Ensuring the safety of automated vehicles

Alan Stevens

Workshop on Verification and Validation for Autonomous Road Vehicles 4 Nov 2016

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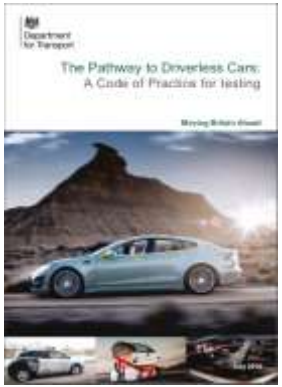
1. Planning trials and safety
2. Estimating safety in use
3. Behaviour
4. Timescales constraints and enablers

DfT: Pathways to driverless cars

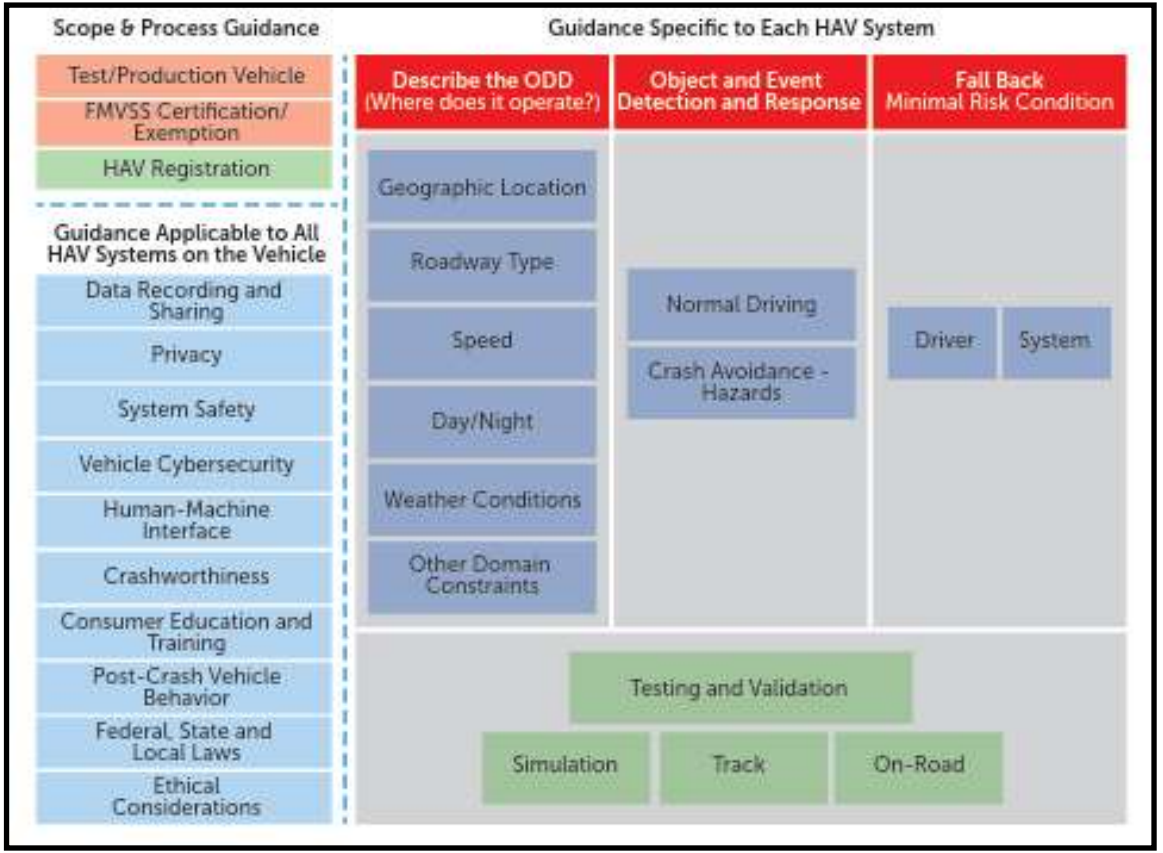
- February 2015 – Regulatory review:
  - *"Driverless vehicles can legally be tested on public roads in the UK today providing a test driver is present and takes responsibility for the safe operation of the vehicle; and that the vehicle can be used compatibly with road traffic law."*

- July 2015 – Code of Practice:
  - Insurance (no bond required)
  - Engagement with the public, emergency services etc.
  - Test driver/operator (vehicle operation, licence, training)
  - Vehicle (prior testing, roadworthiness, technology maturity)
  - Data recording/protection
  - Cybersecurity
  - Safety during mode transitions
  - No need to obtain certificates or permits



https://www.gov.uk/government/publications/automated-vehicle-technologies-testing-code-of-practice

NHTSA Framework for vehicle performance guidelines



Federal Automated Vehicles Policy.
Accelerating the Next Revolution In Roadway Safety September 2016

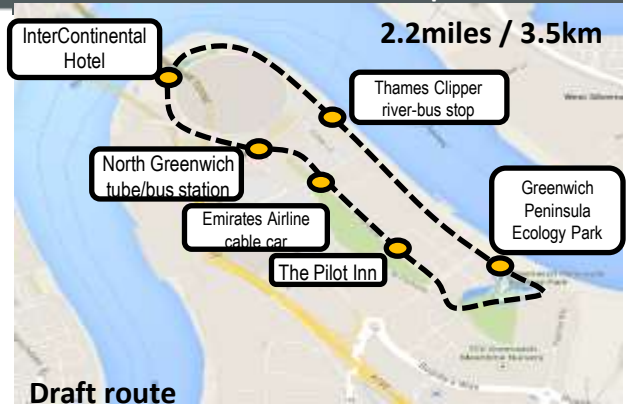
GATEway project in Greenwich, London

Automated passenger shuttles in real urban environment

GATEway

GATEway trials

Last-mile shuttle transport

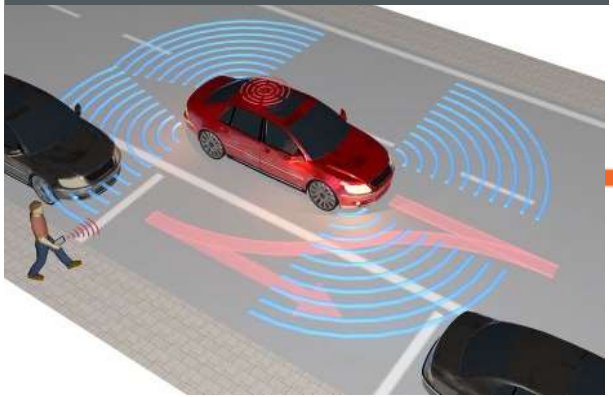


- Greenwich peninsula
- Different demographic groups invited to participate in a managed process
- ‘Steward’ on board to comply with DfT Code of Practice
- In-depth engagement with participants

Urban deliveries

- Demand from retailers
- Deliveries to be made via automated EVs
- Zero emission, low noise, automated vehicle

Accessibility/ Valet Parking



- Focus on users with mobility needs
- Test-bed for Tier-1 technology
- Vehicles to search for space and park autonomously
- Vehicles to be summoned / dispatched via smartphone

GATEway

Developing a safety case for automated vehicles

- Overview and description of the system, vehicles and control system
- Operating principles and design features
- Demonstrating compliance with relevant legislation
- Risk assessment including hazard identification, risk analysis, risk mitigations and risk evaluation
- System response to specific (planned or unplanned) events
- Operating parameters and limitations
- Safe operating procedures
- Vehicle safety and stability
- Driver/ passenger safety
- How business continuity can be assured
- Emergency response (fire/ collision/ breakdown)
- Training requirements
- Data recording and monitoring
- Communication
- Physical security
- Cyber security
- Monitoring required
- Due diligence tests and results
- Minimising litigation/ liability claims

“To demonstrate that the entire system is safe, fails safe and does not pose unacceptable risk to any affected parties ”

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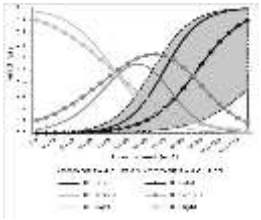
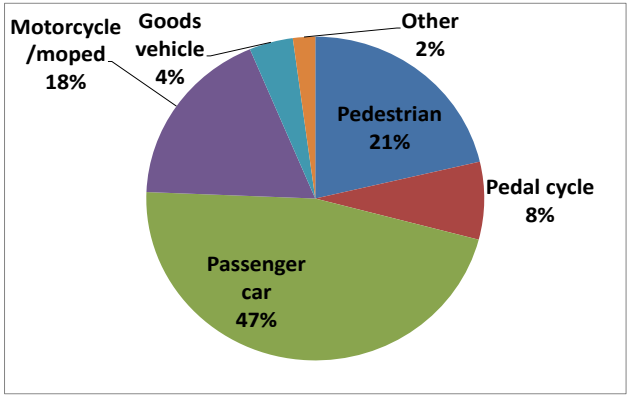
Estimating benefits of AV for pedestrians

Edwards M, Nathanson A, Wisch M (2014) *Estimate of the potential benefit for Europe of fitting Autonomous Emergency Braking (AEB) systems for pedestrian protection to passenger cars.* AAAM conference 2014 Munich. Traffic Injury Prevention (2014) 15, S173-S182

- Best performance currently estimated as technically feasible



	Fatal	Serious	Slight
2023+ (DE)	-9.9%	-15.8%	-14.8%



Road accident fatalities EU27

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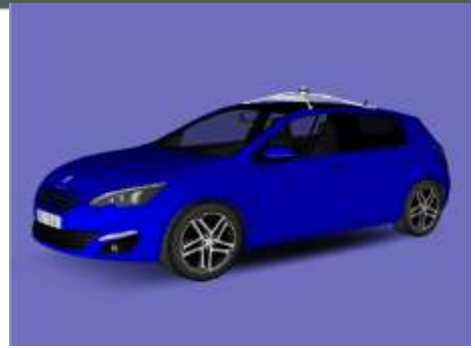
GATEway trials

Trial 4: Simulator trial



- Examining driver behaviour with fully automated vehicles
- Investigating whether human drivers adapt their driving upon recognising an AV on road (e.g. overtaking decisions, gap size acceptance)
- Using a photorealistic 3D model of the Greenwich peninsula

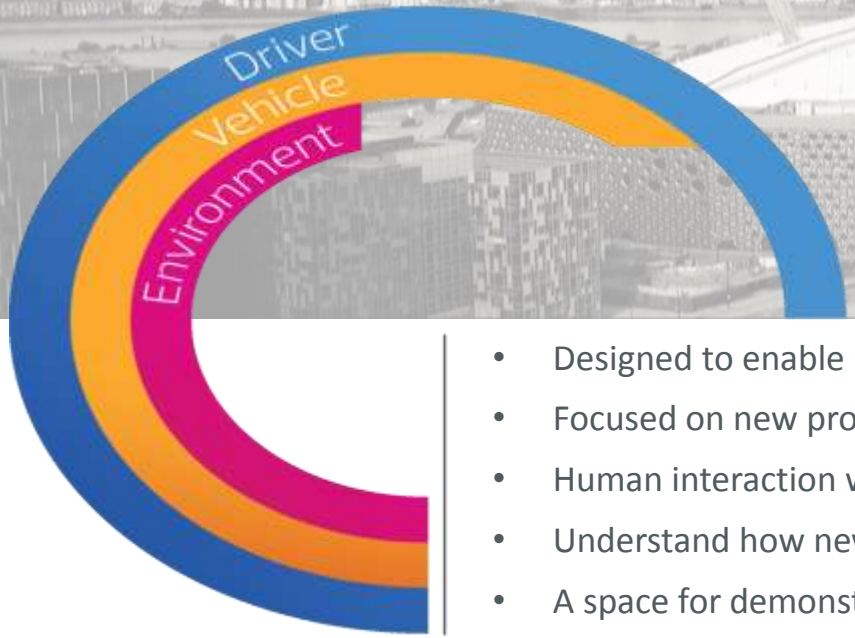
TRL's UK Smart Mobility Living Lab

The only 'Living Lab' in the UK for smart, connected & autonomous vehicles…

UK Smart Mobility Living Lab

MOVE_UK

Atlas



- Designed to enable CAV and Mobility solutions to be brought to market faster
- Focused on new product, technology and service R&D
- Human interaction with technology
- Understand how new technology will work in a complex urban environment
- A space for demonstration to investors, decision makers, stakeholders
- The opportunity to collaborate with other innovators
- Develop strategy in a rapidly evolving and supportive political environment

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DRAGON – supporting NRAs in decisions around CAVs

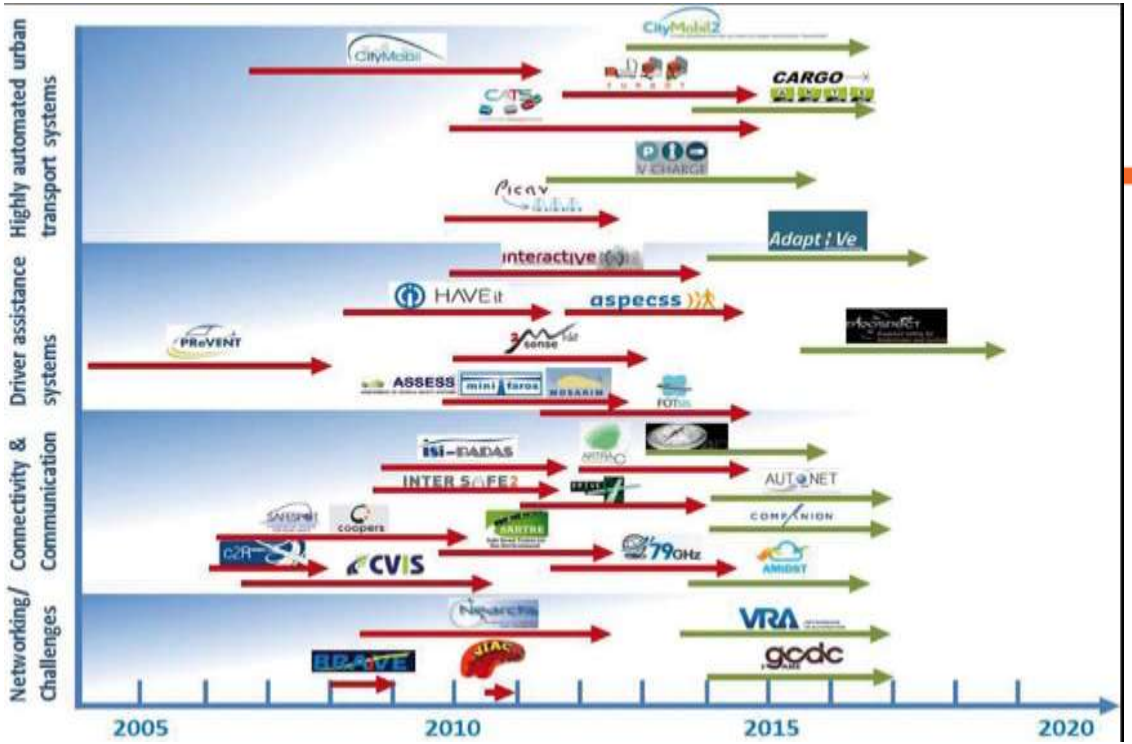
Connected and automated vehicles may change highway driving dramatically. What do national highway authorities need to be doing now to maximise benefits?

Project is funded by CEDR and led by TRL – expected outputs:

- International expert review of predicted changes in vehicle connectivity and automation
- Case study approach to understand how national road authorities in different EU nations might adapt their approach to maximise the benefits of connectivity and automation
- Guidance for national road authorities in how to set policy to achieve the anticipated benefits of CAVs

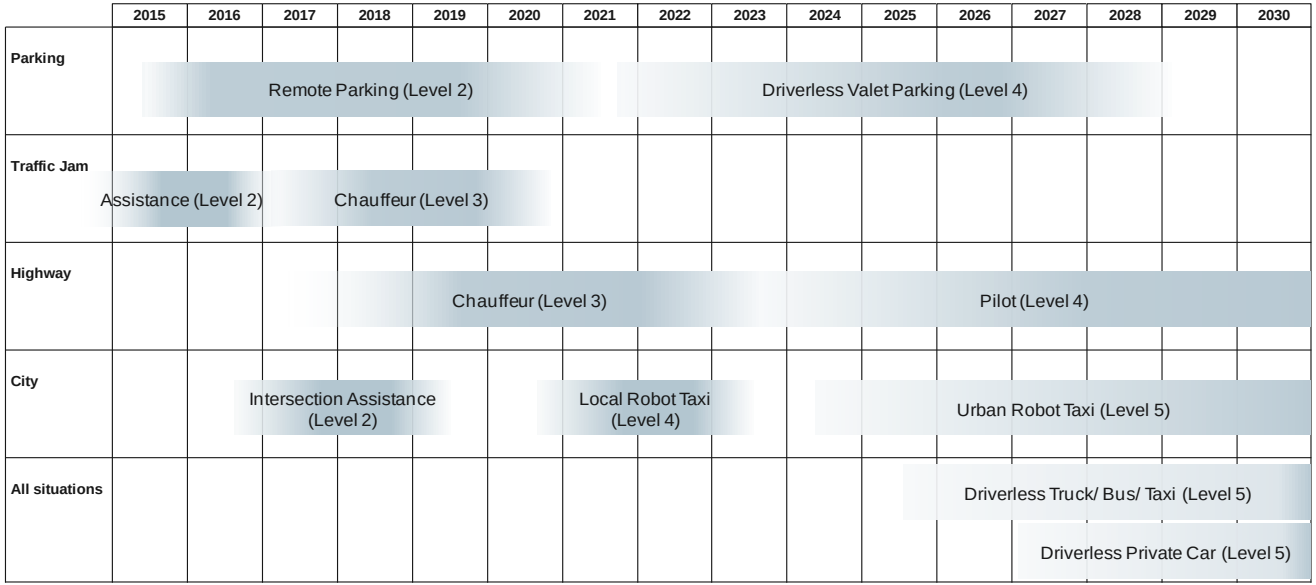
DRAGON WP1 – Current situation and forecasts

- Review of current projects
- Review and consolidation of roadmaps from Europe, US + Japan, South Korea, China, Singapore, Australia and UAE



European CAV projects 2005 -2020

DRAGON WP1 – Current situation and forecasts



- We're very clear that it is highly unlikely SAE L5 vehicles will be having any influence on traffic congestion or road safety by 2025

DRAGON WP2 – Impacts, Constraints & Enablers

STEEPLE ANALYSIS - Automated Vehicles

Social	Technology	Economic	Environment	Political	Legal	Ethical
Conclusions						
• Social aspects are significant • Provide solution's to many of societal needs • Active familial engagement, and improved use of time	• Early developmental stage • Currently available as add-on • Collaborative and cooperative infrastructure	• Global industry • High tech industrial sector • Funding and RoI key to overall success • Private – vehicles • Public – infrastructure	• Global benefits • Usage model to be key factor • Improved efficiencies • Net effect to be determined	• Roll-out requires political will • All party support • Continuous and on-going process	• Legal and regulatory drag • Laws, regulations, standards require full review • Provide robust framework	• Public safety is paramount • Development and deployment of vehicles to be built on this premise
Overall						
• Globally, mass deployment of automated vehicles, requires significant cooperative and collaborative engagement between all stakeholders in the chain. • From technology developers, industrial suppliers, the political and legal establishment and the general public, whom will ultimately use the transport. • Significant bridges to cross remain, from developing a safe and efficient transport medium, the level of funding for infrastructure upgrades, and the determination of robust regulations and standards, to the engagement of the end users.						

Thank You

Prof. Alan Stevens
Research Director, Transportation
Email: astevens@trl.co.uk