https://www.synopsys.com/automotive/autonomous-driving-levels.html
The Society of Automotive Engineers (SAE) defines 6 levels of driving automation now adopted by the U.S. Department of Transportation.

Human Monitors Driving Environment

Level 0. ***No Driving Automation***

L1. Driver Assistance: Cruise Control, Adaptive Cruise Control. Driver steering, braking

L2. Partial Driving Automation (Advanced Driver Assistance Systems – ADAS): Automated steering / acceleration / braking; Driver can take control at any time. Tesla Autopilot and Cadillac Super Cruise systems.

Automated Systems Monitor Driving Environment

L3. Conditional Driving Automation: Environment detection and decision-making with Driver override.

L4. High Automation: Automation can intervene if adverse conditions arise without human interaction but humans can still override. Geofencing operations within specific area and speed limits. Currently used for ridesharing in some markets.

L5. ***Full Automation***: Human attention not required. "Dynamic Driving" tasks eliminated. No steering wheels or acceleration / braking pedals. No limited geofencing.

Some Driving Automation Issues:

1) Human error is system design error. Software must be designed for bottom half of user skill distribution. ***Objective stress testing in non-optimal situations*** is needed***.***

2) ***Sensor limitations in*** non-optimal, ambiguous or misleading environments like rain, snow, fog, night rain/glare, poor signage/graffiti, poor or no lane markings.

3) ***Distracted driving / boredom***. Human monitoring of low-probability events is high risk for any partial automation that requires driver attention and automation override. Cognitive inertia to reacquire situation awareness.

4) ***Skill decay***. If drivers, particularly new drivers, come to depend on partial automation, will they have the skill to be able to take over when they should?

5) How do non-automated drivers interact with automated systems? Will there be standardized and predictable behavior among independently developed autonomous systems? Is this a new training issue for driver's ed?

6) ***Inferring Intent / Prediction of traffic behavior***. How to emulate human interpretation of local traffic decisions. For example, the car in front of us has a left-turn blinker on. Is it actually going to turn left (opportunity); Is the driver looking to change lanes because traffic

is backed up ahead; Has the driver forgotten the blinker is on? How to react to other aberrant driving behavior like a car tailgating or weaving across lanes? Cyclists / Pedestrian intent?

7) When should the automation break the rules? For example, speeding up to avoid a collision? Proactive behavior to disambiguate situation/ update predictive model.

8) ***Ethical decision-making, risk assessment and financial optimization***. How do people decide whether to save the car and driver (industry interest) versus limiting overall impact damage? For example, a human might decide to swerve away from a baby stroller in its path onto a sidewalk with a high risk solution that might send the car into a crowd of people.

9) ***Who is at fault*** in case of adverse outcomes/ accidents? The driver? The software company? The car manufacturer? The regulatory agencies?

Future Developments:

Connected Vehicle systems, System level monitoring and direction of traffic including speed, spacing satisfying both individual/shared goals and intent. “Mixed equipage” is an issue here with legacy, non-automated vehicles likely to be on the road for the next 50 years. This issue is a big deal at the FAA for general aviation of mostly small private planes.