# AUTOMATED DRIVING VEHICLES – LIABILITIES IN CASE OF ACCIDENTS

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## INTRODUCTION

One of the most popular research topics in the modern automotive sector is autonomous vehicles (AVs), sometimes known as smart automobiles. One of the best uses of the internet, smart automobiles can exchange data with other devices both inside and outside the vehicle. It is a vehicle that navigates between locations autonomously by combining sensors, cameras, radars, and Artificial Intelligence (AI). By eliminating accidents and providing benefits like increased mobility, lessened congestion, etc., AV technology also intends to revolutionize the transportation ecosystem. The most important concerns are with the safety and security of AVs since they directly impact human life. Transport will change as a result of AVs. AVs are becoming a reality as of late. Due to recent advancements in the internet of things (IoT) and related advances, AVs are becoming a reality. Many automakers are creating autonomous vehicles. businesses including Volvo, Volkswagen, BMW, Tesla, and Audi. Numerous studies have been conducted on AVs that potentially enhance traffic safety and lower accident rates.

## MECHANISM OF AUTOMATED VEHICLES

Artificial Intelligence (AI) Technologies are involved in the functioning of self-driving cars. All sensors, input, and Google Street View are linked to AVs. There is a network that identifies patterns given to it through Machine Learning Algorithms. The car identifies the surroundings like traffic lights, trees, and pedestrians, and stores it in form of data. The developers of AVs use the data from image recognition for every mile covered by the car. They get the data from the car which they use to enhance the quality of the ride. The WAYMO project by Google is a sample of AV[1], however, a human driver is still required, but just to override the system as necessary. In ideal circumstances, it can drive itself. It is rather autonomous. The workload of drivers may be eased, and the security of the transportation system can be increased. A safety and security framework, motion planning algorithms, and object detection are also covered. The vehicle's software checks Google Maps for information on nearby landmarks.

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[1] https://waymo.com/

## AUTOMATED VEHICLE FEATURES

Features include HANDS-FREE STEERING allows the driver to turn the automobile without holding the steering wheel. Although it can drive itself with a limited degree of autonomy, it is not truly autonomous. ADAPTIVE CRUISE CONTROL (ACC) keeps the driver's automobile at a predetermined distance from the vehicle in front, LANE ANE CENTERING STEERING steps in to automatically nudge the car in the direction of the other lane. AUTOMATIC EMERGENCY BRAKING SYSTEM (AEBS), this feature enables you to stop the vehicle to avoid a collision. The primary focus of feature enhancement or addition is safety in pursuit.

## SAE CLASSIFICATION

SAE (SOCIETY OF AUTOMOTIVE ENGINEERS) is a professional association [2]and organization that develops standards for engineering professionals with a US-based worldwide presence. The company's headquarters are in Warrendale, Pennsylvania. The SAE foundation promotes and aids in the advancement of knowledge in the fields of science, technology, engineering, and math. Companies, governmental organizations, academic institutions, and consultants can collaborate to create technical standards through SAE International. Except in certain circumstances, its documents are not legally binding. It suggested a significant classification for driving automation levels. It offers extensive requirements for brake horsepower(bhp) and horsepower (hp).

## LEVELS OF AUTOMATION

AVs are classified within several levels of autonomy that range from 0 – 5

- LEVEL-O: NO AUTOMATION

Vehicles at this level have no autonomous capabilities meaning, Even though the car has warning and intervention systems, the driver still has full control over it. Only Ordinary Cruise Control is available to aid in long-distance driving and lessen the likelihood of receiving a speeding ticket; it just offers a quick intervention during a potentially dangerous circumstance.

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[2] https://www.sae.org/blog/sae-j3016-update

- ### LEVEL-1: DRIVER ASSISTANCE

This is the most fundamental kind of autonomy and safety, in which one aspect of the driving process is taken into account using information from sensors and cameras, but the driver is still very much in control. Adaptive Cruise Control can be seen here keeping a safe space between you and the car in front of you, braking when required, and picking up speed when it is safe to do so. These were the initial measures taken to create an autonomous car.

- ### LEVEL 2: AUTOMATION TO A DEGREE

Here, the driver must be in charge at all times and have their hands on the wheel. The driver must still execute tactical actions like swerving to avoid dangers and changing lanes in response to traffic signals. These come with an ADAS, or advanced driver assistance system, which may take over control of the navigation, acceleration, and braking. Level-2 autonomous capabilities are provided by Tesla Autopilot and Volvo Pilot Assist.

- ### LEVEL 3: CONDITIONAL AUTOMATION

It is a specific mode that handles all aspects of driving but the driver must be ready to respond to a request to intervene. AVs can drive themselves, but only in the perfect situation and with certain restrictions. Some Vehicles at this level have "Environmental Detection" capabilities and can make informed decisions for themselves. AUDI A8 is an example of this level of Automation.

- ### LEVEL-4: MAXIMUM AUTOMATION

At this stage, the vehicle is completely capable of keeping track of its surrounding environment and managing every aspect of it. The car could warn the driver if there is a lot of snow and the road becomes slippery or if it's getting close to its breaking point. If the driver does not react, the car will be restrained with safety features like slowing down and eventually stopping.

- ### LEVEL-5: FULL AUTOMATION

These are fully autonomous, meaning a driver is not required to perform the driving task. These are not bound by or affected by the weather and can transport human beings comfortably and efficiently. Passengers simply need to enter voice commands to get from point A to point B or onboard systems such as entertainment, air conditioning, and video calling.

Although the technology for a fully autonomous car exists today, they are still in the development stage. The mainstream use of Level-5 vehicles will be seen in the future

## LIABILITIES IN CASE OF AN AV ACCIDENT

Liability in case of an AV accident, especially with people being hurt is difficult to determine. There are different opinions on the matter of liability. Liability in the case of an AV accident has no clear answer, it depends on multiple factors. It is said that the focus will shift from personal liability to manufacturer liability. Car accidents are usually caused by human error or negligence, the victim may pursue damages based on drivers' negligence but in the case of AVs, the accident may have been a defect in the vehicle, which means the manufacturer is at fault. However, in the context of technological, legal, and moral obligations, liability can be addressed.

Product Liability[3]:

Manufacturer responsibility is mostly based on product liability. Manufacturing flaws, design flaws, and failures to warn are all grounds for suing a company.

(a) Manufacturing Defects: When a product does not perform in accordance with its specifications, there is a flaw. The claimant must provide evidence that the product did not perform as intended.

(b) Design Defects: These flaws are merely regarded as accidents that may have been prevented with a better or different design. Market expectations testing and vulnerability testing can be used to identify flaws.

(c) Failure to warn: A producer is required to warn customers about any potential risks and to offer precise instructions on how to use the product properly. The product is dangerous to use if there are no instructions or cautions.

## Could the owner (Personal Liability) of an AV be held liable?

Yes, the owner of the AV can be held liable. There are certain situations where the owner can be held liable for example if the owner decides to take over control of the vehicle by removing the autopilot mode during which if he causes an accident that will be completely his liability, another such situation is that if the owner fails to maintain the vehicle if he fails to service the

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[3] https://www.mdpi.com/2032-6653/12/2/62/htm#:~:text=Operator%20(Driver)%20Liability

car which leads to a failure in the functioning of the car properly and led to an accident then the owner can be held liable.

## INSURANCE LIABILITY

Claiming Insurance after the accident and on whose part does the fault lie? This is a concern for the insurance company. It communicates with all other entities to find out the liable entity in case of an accident. It also defines new policies, regulations, or updates. Based on its communications it decides the liable entity and sometimes is also responsible for paying compensation on behalf of a client. In AVs, the responsibility of the driver will be shifted to the manufacturer for most of the accidents and the manufacturers need to insure against road accidents. Manufacturers will be solely held liable for the damage to fully automated vehicles. As current insurance regulations do not apply to AVs in most cases, new rules should be defined about compensation and fault determination. The social attitudes toward mobility are changing rapidly along with advanced technology, insurance companies have to rethink their relationship with drivers, owners, and manufacturers.

Personal Overview: NO fault insurance and Victim compensation are two good options.

## PROS AND CONS OF AVS

**The Pros:**

- Reduced Vehicle crashes: Major car crashes are due to human error; Avs introduction will help in decreasing the number of accidents. Accidents that frequently occur are caused because of driver's faults like misjudgments, carelessness, or negligence.

- More Efficient Travel: The communication technology involved in AVs where communication is a real-time analysis that can help determine routes and enhance the quality of ride by efficiently choosing the best routes, and calculating the appropriate speed for traveling.

- Decreased Traffic Flow: The communication technology in AVs can improve traffic concerns by planning a well-devised route for traveling between point A to point B.

- Easier access for the Elderly and Disabled: AVs are a safer, more accessible alternative for persons with disability and as well for the elderly. A study by Ruderman Family Foundation said that AVs would enable new employment opportunities for

approximately 2 million individuals with disabilities as they face problems in commuting.[4]

## THE CONS

- Wide Adoption is necessary: To be able to consider the above-mentioned pros, there should be wide adoption of AVs. Everyone cannot afford AVs as they are a bit expensive. The technology costs much more than what a normal car offers. It will be difficult for a common man to afford.

- Effect on the Transportation sector: The population depending on the automotive industry for their livelihoods, will have to look for alternatives. People working in public transit, and delivery service will lose their jobs.

- Hackers and Cyber-Security threats: Security issue is a major concern for AVs. The vehicle relies on a computer to function. The computers are prone to hacking, if the hacker could get into the system of the vehicles, he can do anything he wants with the vehicle.

- The Morale Dilemma: The idea of AI in driving vehicles is not completely perfect. For example, AV chooses to run off the bridge possibly killing the passenger inside, in an attempt to avoid a crash.

## INCIDENTS OF CRASHES OF AVS

- **Uber car crash in Arizona, United States** [5]

Elaine Herzberg aged 49 on March 18, 2018, was pushing her bicycle across a High Way in Tempe, Arizona, when she was hit by a uber test vehicle (Volvo XC90) that was in self-drive mode. She was rushed to the local hospital with serious injuries which led to her death. After the incident, the National Transportation Safety Board (NTSB) [6]issued an order to uber to suspend testing of AVs in Arizona. IN March 2019 the driver was charged with negligent homicide.

- **Death of two men riding in driver-less Tesla Model S**[7]

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[4] https://rudermanfoundation.org/white_papers/self-driving-cars-the-impact-on-people-with-disabilities/
[5] https://www.bbc.com/news/technology-54175359
[6] https://www.ntsb.gov/Pages/home.aspx
[7] https://www.nytimes.com/2021/04/18/business/tesla-fatal-crash-texas.html

Two men were riding in Tesla Model S and were in Auto Pilot mode when the car failed to make a cul-de-sac bend and ran off the road just before 11:30 p.m. CDT on Saturday 17 April 2021 in the Houston suburb of Spring, Texas. Police officers came to the preliminary conclusion after investigating that although the car was moving quickly, no one was in the driver's seat and that the two unidentified guys were instead seated in the front passenger seat and the back.

- **Crash of Tesla Model S on Autopilot in Hebei province, China**

In China's Hubei province, A crash involving a Tesla with Autopilot took place[8]. Gao Yaning, 23, of Hebei province was operating a Model S when it collided with a street sweeper at high speed. The graphic video was captured on the dash camera of the car. Model S is seen racing along a foggy highway, a street sweeper truck that occupies roughly a fourth of the lane which is clearly visible. The Tesla strikes the junk truck at full speed rather than slowing down or changing lanes.

## LAWS ON AVS

Many nations have created legislation to deal with certain AV-related cases. Many American states, like Michigan, Nevada, and Washington, D.C., have established regulations that specify how responsibility will be handled. The majority of these new regulations include a detailed list of licensing criteria for autonomous vehicle operation.

UNITED STATES:

The above-mentioned states brought these laws back in 2012 and 2013, these provisions are:

- Limits a vehicle manufacturer's or upfitter's responsibility for damages in a product liability lawsuit stemming from alterations made to an automated vehicle or technology by a third party under specified conditions.
- Any conversions in the car are restricted, the manufacturer will not be liable for a converted car.

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[8]https://datasetsearch.research.google.com/search?query=tesla%20deaths&docid=L2cvMTFxcDJybnYxNQ%3D%3D

NHTSA- Guidelines:

The National Highway Traffic Safety Administration[9] published a policy study to promote the use of highly automated vehicles, often known as autonomous vehicles, or HAVs, Rules concerning HAV liability are determined by the states. When a crash happens, states should and to outline principles for a preliminary regulatory framework. The essentials are:[10]

- think about how to divide responsibility among HAV owners, operators, passengers, manufacturers, and other parties.
- Liability for collisions involving a particular HAV is not always determined by identifying who or what is the "driver" of that HAV in a specific situation.
- Consumer adoption of HAVs and their rate of implementation might be significantly impacted by rules and regulations that allocate tort liability. In areas where HAVs operate, these regulations may also have a significant impact on the incidence and cost of motor liability insurance.
- The States may discover new liability problems in the future and work to provide unified fixes. The formation of a commission to research liability and insurance concerns and offer suggestions to the States may be useful.

 UNITED KINGDOM:

In 2018, a British Automated Vehicle and Electric Vehicles act of parliament defines the rules for:

- The Secretary of State's list of autonomous cars.
- Contributory negligence etc.
-  Responsibility for insurance, etc., in the event, that an automated vehicle accident occurs.
- An accident brought on by illegal software modifications or a failure to update software, among other things
- The ability of insurers, among others, to file a claim against the accident's cause

**Basic liability**

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[9] https://www.nhtsa.gov/
[10] https://www.transportation.gov/AV/federal-automated-vehicles-policy-september-2016

Some instances of autonomous vehicle liability are defined by law.

(1) Where—

> (a) When an autonomous vehicle in Great Britain is operating by itself on a road or other public space, it causes an accident,

(b) the car was covered by insurance at the time of the accident and

(c) The insurer is responsible for any harm that an insured person or any other person sustains as a result of the accident.

d) The vehicle is exempt from section 143 of the Road Traffic Act of 1988 (uses of motor vehicles must be insured or secured against third-party risks) at that time due to section 144(2) of that Act (exemption for public bodies etc.) or (ii) the vehicle is in the Crown's public service, and

(e) the harm caused by the accident to a person,

That damage is the responsibility of the car's owner.

**liability in case of the unauthorized alteration of software**

For instance:

The insurer's obligation under section 2(1) for damage sustained by an insured person resulting from an accident happening as a direct result—may be excluded or limited by an insurance policy relating to an autonomous vehicle.

(a) any software modifications made by the insured party or with their knowledge that are against the terms of the policy, or

(b) the insured person's failure to apply safety-critical software upgrades that they know, or should reasonably know, are safety-critical.

— *Automated and Electric Vehicles Act 2018*[11]

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[11] https://www.legislation.gov.uk/ukpga/2018/18/section/4

**CONCLUSION**

As we are at the beginning of this new technology, which is fast moving and without properly addressing safety issues. However, despite the fact that technology is not yet at a level that is suitable for fully autonomous vehicles, the advancements we are witnessing are suitable for a much-needed discussion regarding the potential applications of this technology in the future, once it has been fully developed. Transportation is essential to our civilization; thus, it would be foolish to assume that autonomous vehicles won't fundamentally alter how we live. Aside from their advantages, AVs also have negative social, environmental, economic, and security/safety implications. The most important concerns are with the safety and security of the AVs since they directly impact human life. The focus is on making changes in road safety and commuting and drastically reducing accidents and human errors through continuous system learning because self-driving cars are the primary advancement in the automatable industry in the future. Currently, in the event of an accident, the driver is primarily held responsible. It becomes extremely obvious that the car industry needs to create AVs that are the greatest in design and completely safe because else, product liability lawsuits will continue to rise in the future. Additionally, research should be conducted to determine how product responsibility may be included with cost-benefit analysis from the manufacturer's perspective without compromising the efficiency, security, and safety of the AVs