Collaborative Sciences Center for ROAD SAFETY

Coffee and Conversation Speaker Series

Proceedings from "Automated Vehicles and the Vision for Safety:
A Federal and Industry Perspective"
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In planning for autonomous vehicles, stakeholders will need to focus on safety while continuing to innovate and test features and design.

In this talk, "Automated Vehicles (AVs) and the Vision for Safety: A Federal and Industry Perspective" Dr. Michael Clamann, Senior Human Factor Engineer at the Highway Safety Research Center, outlined the state of AV technology development and how the government and the automobile industry are currently navigating safety issues.

The National Highway Traffic Safety Administration (NHTSA) is the federal agency charged with standards. In September 2017, NHTSA and the U.S. Department of Transportation (USDOT) released federal guidance for AVs entitled "Automated Driving Systems (ADS): A Vision for Safety 2.0."

"A Vision for Safety" focuses on two aspects of the AVs development:

- Automated Driving Systems (ADS) Safety Elements
- Technical Assistance

Clamann honed in on the safety elements of the guidance document. "Most of these are guidelines because the technology is still being tested," said Clamann. More federal regulation might be better for safety testing, he said.

NHTSA adopted the Society of Automotive Engineers' (SAE) levels for automated driving systems, ranging from complete driver control to full autonomy.

- Zero: Complete driver control. This is where most cars from the 1980s would be, said Clamann.
- 1-2: Driver assistance and partial automation, respectively. Current automobiles are in the 1-2 range with anti-lock braking systems, cruise-control and some driver-assist functions.
- 3: Conditional automation. The driver is still necessary, but the car is able to function without the driver's engagement in surroundings.
- 4: High automation. The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.

- 5: This is full automation. The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to drive the vehicle.

According to the NHTSA, the recommendations within "A Vision for Zero 2.0" cover automation levels 3-5. Clamann underscored the 12 ADS safety elements in the guidelines.:

1. **System Safety.** Everything below fits this one topic, said Clamann. NHTSA should follow standards and learn from others in industries like aviation, space, and military, he said.
2. **Operational Design Domain (ODD).** Most of the emphasis is in two different areas. Trucking and
3. **Object and Event Detection.** This includes everything from LIDAR to other sensing technology. How does the car detect and define objects in the environment? "This is probably the thing that is keeping us from seeing AVs soon," said Clamann. "This is why we see so much testing going on this time."
4. **Fallback Condition (Minimal Risk Condition).** If your AVs use sensors, then how do the vehicles sense themselves, essentially?" asked Clamann. Based on the levels of automation In Level 3, human is the fallback. In level 4 it's the vehicle. If you were lost or something, you would pull over and try to figure it out. That's what everyone is working through: When everything goes dark, who is controlling the car?
5. **Validation Methods.** "There are several different ways this is done and they all have pros and cons, said Clamann.
    - A prototype vehicle with a professional driver collecting data.
    - A prototype with non-professional drivers. Tesla is an example of this.
    - Customer testing. Volvo is looking to releasing AV cars to customers, in Gothenburg, Sweden. Customers could choose to take control. And it would help them refine the automation. They decided 3 months before their deadline, they had to scale back the whole project.
    - Closed track testing. Ford's motor city. Center for driving here in Carolina?
    - Another issue is simulation software testing, whether with or without humans. An example: "You go millions of miles. You re-test the same situations," said Clamann. "The good thing is that you get to test. But you are testing things you have already seen. I am in the camp of formal validation. This becomes a regulation issue." Currently the safety standards are guidelines or recommendations, but not enforceable.
6. **Human Machine Interface.** This is the manner in which ADS exchanges info with the driver. Clamann used this example: "I don't want to go all the way home. I want to stop and get a quart of milk. How do you tell the car this?"
    - How do we accommodate people with disabilities?
    - At what point would it be necessary to remotely take control of the vehicle?
7. **Vehicle Cybersecurity.** This issue gets into the sharing of information among the automakers.
    - Sharing is not required. But encouraged to share information among each other.
    - This issue references human machine interface because the technology to remotely take control of the vehicle is the one that would most likely be hacked, said Clamann.

8. **Crashworthiness.** This element recommends that any new design of the interior of the vehicle now that a driver is not necessary) takes into consideration "countermeasures that will protect all occupants in any alternative planned seating or interior configurations during use," according to "A Vision for Zero 2.0." AN example of this would be a design wherein all of the occupants are seated in a circle. What does the seatbelt or safety feature design look like?
9. **Post-CRASH ADS Behavior.**
    - How much automation is available to alert emergency workers. Can the car call 911?
    - A crash becomes more complicated with all of the technology installed. How does a car get fixed so that it is functional?
10. **Data Recording.** How is information on Av performance kept? This is data related to the occurrence of malfunctions, degradations, failures. The methods open up privacy issues. "On the one hand we want to be able to share safety features," said Clamann. "But then you get into personal data about where you are going, or information about you, your preferences or your healthcare."
11. **Consumer Education and Training.** "We are bad at this now," said Clamann, regarding driver training for licensure for first-time drivers and new kind of driving.
12. **Federal, State, and Local Laws.** Development of ADSs should account for all governing laws.

Clamann discussed other issues in the pursuit of safety standards for testing AVs before they are released to the general population. These include:

- **Privacy and ethics.** These issues were brought up in discussions among policy and industry leaders but they are no longer covered in a "Vision for Safety 2.0." Clamann theorized that ethics was likely left out because "it is not quantifiable. But I'm not sure about privacy."
- **Driver's licensure and training.** Currently there would be no need for a driver's license using AVs.
- **Insurance.** "The insurance companies are all over this," said Clamann. "This will still be handled at the state level. Who is going to pay for it? Whose fault is it? Manufacturer? The folks who made the sensor?"

In conclusion, planners need to think about how the U.S. can keep up with technology while regulating vehicles for safety. Clamann highlighted greater needs for research and guidance from the federal government.

"This problem with AVs we are having everywhere: AI in the workplace, drones, rail, aviation, pipeline, and vehicles," explained Clamann. "It's kind of the Wild west right now when it comes to technology, standards, and regulation."