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## **Autonomous Vehicles: No Longer the Stuff of Science Fiction**

**Quentin Brogdon**

Author Contact Information:

Quentin Brogdon

Crain Brogdon Rogers, LLP

3400 Carlisle Street, STE 200

Dallas TX 75204

[QBROGDON@CBRLAWFIRM.COM](mailto:QBROGDON@CBRLAWFIRM.COM)

214.598.1009 Cell

214.552.9404

214.613.5101 Fax

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# AUTONOMOUS VEHICLES

Quentin Brogdon

## I. INTRODUCTION

The automation of our vehicles has been occurring for longer than most of us realize. As far back as 1958, brochures for Chrysler Imperials trumpeted “Auto-Pilot,” described as “an amazing new device that helps you maintain constant speed and warns you of excessive speed.” See “Products Liability and Driverless Cars: Issues and Guiding Principles for Legislation,” Brookings Institution, fn 6 April 24, 2014. That same year, an article in *Popular Science* opined that Auto-Pilot “certainly promotes safety by reducing fatigue,” and observed that, “Like it or not, the robots are slowly taking over a driver’s chores.” *Id.* at fn 7. Anti-lock brakes (ABS) have been available since the 1970s, and Electronic Stability Control (ESC) has been available since the mid-1990s. ESC uses data from multiple sources to selectively apply the brakes on specific wheels of a vehicle to increase control on turns and slippery roadways. More recently, “driver assists” systems have provided ever more autonomous control of our vehicles. Volvo’s “City Safety System” automatically applies the vehicle’s brakes to avoid a collision if the vehicle’s system determines that there is an imminent risk of collision with a vehicle detected by the vehicle’s windshield mounted sensor. Mercedes Benz’s Distronic System works in a similar manner. Audi, BMW, Ford, Land Rover, Mercedes-Benz, Nissan, Toyota, and other vehicle manufacturers now sell vehicles with automated parallel parking – a system that essentially takes over the control of a vehicle as it is maneuvered into a parking space.

Automated vehicles (AVs) are no longer the stuff of science fiction. Uber, Tesla, and every major auto manufacturer are developing autonomous and semi-autonomous motor vehicles.

We are in a transition period, when it comes to AVs. The technology is still in its infancy, and AV and drone crashes and mishaps are occurring with some frequency as the technology is developed and perfected. As manufacturers and developers race to be at the head of the AV line, they are taking short-cuts and not paying sufficient attention to safety concerns, in the eyes of many.

The consensus is that autonomous vehicles (AVs) will reduce crashes and save lives, but there are numerous unanswered questions about legal liability, insurance coverage for crashes, and governmental regulation. AVs have already failed, and they will continue to fail. When AVs fail, who will get sued, and what causes of action will be alleged?

## II. NHTSA’s VEHICLE AUTOMATION LEVELS

In 2013, the National Highway Traffic Safety Administration (NHTSA) defined levels of vehicle automation as follows, in NHTSA’s “Preliminary Statement of Policy Concerning Automated Vehicles”:

Level 0: No automation

Level 1: Function Specific Automation - Automation at this level involves one or more specific control functions; if multiple functions are automated, they operate independently from each other. The driver has overall control, and is solely responsible for safe operation, but can choose to cede limited authority over a primary control (as in adaptive cruise control), the vehicle can automatically assume

limited authority over a primary control (as in electronic stability control), or the automated system can provide added control to aid the driver in certain normal driving or crash-imminent situations (e.g., dynamic brake support in emergencies). The vehicle may have multiple capabilities combining individual driver support and crash avoidance technologies, but does not replace driver vigilance and does not assume driving responsibility from the driver. The vehicle's automated system may assist or augment the driver in operating one of the primary controls – either steering or braking/throttle controls (but not both). As a result, there is no combination of vehicle control systems working in unison that enables the driver to be disengaged from physically operating the vehicle by having his or her hands off the steering wheel AND feet off the pedals at the same time. Examples of function specific automation systems include: cruise control, automatic braking, and lane keeping.

**Level 2: Combined Function Automation** - This level involves automation of at least two primary control functions designed to work in unison to relieve the driver of control of those functions. Vehicles at this level of automation can utilize shared authority when the driver cedes active primary control in certain limited driving situations. The driver is still responsible for monitoring the roadway and safe operation and is expected to be available for control at all times and on short notice. The system can relinquish control with no advance warning and the driver must be ready to control the vehicle safely. An example of combined functions enabling a Level two system is adaptive cruise control in combination with lane centering. The major distinction between level one and level two is that, at level two in the specific operating conditions for which the system is designed, an automated operating mode is enabled such that the driver is disengaged from physically operating the vehicle by having his or her hands off the steering wheel AND foot off pedal at the same time.

**Level 3: Limited Self-Driving Automation** - Vehicles at this level of automation enable the driver to cede full control of all safety-critical functions under certain traffic or environmental conditions and in those conditions to rely heavily on the vehicle to monitor for changes in those conditions requiring transition back to driver control. The driver is expected to be available for occasional control, but with sufficiently comfortable transition time. The vehicle is designed to ensure safe operation during the automated driving mode. An example would be an automated or self-driving car that can determine when the system is no longer able to support automation, such as from an oncoming construction area, and then signals to the driver to reengage in the driving task, providing the driver with an appropriate amount of transition time to safely regain manual control. The major distinction between level two and level three is that at level 3, the vehicle is designed so that the driver is not expected to constantly monitor the roadway while driving.

**Level 4: Full Self-Driving Automation** - The vehicle is designed to perform all safety-critical driving functions and monitor roadway conditions for an entire trip. Such a design anticipates that the driver will provide destination or navigation input, but is not expected to be available for control at any time during the trip. This includes both occupied and unoccupied vehicles. By design, safe operation rests solely on the automated vehicle system.

### **III. AV CARS DO NOT SEE WELL, AND THEY DO NOT ALWAYS “DECIDE” WELL**

AVs navigate with a sophisticated array of systems and sensors, including on-board computers and software, Global Positioning Systems (GPS), Radar sensors that use radio waves, and LIDAR sensors that use light beams, among others. But AV systems do not always “see” well, and they do not always

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