeping in his Audi RSQ while the car was simply driving itself. The scenes from that science fiction movie were supposed to take place in the year 2035, but science seems to have leapt ahead of schedule. The question now is whether a fully self-driving car (or autonomous vehicle) is science or fiction.



By Dr. Essam Dabbour, P.Eng. and Alberto Martinez, P.Eng., Advantage Forensics, Toronto

To start, we need to understand what an autonomous vehicle is, and how to differentiate autonomous vehicles from other vehicles with driver-assistance systems.

The National Highway Traffic Safety Administration (NHTSA) published a preliminary policy on autonomous vehicles, classifying six progressive levels of driver assistance technology. These six levels were originally classified by the Society of Automotive Engineers (SAE).

Level 0 is no driver-assisted technology, with the driver performing all tasks. Currently, almost all vehicles in production are Level 1 (some minor driving assist features) or Level 2 (more advanced features like lane keeping control and adaptive cruise control). Most people are surprised to hear that the Tesla vehicles currently on the road, with their very high level of automation, are still classified as Level 2 on the SAE scale, requiring full driver monitoring and reaction for encroaching turning vehicles.

Level 3 (conditional automation), Level 4 (high automation), and Level 5 (full automation) are not commercially available yet. Level 3 requires driver monitoring for emergencies only, Level 4 requires driver monitoring for unusual locations only (e.g. gravel roads), and Level 5 is full automation on all roads. NHTSA

anticipates "fully automated safety features" and "highway autopilot" to become reality within the next five years, by 2025. Several vehicle manufacturers have promised to produce fully autonomous vehicles before 2025, which has not occurred yet. For example, Toyota announced in 2015 that its first autonomous vehicle would be produced in 2020. Ford announced in 2016 its plans for rideshare fleets using autonomous vehicles in 2021. Alphabet Inc. (Google's parent company) has been testing their Waymo autonomous vehicles since 2009, which are now partially available to consumers in Arizona through their self-driving ride-hailing service 'Waymo One'.

Do we really need autonomous vehicles?

Human advancement stipulates that we do need autonomous vehicles. According to the World Health Organization (WHO), more than 1.35 million people die each year in traffic collisions, with most of those collisions are caused, either fully or in part, by human errors. Autonomous vehicles minimize or eliminate human errors. For comparison, the implementation of autopilot systems in aircrafts significantly improved aviation safety. Of course, introducing autonomous systems comes with other challenges, which will be discussed below.

Autonomous vehicles also increase the capacity of our roads, thereby reducing congestion and delay. Computer reaction times are orders of magnitude faster than typical driver reaction times of 1.5 seconds, allowing vehicles in an automated world to follow each other much more closely. This will significantly increase the capacity of our congested traffic systems. Fully autonomous vehicles will be equipped with the

"Nothing says summer like mayonnaise-based salads congealing in the heat."

Autonomous vehicles also allow for the possibility of parking themselves after disembarking, reducing the need for wide parking allowances in congested urban parking lots.

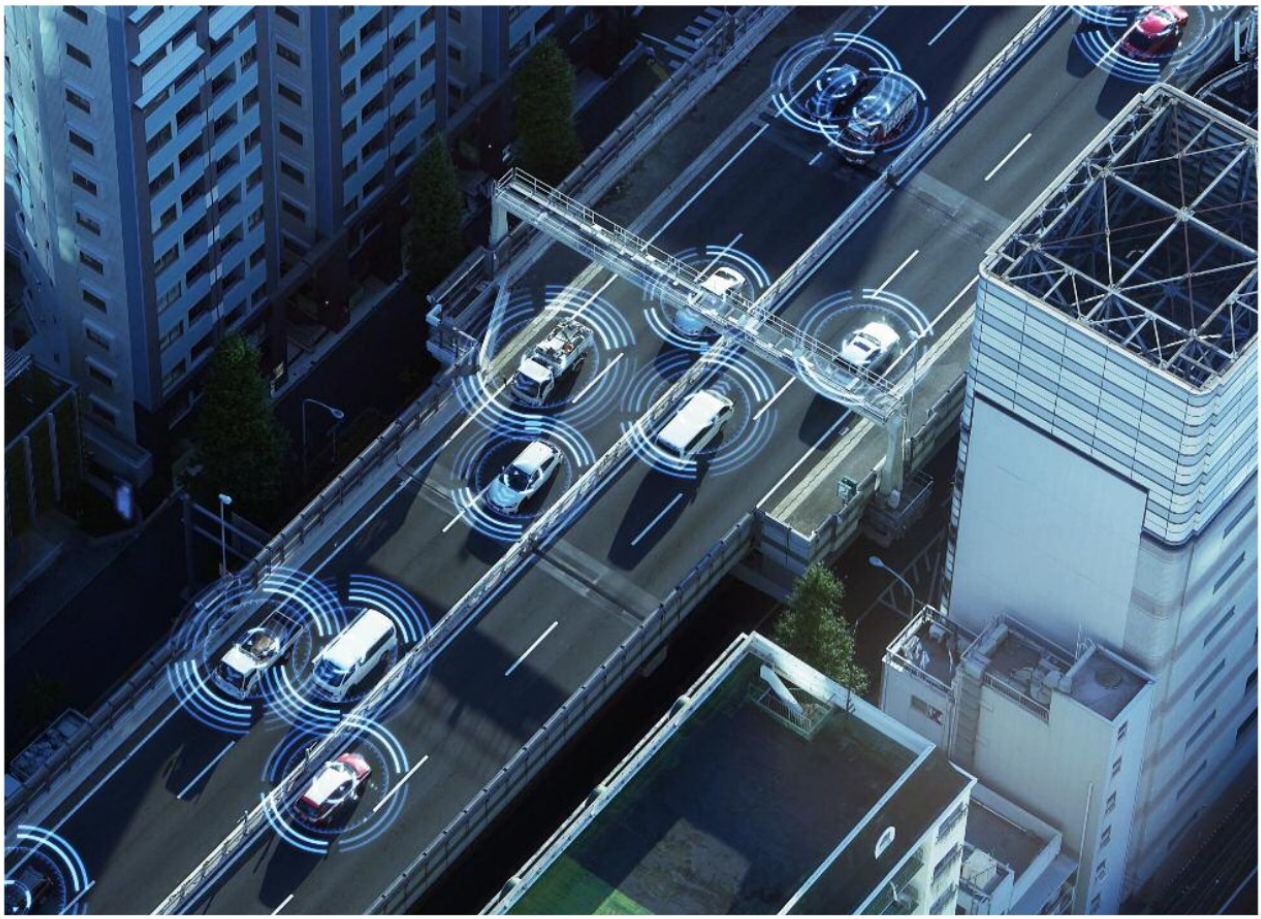
technology needed for precise positioning and lane keeping, allowing for more lanes per road, less road illumination, and less signage. This will result in a more efficient and sustainable environmentally-friendly system.

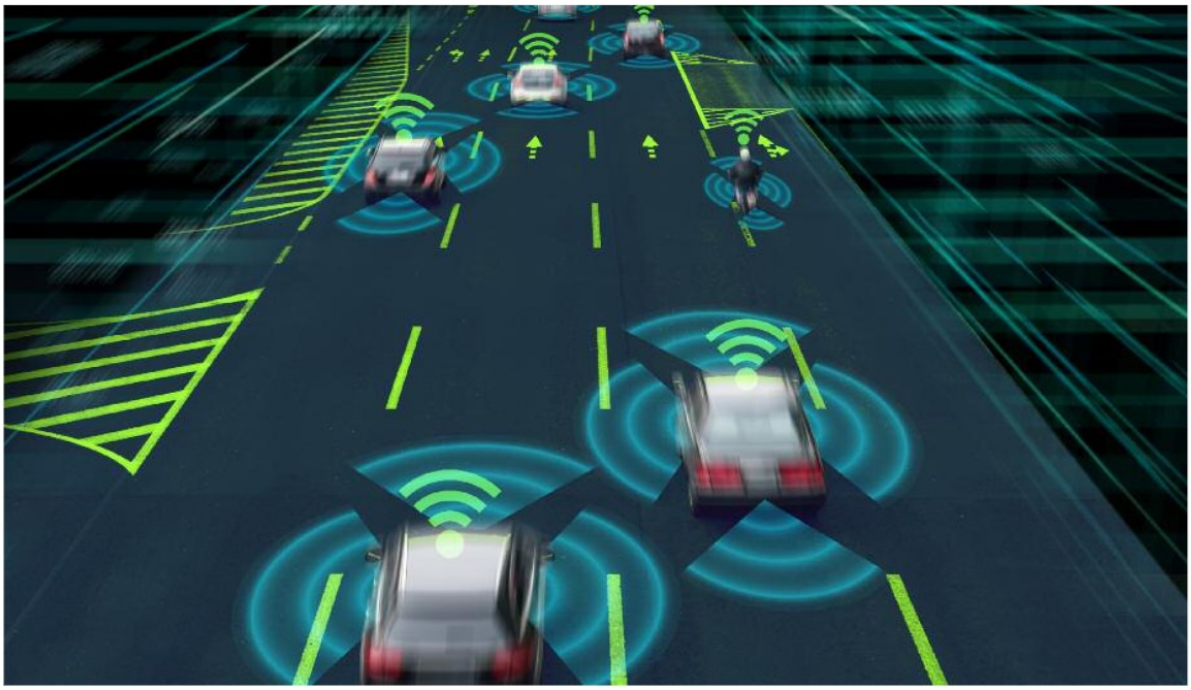
Autonomous vehicles also allow for the possibility of parking themselves after disembarking, reducing the need for wide parking allowances in congested urban parking lots. The vehicle can then be summoned from the parking lot to the owner when needed.

Finally, fully autonomous vehicles will significantly improve the commuting experience, making driving stress-free, allowing drivers to use that time for entertainment, rest, or productive work. These social benefits of fully autonomous vehicles would also open up the world of commuting to younger drivers, the elderly, and people with disabilities.

Is Canada ready for autonomous vehicles?

The simple answer is that we are not quite ready. Fully autonomous vehicles rely on vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication technology. V2V enables a vehicle to access information about the speed and position of other V2V-enabled vehicles. V2I collects data about traffic signal timing along with traffic, weather, and road conditions. This means that the successful implementation of autonomous vehicles depends on both vehicle technology (e.g. cameras, radar sensors, image processing, and on-board computers) and infrastructure technology (e.g. beacon signals, GPS, high-definition maps, and adaptive timing of traffic signals).





All this technology must be integrated and compatible within a safe, secure, and reliable wireless communication system. Our roads must also be able to physically accommodate this technology. Designated safe stopping areas must be provided so that autonomous vehicles can park

The predicted effect that the rollout of autonomous vehicles will have on insurance claims is fairly uncertain, but will no doubt require a major paradigm shift.

themselves in one of those spots in the event of technological malfunction or partial system failure. Backup ground-based systems must be developed to maintain seamless operations when unfavourable weather conditions limit satellite communications. The task ahead is large but achievable.

Ontario is preparing by creating the Autonomous Vehicle Innovation Network (AVIN) program that supports research related to autonomous vehicles. The program capitalizes on the economic potential of autonomous vehicles and helps the province plan for and adapt to this emerging technology. Ont. Regulation 306/15 has been passed under the Highway Traffic Act to allow the testing of autonomous vehicles on Ontario roads under certain conditions. A similar regulation was passed in Quebec in 2018, and Manitoba and British Columbia are looking to pass similar regulations.

How will autonomous vehicles affect insurance claim adjusting?

The predicted effect that the rollout of autonomous vehicles will have on insurance claims is fairly uncertain, but will no doubt require a major paradigm shift. With autonomous vehicles, far fewer collisions are expected, meaning fewer claims. However, the complexity of handling those claims would likely increase, as subrogation claims against the vehicle manufacturer and the autonomous network authority could be commonplace. Determining the liability split between drivers, pedestrians, and the subrogation parties will be challenging, in particular until the insurance industry catches up to the technology and

develops simplified rules of claim liability for Level 3, 4 and 5 autonomous vehicles. Those rules will also need to incorporate future developments in traffic laws and the 'rules of the road' for operating a Level 3, 4, or 5 autonomous vehicle.

Furthermore, the claim value of individual collisions involving autonomous vehicles will likely increase, both for minor collisions (due to the increasing cost of repairing or replacing the advanced safety systems in an autonomous vehicle) and for major collisions (due to possible chain-event collisions from localized system failures or defective sensors keeping an impacted vehicle out of control). Fortunately, this should be offset by the significantly reduced number of collisions and by redundant control systems to minimize the likelihood of such occurrences.

For claims adjusters, specialization in autonomous system analysis will be a standard requirement when looking for a qualified collision reconstruction expert. Investigation of each collision will involve a review of the automated vehicle sensor data and vehicle control responses, similar to assessing driver inputs in current collision investigations. Our team has been involved in standards development for automated vehicle systems since 2014, and we have been training claims adjusters and lawyers on new developments in this area since 2018.

As a first attempt to address the paradigm shift needed to insure autonomous vehicles, the Insurance Bureau of Canada (IBC) published a position paper that addresses the anticipated effect that autonomous

The first recommendation, if implemented by insurers, would ensure that injured parties are quickly compensated directly by the vehicle's insurance policy, regardless of whether or not the autonomous system was at fault.

vehicles will have on the insurance industry. The report ("Automated Vehicles: Implications for the Insurance Industry in Canada") outlines four anticipated effects:

- There will be fewer collisions but the cost to repair vehicles will increase.
- The risks associated with driving will change.
- Vehicles will record a significant amount of data.
- Responsibility for collisions will shift from the driver to the vehicle.

The IBC report recommended the following for developing a new insurance framework:

- A single comprehensive insurance policy that covers both driver negligence and the autonomous vehicle system.
- A data-sharing arrangement with vehicle manufacturers, vehicle owners, and insurers.

The first recommendation, if implemented by insurers, would ensure that injured parties are quickly compensated directly by the vehicle's insurance policy, regardless of whether or not the autonomous system was at fault. The burden would then be on the insurer, if they so choose, to sue the vehicle manufacturer or the autonomous network authority and prove liability to recover that claim payout. The increase in

individual premiums required to maintain such a policy nationwide remains to be seen and is a frightening thought.

The second recommendation, if agreed to by vehicle manufacturers, would provide insurers with the data they need to determine liability and conduct risk management for future autonomous vehicle policies. Aside from the data already stored in current vehicles (collision data in the event data recorder and navigational/personal data in the infotainment systems), autonomous vehicles will have a wealth of stored data from the active sensor systems and the autonomous control systems.

A final thought

The development of fully autonomous vehicles will provide substantial benefits to society in terms of safety, convenience, and accessibility. However, this will also bring major changes and challenges to the insurance industry. The world of claims handling will need to prepare in advance for these challenges and for the paradigm shift. While philosophers and legal experts debate the ethical dilemma of programming collision alternatives in advance, the insurance industry must prepare for its coming challenges to ensure that we are ready for the rollout of fully autonomous vehicles in North America within the next five years.

Dr. Essam Dabbour, Ph.D., P. Eng., is a senior forensic engineer at Advantage Forensics and is a recognized leading expert in road design and traffic safety. Dr. Dabbour has lectured worldwide at numerous international conferences and has published many scientific papers on road design and traffic safety research.

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