

Appendix 1 - Autonomous vehicle operating systems and standards

Operating systems

1. AVs use several sensor types to 'scan' surroundings to ensure maximum visibility of the area around it. These include:

- **Cameras** — detect lanes, traffic lights, people, vehicles, signs, etc
- **LiDAR** — uses lasers to create a 3D map of nearby objects
- **Radar** — measures speed and distance, especially useful in rain/fog
- **Ultrasonic sensors** — help with close-range detection like parking

Automated passenger services will operate within geo-fenced areas. Within the areas it is operating the vehicle will determine its position using:

- GPS
- High-definition prebuilt maps
- Sensor matching (comparing real-world surroundings to stored maps)

2. To plan a safe route, the AI system will anticipate the movement of other street users including people walking and wheeling via the use of the technology above, this includes anticipating actions such as:

- Speed
- Lane position
- Turns
- Stopping distances
- Alternate routes
- Steering
- Braking
- Acceleration

3. Similar to existing PHV operations such as Uber and Bolt, automated passenger services operators will use a centralised systems that dispatches trips, monitors vehicles, handles charging. Remote assistance can set in when the automated system is uncertain on how to act.
4. Automated passenger services will operate through mobile phone apps, with the vehicles having several features in order to make them accessible to those with disabilities, including in-app haptic features for those with visual impairments as well as screen reader support and adaptive app navigation, and audible features to help cars be easily located once booked.

Department for Transport (DfT) Standards

The UK Department for Transport (DfT) is using the United Nations Economic Commission for Europe (UNECE) frameworks to establish the UK domestic standards for autonomous vehicles. UK self-driving policy heavily relies on UN regulations to ensure international uniformity, type approval, and consistent safety requirements for Automated Driving Systems (ADS).

5. The DfT states that as part of their Automated Vehicles Act implementation programme, they have several objectives centred around deployment, 'in-use regulation' and 'international and building capability' which are designed to:
 - Develop the safe operations of the future AV framework, ensuring that relevant government bodies are ready to fulfil the functions of the framework
 - Develop processes to approve and authorise AVs and ongoing requirements to maintain the validity of this authorisation
 - Protect consumers, by ensuring that only vehicles that are authorised as automated under the framework can be marketed as such
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 - Develop in-use regulation capabilities to ensure the safe and secure deployment and ongoing roadworthiness of automated vehicles
 - Develop an independent incident investigation capability to learn lessons from incidents involving automated vehicles to implement change and prevent similar future incidents
 - Develop an in-use regulatory scheme to safeguard the safe and secure operation of automated vehicles
 - Support safe trialling of prototype AVs on UK roads and ensure the UK is the trialling destination of choice for industry - this will be achieved by building on the Code of Practice: automated vehicle trialling
 - Develop and/or adapt rules on the safe use of AVs, such as through the Highway Code, driver, vehicle and service licencing and insurance
 - Ensure government has the skills, capabilities and access to assets to deliver safe and secure use of AVs
 - Design and implement processes to ensure that AVs are resilient to and can respond to cyber-attacks and that the data they hold is secure

- Alongside developing our domestic regulations, the DfT is playing a leading role in work to harmonise international rules on self-driving, which will enable our companies to export globally

UN Standards & Global Regulations (UNECE)

Global Technical Regulation (GTR) on ADS: The UNECE Working Party on Automated/Autonomous and Connected Vehicles adopted a comprehensive draft GTR for Automated Driving Systems. This standard outlines methods for validating vehicle safety based on an overarching "safety case" approach, requiring ADS to perform at or above the level of a careful human driver.

UN Regulation 157 (ALKS): This is the established framework for Automated Lane Keeping Systems, allowing hands-off, eyes-off automated driving on motorways up to 70 mph (in participating jurisdictions). The UK incorporates these UN rules to guide domestic vehicle approvals.

Cybersecurity Standards (UN R155 & R156): These standards mandate strict cyber security management systems (CSMS) and software update processes to prevent hacking and ensure software integrity throughout the vehicle's lifespan.