The mock civil trial for a hypothetical crash caused by a vehicle with the Level 2 automated driving system

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1. Introduction

The Automated Driving HMI Committee, consisting of human factors experts from universities and other research institutions, experts from the legal and law professions, experts from industry, and safety-conscious automobile users, had been active for three years from FY2020 to FY2022 in JSAE (Society of Automotive Engineers of Japan). The SAE Level 2 Automated Driving System is already being distributed around the world, however a number of road crashes caused by vehicles with the system have already been reported. Most of these crashes involved human factors such as drivers' over-trust or misunderstanding of the system functions. A fatal crash of Tesla occurred in Yokohama, Japan, in 2018 and the driver of the Tesla was found guilty, in the criminal trial, of negligent driving that had caused death and injuries. Focusing on the crash in Yokohama, the committee delved deeper into the human factors behind the crash. In order to summarize the discussion, a mock civil trial was held on December 20, 2022 in the courtroom of Meiji University. The aim of the trial was to examine how the legal liability would be determined when the human factors, especially the limitations of human capabilities, were publicly known. The committee provided recommendations on what should be done in order to avoid similar crashes in the future.

2. Overview of the fatal crash caused by Tesla in Yokohama

On April 29, 2018, two passenger cars collided in the third traffic lane (fastest lane) of Tomei Expressway, and a following car (a third car) stopped in the same lane before the spot of the collision. One of the motorcycles traveling in a group in the same lane failed to detect the stopped third car and crashed with it (pre-occurred crash). Another car (a fourth car) followed by a Tesla approached the pre-occurred crash in the same lane and changed lane into the second traffic lane in order to avoid the pre-occurred crash. However, the Tesla accelerated and crashed into the pre-occurred crash. The Tesla killed a rider and injured two other riders of the motorcycle group who were waiting for a rescue by the pre-occurred crash (Figure 1). The Tesla was driving with Autopilot functioning.

The case went to the criminal trial, and the Tesla driver was found guilty of negligent driving that had caused death and injuries. The obstacle detection function of the Tesla Autopilot was not judged for defectiveness because it was not clear whether the object detection failure was due to a malfunction or a functional limitation.

The family of the victim rider subsequently filed a product liability lawsuit in the U.S. District Court in San Jose against Tesla, alleging defects in the Tesla vehicle. The claim of the plaintiff referred to the human factors as the cause of the crash, stating that "Inattention and drowsiness induced driver's over-reliance on the automated driving technology and caused the crash". The claim of the plaintiff also

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included a reference to a driver monitoring system, stating that "Determining driver's engagement in the driving task based only on driver's hands position was defective". This case was dismissed on the grounds of international jurisdiction (the Japanese court being preferable). However, it was requested to Tesla that Tesla should accept a service of process provided by a court in Japan, make deposition of witness available, and make judgment in Japan enforceable both in Japan and in the United States.

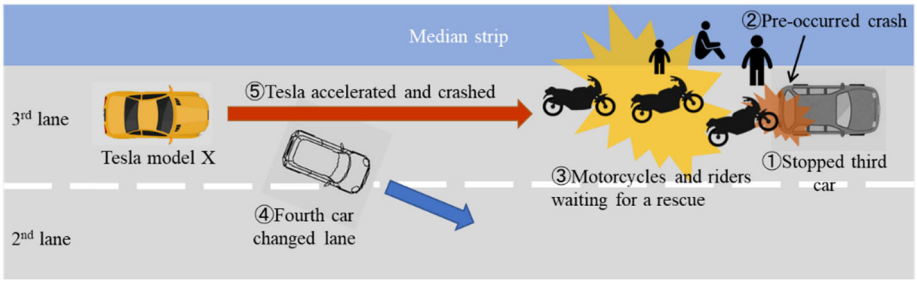


Figure 1. Fatal crash caused by Tesla in Yokohama Japan in 2018

3. Mock Trial

3.1 Aim of the Mock Trial

The aim of this mock civil trial (Figure 2) was to examine, using a hypothetical crash scenario caused by a car with the Level 2 automated driving system, if the legal liability of the manufacturer for inappropriate or inadequate system design and that of the dealer for inappropriate or insufficient explanation about the system would be recognized when the limitations of human capabilities for safe use of the system were publicly known.

Figure 2. Mock trial in the courtroom at Meiji University

3.2 Hypothetical crash scenario

1) Automated driving system

Level 2 hands-on system (product name "Auto Driving System, AuDS")

2) Time and place of the crash

Date: 14:00, Friday, September 30, 2022

Location: Near the west side of Numazu Tunnel between Shin-Shimizu IC and Surugawan Numazu IC on 2nd Tomei Expressway towards Tokyo

3) Crash scenario

① The subject vehicle entered 2nd Tomei Expressway from Toyota Higashi IC.
② The driver soon activated AuDS in the 2nd lane and set the speed at 120km/h.
③ After passing Shin Shizuoka IC, the driver felt a little sleepy but he believed he could manage till arriving at Gotemba City which was the goal.

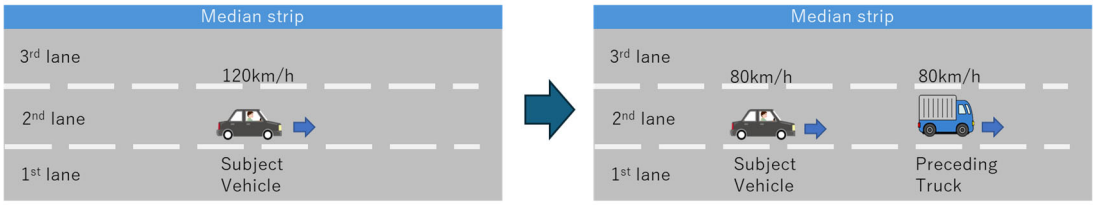
④ After passing Shin Shimizu IC, the subject vehicle caught up with a truck traveling at about 80km/h within the 2nd lane and stayed behind the truck by the AuDS (Figure 3a).

⑤ Just before Numazu tunnel, the preceding truck changed lane rapidly to the 1st lane.

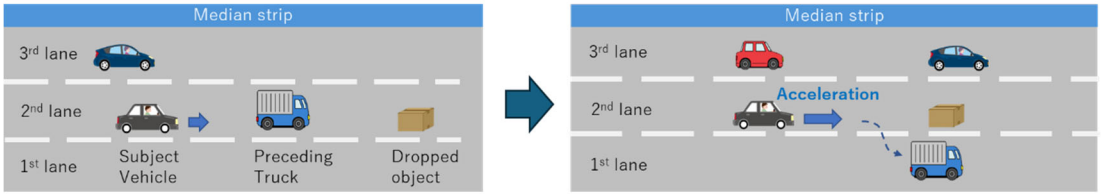
⑥ The driver of the subject vehicle found a dropped object just in front but the subject vehicle began to accelerate automatically (Figure 3b).

⑦ The driver got upset and hurriedly turned the steering wheel, with braking, to change lane to the vacant 1st lane. The subject vehicle lost stability, ran over the shoulder into the slope, and flipped over (Figure 3c).

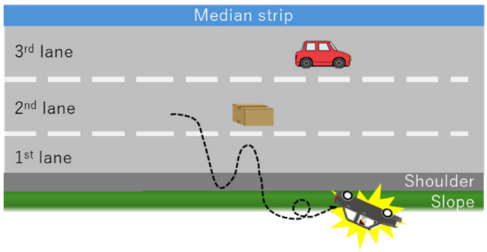
⑧ The driver got his bones broken that caused aftereffects. The vehicle was badly damaged and a vase of 130K USD being carried by the car was broken.



(a) Scenario ①-④



(b) Scenario ⑤⑥



(c) Scenario ⑦⑧

Figure 3. Crash scenario

4) Other facts

⑨ AuDS had a good reputation. The driver of the subject vehicle interpreted “Auto” of the system name as a function that would handle a situation like that to avoid a crash automatically.

⑩ At the dealer, the driver was explained by a written document about the system features and how to use the system, and signed the informed consent. There was no verbal explanation about the system.

⑪ The driver was not explained sufficiently that the system would not be able to cope with a situation like that. The driver was not explained either that the car would accelerate automatically in a situation like that.

⑫ The driver was explained that the system was a driver assistance system. He interpreted it as a system that would assist the driver to avoid a crash like that.

3.3 Lawsuit Filing

Plaintiff (driver of the subject vehicle) claimed a total of 268K USD (67K USD for the car, 134K USD for the vase, and 67K USD for the medical treatments) against the manufacturer (Defendant 1) and the dealer (Defendant 2) of the car.

3.4 Claims of Plaintiff (driver of the subject vehicle)

Claim for damages against Defendant 1 (manufacturer) under the Product Liability Act.

The cause of action for this claim is a defects in the vehicle, namely: 1. Defects in the design: (i) despite the existence of the object, the system generated sudden acceleration towards the object. (ii) safety measures were not designed considering decline in alertness of an ordinary driver when AuDS was in operation. 2. Defects in warnings and instructions: Defendant 1 failed to provide minimum warnings and instructions for Plaintiff to respond appropriately to the situation that AuDS and Autonomous Emergency Braking system (AEB) would not be able to handle.

Claim for damages against Defendant 2 (dealer) for damages based on the breach of the contract.

The cause of action for this claim are: 1. Sale of the car with the above defects. 2. Breach of the duty to explain features of the car with AuDS and AEB so that Plaintiff would understand them and use the car appropriately.

3.5 Opinions of Appraisers

1) Opinion of Appraiser 1 (human factors expert) about human capability limitations

There are three key points when looking at the course of this crash from a human factors point of view. First, there is a range of task demand that keeps high alertness of humans. Lower demands than the range can cause a decrease in alertness. Monitoring task is a typical example for the task with the lower demands. The Level 2 system requires monitoring task of the driver while the vehicle is controlled by the system. It is also generally known that it is difficult for humans to maintain a constant level of alertness during monitoring tasks, and oversights can increase after 30 minutes of monitoring. Plaintiff had been using the system for approximately two hours continuously before the crash and detection of the dropped object may have been delayed. Second, it is difficult for general drivers to understand system limitations of detection of objects other than cars. Daily driving experience with the system detecting front cars securely can make the driver over-simplify the perceived system function as being able to detect any objects in front. There was a possibility that Plaintiff expected the system to detect the dropped object, resulting in a delay of the avoidance action. Third, when a human receives an unexpected and strong stimulus, he/she tends to reflexively shrink the body (i.e. the startle reflex). The sudden acceleration of the subject vehicle towards the dropped object was unexpected vehicle behavior for Plaintiff expecting deceleration. The startle reflex may have caused Plaintiff to steer abruptly to avoid the object, resulting in the loss of vehicle control and the crash.

2) Opinion of Appraiser 2 (human factors expert) about importance of education

It is important to provide drivers with appropriate knowledge about necessary driver interventions into vehicle control when using an automated driving system and a driver assistance system. The tasks to be performed by the driver, which are dependent on the levels of automated driving, are not well understood by the general public. Drivers need to understand that Level 2 systems generally have functional limitations, and the driver must take appropriate actions at those limitations with or without notification from the system. Furthermore, it is important to inform drivers, with representative examples, of situations where the system may miss or misjudge objects, and actions to take by the driver to cope with the situations. It is desirable to give drivers an experience driving through such situations, using a driving simulator or a real vehicle.

In this case, it is questionable how much effort Defendant 1 (manufacturer) made to prevent misunderstandings of Plaintiff about the driver assistance system. It was possible that Plaintiff misunderstood the system functions and expected the system being able to assist the driver in any troubles. Defendant 1 explained "AuDS does not react to objects other than vehicles," but “AEB assists the driver in

avoiding collisions with pedestrians, too" which may have caused confusion and misunderstanding of Plaintiff. There was no explanation by Defendant 1 about what actions driver should take when the system did not react to non-vehicle objects. Defendant 2 (dealer) only gave written materials on “important information” and requested Plaintiff to sign the informed consent. No verbal explanations and interactions were given. It is not always possible for general users to understand wide range of “important information” through written materials.

3.6 Rebuttals of Defendant 1 (Manufacturer)

Although Plaintiff claimed defects in the system design and defects in warnings and instructions for the damages under the Product Liability Law, there was no basis for either of these claims. The vehicle was equipped with AuDS, the Level 2 automated driving system, which had been designed appropriately as a driver assistance system requiring driver’s responsibility for safe control of the vehicle. AuDS assists the driver by maintaining the vehicle speed at a set one or the headway distance when there is a vehicle in front. Therefore, it was a normal vehicle behavior that the vehicle accelerated to achieve the set speed of 120km/h when the front vehicle (running at 80km/h) disappeared by changing lane. The main cause of the crash was Plaintiff’s violation of duty for safe driving in that Plaintiff saw the dropped object in his path and got panicked, resulting in stepping on the brake and turning the wheel abruptly that made the vehicle loose stability and controllability. Installation of safety counter measures for low alertness of ordinary drivers when using the Level 2 systems was not required by laws and regulations. Plaintiff was obligated to maintain a certain level of alertness by, for example, immediately taking a rest when he became aware of declined alertness. However, Plaintiff failed to do so. There were no defects in the system design.

Defendant 1 had been conducting sufficient publicity activities to prevent general users from misunderstandings of functional limitations of AuDS. Such information was comprehensively written in the instruction manual. Also, the system was designed to visually display such information each time the power of the vehicle was activated. Therefore, Plaintiff should have known that AuDS was a driver assistance system and that the driver was responsible for taking appropriate actions when the situation was beyond the functional limitations of the system. As stated above, Plaintiff should have known the risks in using the system and could have avoided the risk. There were no defects in warnings and instructions.

3.7 Rebuttals of Defendant 2 (Dealer)

Although Plaintiff claimed breach of the contract of Defendant 2 for the sale of the car with defects in the system design, there was no basis for this claim. It was a vehicle that had received proper type certification. If there had been problems in the system design, the problems would have lain in the type certification. Also, the instruction manual had been provided by Defendant 1 and Defendant 2 had no responsibility to explain more than the contents of the instruction manual. Defendant 2 had no responsibility for the damages in this respect.

Although Plaintiff also claimed breach of the contract of Defendant 2 for inappropriate and insufficient explanation about feature of the car, there was no basis for this claim, too. Defendant 2 had no responsibility to prevent users’ misunderstandings about the system caused by media reports. Imposing such a responsibility on dealers is excessive consumer protection and induces users to abandon their efforts to understand the system. Defendant 2 fulfilled its responsibility by giving Plaintiff a written explanation of “important information”, that included general information about the system functions, and obtaining plaintiff's signature on the informed consent. Defendant 2 had not been requested by Plaintiff for further information. The behavior of the vehicle would not have occurred if the driver’s alertness had been on the normal level. Defendant 2 did not have a responsibility to explain such behavior in advance. It was understandable for general users that the driver had the responsibility for safe driving with the driver assistance system. Defendant 2 had no responsibility for the damages in this respect.

3.8 Judgment

Conclusion of the Judgement

Defendants shall pay Plaintiff 107K USD. The remaining claims of Plaintiff are dismissed.

Reasons for reaching the conclusion

Issue 1) Defects of the system under the Product Liability Act

The vehicle satisfied the safety standards of the Road Trucking Vehicle Law. The system of the vehicle did not violate any of the performance guidelines set forth by the national government or industry organizations. Therefore, no "defect" was found.

The reduction of alertness while driving was an obvious phenomenon from both empirical and ergonomic viewpoints. However, the primary driver of a car with the Level 2 system was still a human driver, and responsibility of the human driver for safe driving did not decrease.

Although there is a growing need in Japan and other countries for driver monitoring systems, they are still under discussion as future solutions.

Issue 2) Duty for explaining the system at the time of sale

Functions, performance, and limitations of the Level 2 driver assistance system are complicated and it is difficult for drivers to understand all. However, it is possible to increase possibility for the driver to cope with situations like the situation of this case by warning, explaining or letting drivers experience typical and representative situations in advance.

The primary driver of a car with the Level 2 system is a human driver and the system only “assists” the human driver. However, there are vehicle behaviors that are different from driver’s expectations based on his/her experiences. Expecting drivers to read and understand delivered instruction manual was not sufficient. A defect in instructions and warnings under the Product Liability Law was recognized for Defendant 1 and a breach of the duty of explanation was recognized for Defendant 2.

Issue 3) Ratio of responsibility (Comparative Negligence)

The primary driver of a car with the Level 2 system is a human driver. Even when AuDS of the vehicle was functioning and the driver did not need to operate the vehicle control including steering, the driver still had the responsibility for safe driving.

It was recognized that Plaintiff may have been drowsy. Even if a decrease in alertness or attentiveness was a natural consequence with the system from ergonomic viewpoints, absence of a device to avoid such a decrease did not immediately become a defect of the vehicle (already judged in Issue 1), and driver’s duty for safe driving was not reduced. If the driver had been properly watching the road ahead, he would have been able to easily detect and avoid the object. Therefore, Plaintiff bore the primary responsibility for the injury of Plaintiff and the damages to the vehicle and the vase caused by the crash.

On the other hand, as already judged, responsibilities of Defendants were also recognized. It could not be overlooked that Defendants’ problematic explanation about the system could have influenced Plaintiff’s understanding of the system and contributed to occurrence of the crash.

Taking the above into consideration, it is reasonable to consider that the ratio of responsibility is 6:4 for Plaintiff and Defendants.

4 Committee recommendations for the future

The aim of the trial was to examine how the legal liability would be determined when the human factors, especially the limitations of human capabilities to safely use the Level 2 systems, were publicly known. The judgment results were that defects in the system design under the manufacturer's liability were not recognized, while only a part of the responsibility of the manufacturer and the dealer was recognized for the insufficient and inappropriate explanation on the system. The SAE definition of Level 2 that “the primary driver of a car with the Level 2 system is a human driver” was effective in the judgment. Based on the discussion and the judgement in the mock trial, the Committee provides following recommendations to prevent similar crashes in the future.

Recommendations to the Industry

- The industry should collaborate with academia to investigate and define limitations of human capabilities in using the Level 2 system and share them within the industry.

- A guideline for Level 2 should be developed in cooperation with the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). The guideline should include design guidelines to mitigate risks that may be caused by human capability limitations (foreseeable risks).
- Manufacturers and dealers/distributors should standardize contents of information given to users for safe use of the system and methods of explanation for secure and effective understandings of users. The information contents should not be the system functions alone but also include functional limitations of the system, the role of the driver, and the foreseeable misuses in a concrete form.

Recommendations to manufacturers

- Manufacturers should avoid using system names that may mislead users.
- Manufacturers should continue efforts to give systems ability to avoid or compensate for foreseeable misuses, including driver monitoring systems.

Recommendations to dealers/distributors

- Dealers/distributors should consider effective explanations of the system to deepen understandings of individual users, such as using the actual system, a simple driving simulator, and animated images.
- User's signing on the informed consent should be used as a tool to confirm user's understanding of the information provided.

Recommendations to users/potential users

- Users should make efforts to understand the information provided by the manufacturer and the dealer.
- Users should continue efforts, after purchase, to understand the system, especially functional limitations of the system.

The new committee "Special Committee for Issues related to Engineering and Law in automated driving" was established in 2023. The committee continues discussion on new safety-related issues arising from commercialization of the automated driving technology.