What is an automated vehicle and what does it mean for child passenger safety?

Lifesavers Conference
Louisville, KY
April 2, 2019

Jessica S. Jermakian
Uber Strikes Deal With Volvo to Bring Self-Driving Cars to Its Network

Nissan Begins Public Robo-taxi Trials Next Year

Lyft is Now Offering Self-driving Car Trips in Boston

Mercedes promises self-driving taxis in just three years

Self-driving taxi service from Waymo set to begin shortly

GM Aims for Self-Driving Taxi Fleet by 2019

Final Countdown: Nissan Introducing Fully Autonomous Cars in 2022
What does it mean to be an “autonomous vehicle”?
What does it mean to be an “autonomous vehicle”?

<table>
<thead>
<tr>
<th>Level</th>
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SAE J3016 Levels of Driving Automation

**SAE LEVEL 0**
- You are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering.
- You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety.
- These features are limited to providing warnings and momentary assistance.
- Example Features: automatic emergency braking, blind spot warning, lane departure warning.

**SAE LEVEL 1**
- You are not driving when these automated driving features are engaged – even if you are seated in “the driver’s seat.”
- When the feature requests, you must drive.
- These features provide steering OR brake/acceleration support to the driver.
- Example Features: lane centering OR adaptive cruise control.

**SAE LEVEL 2**
- You are not driving when these automated driving features are engaged – even if you are seated in “the driver’s seat.”
- When the feature requests, you must drive.
- These features provide steering AND brake/acceleration support to the driver.
- Example Features: lane centering AND adaptive cruise control at the same time.

**SAE LEVEL 3**
- These automated driving features will not require you to take over driving.
- These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met.
- Example Features: traffic jam chauffeur.

**SAE LEVEL 4**
- These automated driving features will not require you to take over driving.
- This feature can drive the vehicle under all conditions.
- Example Features: local driverless taxi, pedals/steering wheel may or may not be installed.

**SAE LEVEL 5**
- These automated driving features will not require you to take over driving.
- Same as level 4, but feature can drive everywhere in all conditions.
- Example Features: same as level 4, but feature can drive everywhere in all conditions.
# Crash avoidance systems are Level 0

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Automatic Emergency Braking
Partial automation combines speed control (ACC) and steering assistance

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Partial automation is available to consumers today but their effect on crashes is not yet known.

- Autopilot (Tesla)
- Driving Assistant Plus (BMW)
- Drive Pilot (Mercedes)
- Co-Pilot 360 (Ford)
- ProPilot Assist (Nissan)
- SuperCruise (GM)
Partial automation can struggle even in basic driving tasks
Lane keeping on hills
Less common hazards may or may not be detected
On-road testing
What CPS technicians need to know: Passenger vehicles with partial automation

- Partial automation is available to consumers today as the combination of speed control (adaptive cruise control) and steering assistance (lane centering technology)
- Drivers MUST remain engaged for these systems to be used safely
- Passenger vehicles with partial automation meet all occupant protection safety standards

August 2018
## Level 4 – No human required within the design domain

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Autonomous vehicle testing and deployment laws
As of April 2, 2019
Some high automation vehicles are retrofitted passenger vehicles

- Passenger vehicles equipped with upgraded sensor suite and proprietary automation software
- Meet all occupant protection safety standards
- Owned and operated by companies, not consumers
- Operated in limited areas
Some high automation vehicles are minimally regulated

- Gap in the regulations for many of these vehicles
- Do not meet occupant protection safety standards
- Owned and operated by companies, not consumers
- Operated in limited areas
High automation vehicles may have alternate seating configurations in the future

- Research is on-going to determine the best way to protect occupants in non-traditional seating configurations
- Non-traditional seating in passenger vehicles will require exemption from federal safety standards
  - In 2018, General Motors requested an exemption to allow a passenger vehicle with no steering wheel or accelerator
What CPS technicians need to know: High automation vehicles in 2019

- High automation are being tested or deployed in limited areas
- Retrofitted passenger vehicles with high automation meet all occupant protection safety standards
- Other high automation vehicles are minimally regulated
- New seating concepts in passenger vehicles require exemption from safety standards
Crashes will still happen
It takes time for new vehicle features to penetrate the vehicle fleet

Predicted registered vehicles by feature by calendar year

- Autobrake
- Adaptive headlights
- Blind spot warning
- Lane departure warning
- Parking sensors
- Rearview camera

Year: 2018, 2023, 2028, 2033, 2038
Crash prevention potential of two domain restricted automated driving systems
Percent of crashes

- Crashes
  - 0 to 10
  - Freeway autopilot
  - Traffic jam autopilot
- Injured persons
  - 0 to 10
- Deaths
  - 0 to 20
Waymo: Google self-driving car program
2009 to present

- Involved in 1/3 as many police-reportable crashes as human drivers per mile traveled in Mountain View, CA
- Vast majority of crashes involved Google car rear-ended by another vehicle (driven by a human)
- So, even if autonomous vehicles (or their test programs) are operated extremely safely, there will still be crashes when they are struck by other vehicles driven by humans.
- Expected crash rate reduction is about two-thirds.
Restraint use will still be critical to safety
What CPS technicians need to know: summary

- Partial automation (driver assistance) is available to consumers today but driver MUST remain engaged for these systems to be used safely
  - These are NOT driverless vehicles

- High automation vehicles are being tested or deployed in limited areas
  - Vehicles are owned and operated by companies, not consumers
  - Retrofitted passenger vehicles meet safety standards but other vehicle types are minimally regulated and do not meet occupant protection standards

- Crashes will continue to happen so we need continued focus on child passenger safety
Post-conference presentation downloads:
iihs.org/lifesavers

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