



# ● CAV Standards Update – July 2022

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# BSI – Our function and global relationships



**ISO**  
(International Organization for Standardization)  
164 National Standards Body members globally



**IEC**  
(International Electrotechnical Commission)  
80 members (National Committees)  
and 80 affiliates globally



**ITU**  
(International Telecommunications Union)  
Agency of the UN. Members are national  
governments and industry

  
Department  
for Culture  
Media & Sport  
(UK member)



**CEN**  
(European Committee for Standardization)



**CENELEC**  
(European Committee for Electrotechnical  
Standardization)

CEN & CENELEC have 33 member countries  
(EU ×28, EFTA ×3, FYROM and Turkey).  
24 countries including the UK have common  
members of both CEN and CENELEC.



**ETSI (European Telecommunications Standards  
Institute)**  
Industry, government and NSB members

# BSI Connected and Automated Vehicles (CAV) standards programme

## Convening the eco-system to help:

- Accelerate and support the development of CAVs in the UK
- Support the UK as a global Centre of Excellence
- Inform the development of international standards

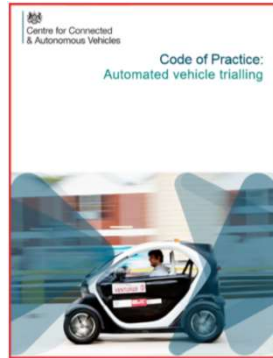
The programme has delivered a range of good practice and resources in support trialling and development of CAV

Investigating how standardization can support safe deployment of self-driving / automated vehicles

BSI has used the programme to test and trial new products, tools and services.



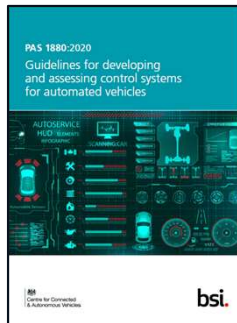
# BSI PAS 1880 Series: good practice for CAV trials and testing



**PAS 1881:2020**  
Assuring the safety of AV Trials and Testing – Spec



**PAS 1880:2020**  
Guidelines for Developing and Assessing Control Systems



**PAS 1882: 2021** Data Collection and Management during AV trials – Incident Investigation Spec



**PAS 1883:2020**  
Operational Design Domains taxonomy for an ADS – Spec



**PAS 1884:2021** Safety Operators in AV testing and trials - Guide



# BSI's CAV Standards Programme

## Good practice for trials and development

- PAS 1881:2022 Safety Case for CAV trials and testing
- PAS 1882:2020 Data Collection for Incident Investigation
- PAS 1883:2020 Taxonomy for Operational Design Domains for an ADS
- PAS 1884:2021 Guidelines for Safety Operators
- BSI Flex 1890 CAV Vocabulary
- *BSI Flex 1889 Natural Description Language*

## CAV Vocabulary and Terms

- Need identified to generate common terms and definitions
- First product to use BSI Flex process
- Interactive online tool
- Version 4 published in March 2022



**CAV Vocabulary v4.0**  
Explore our connected and automated vehicles vocabulary to get updated on industry terms

Vocabulary ABCD EFGHIJ KLMNO PQRST UVWXYZ

**Handover**  
This term is part of the following categories: [Safety](#), [Technology](#), [Human factors](#) and [Activity / Process](#).  
Version: 3.0, Release date: October 2020  
Definition: Process by which the sustained [dynamic driving task](#) function transitions either from a human driver to an [automated driving system](#) or from an automated driving system to a human driver.

Connected and automated vehicles -  
Vocabulary

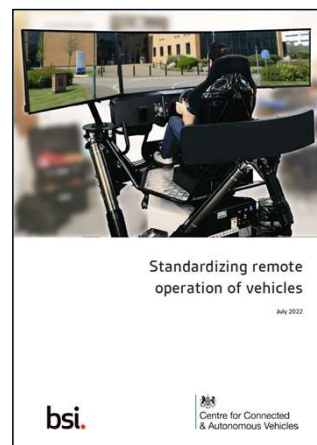
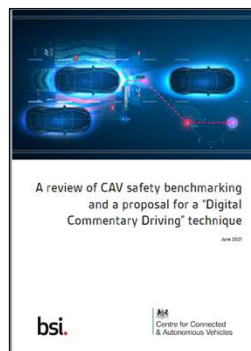
BSI Flex 1890 v4.0:2022-03



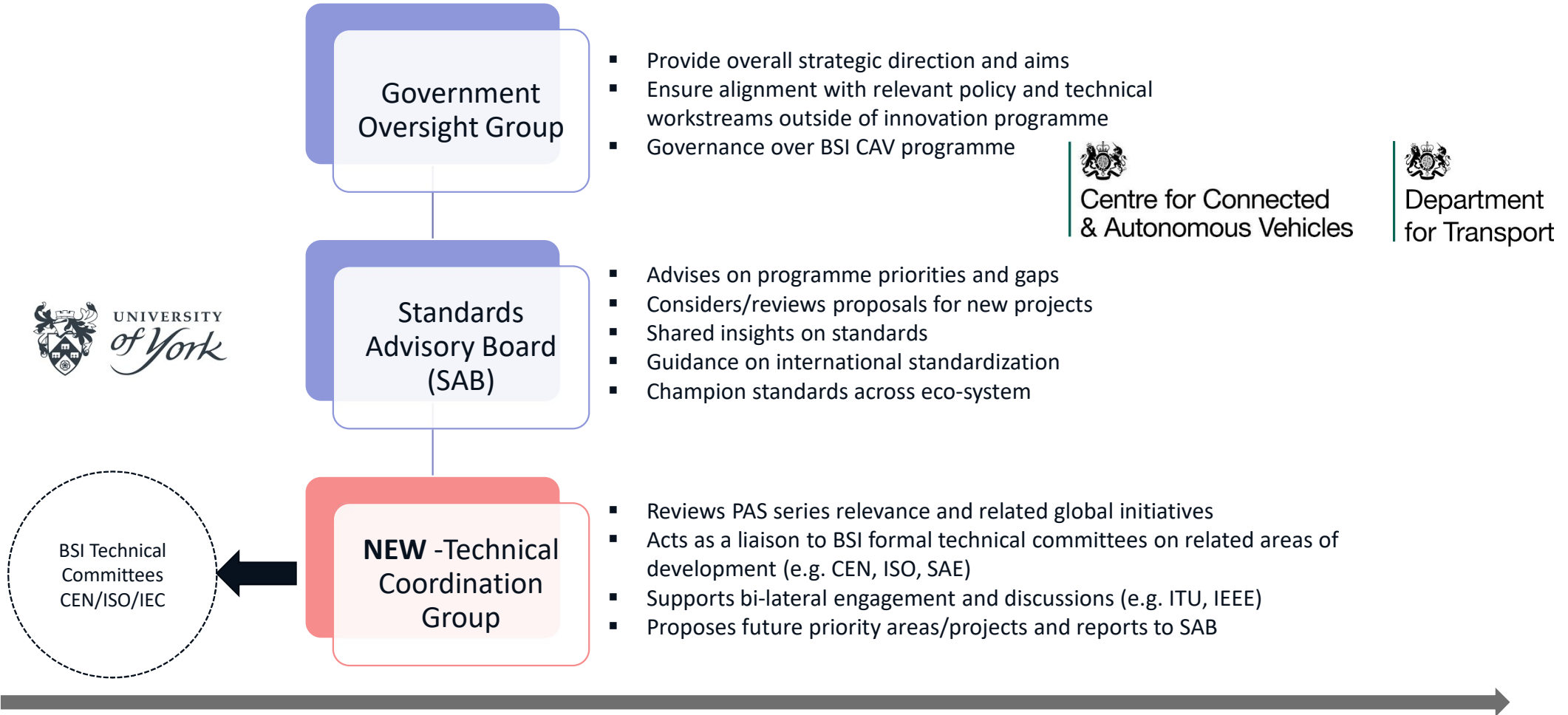
## Supporting UK CAV trials and development.

### Our good practice is world-leading and promoting real-world conversations

- More than **4000 downloads** of BSI PAS series and vocab in **55 countries**
- Over **75** trialling organizations involved to date on PAS Steering Groups
- **1000+** comments received during PAS development process
- BSI PAS series supporting UK **trials and testing now** – user feedback and case studies can help demonstrate impact
- **Shaping global practice** – PAS 1883:2020 basis of new ISO 34503 standard
- Digital Commentary Driving and Teleoperation projects have gained international interest



# Programme governance, oversight & liaison



# CAV Standards Roadmap – The global context and landscape



ISO/AWI 34503 — Taxonomy for operational design domain for automated driving systems

ISO/AWI PAS 8800 – Road Vehicles — Safety and artificial intelligence

ISO/AWI TS 5083 – Safety for automated driving systems – Design, Verification and Validation

ISO/AWI 23793-1 — Minimal Risk Manoeuvre (MRM) for automated driving — Part 1: Framework, straight-stop and in-lane stop

ISO 24089 – Software updates

IEEE P2846 Assumptions for Models in Safety-Related Automated Vehicle Behaviour

SAE J3016\_202104 Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles

ITU TR-01 – 03 Safety data protocols for Autonomous Driving

ASAM OpenSCENARIO® March 2021 (Rel)

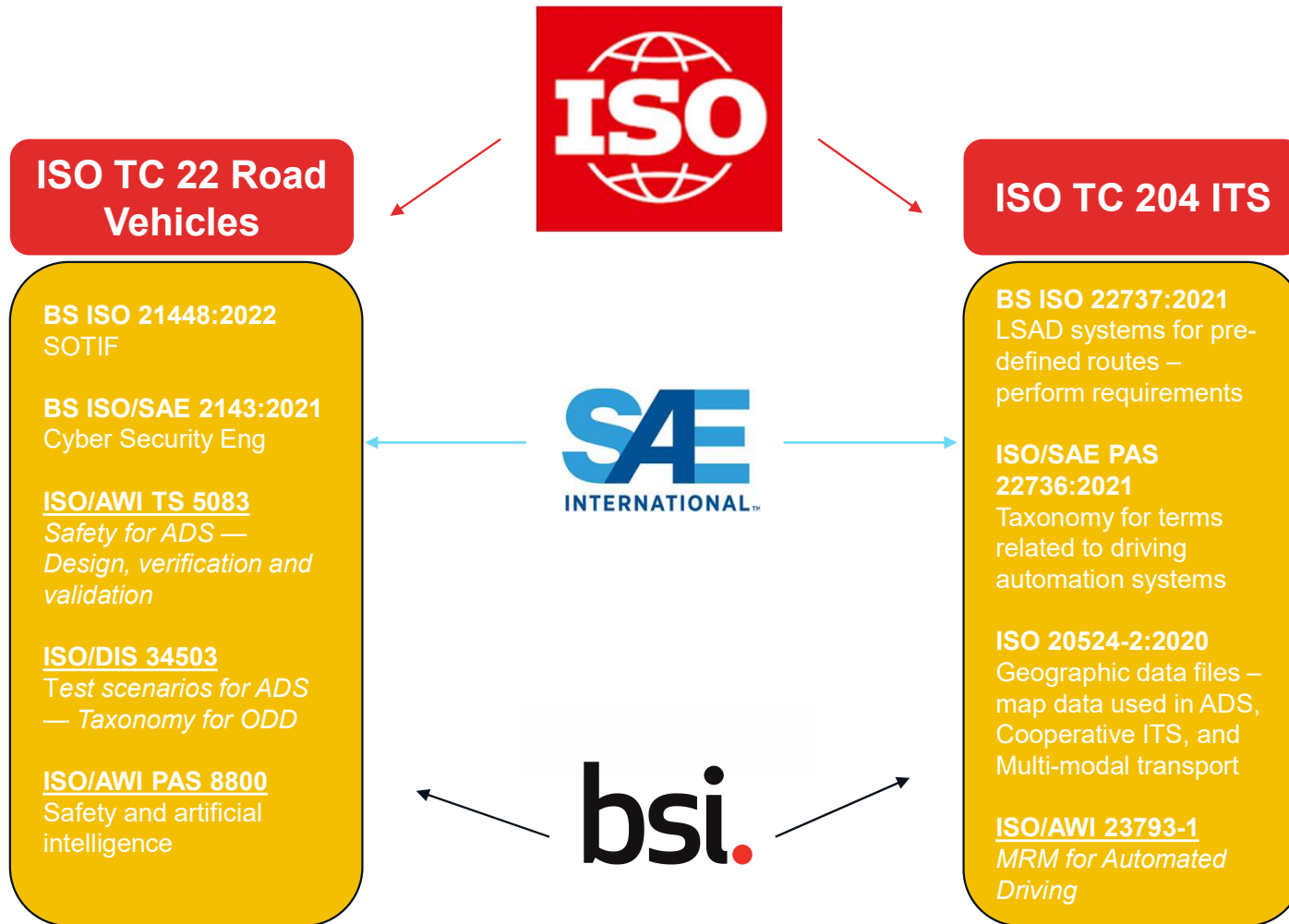
Roadmap for CAV standards: Safety & Assurance Theme

	Published/2020	2021	2022	2023	2023>	
Operational Safety	SAE J1698 EDR SAE J3018 Trials BSI PAS 1881:2020 Safety of AV trials	CCAV CoP AV Trialling (2019) Aus AP-C101-17 SAE AVSC GB/T 201-5 Software upgrade eval. GB/T 305-1 EDR	BSI PAS 1884 Safety drivers	BS ISO/AWI 24089 Software update eng. BS ISO/WD 34503 ODD	Monitoring in use – requirements for operators	Deployment Management Change Management
Safety Organizational Management	SAE J3206 Safety CSA T150 Principles BSI PAS 1885:2018 Automotive cyber security	ISO 56XXX QA BSI PAS 1882 Data collection for AV trials	BS ISO/AWI 39003 AV Ethics BS ISO/WD TS 14812 ITS Terms ISO/SAE PAS 22736 ITS Taxonomy	Safety Management / QA Advanced trials / Licensing framework	Safety Responsibilities & Requirements	
Independent Verification	Testing Framework: ASAM, ISO, GB/T Test evaluation: ASAM CEA, GB/T 201-1&2 Test Scenario/Req. ISO ADAS, ITS eCall, V2X, TC204, GB/T 304-X, MUSICC Common definition – JASO D804; SAE J3XXX; ISO: N3947, N4045, NP 14812, TR 4609; GB/T 10X	BS ISO/WD 34501 Scenario terms BS ISO/WD 34504 Scenario attributes	BS ISO/WD TS 22133-1 Test object monitoring & control	BS ISO/AWI 22737 LSAD	Scenario / Test case library	
Verification & Validation	BSI PAS 1880:2020 Design of control systems BSI PAS 1883:2020 ODD taxonomy	GB/T 305-X Information Interaction	Safety Goals / Targets	Data-based safety validation / Evaluation including simulation	Common interface / architecture model	
Physical Safety	Simulation Validation/Techniques: BS ISO 19265:2016, 19364:2016 V&V framework: ASAM, ISO, SAE, JSP 939, GB/T SAE J2640 embedded software V&V design: SAE J1211, 1879, 1938, 3803	ISO/NP TR 23735 External Visual comms	Test Equipment: BS ISO 19206:2018, 22133, N3675, N3674 Simulation Validation/Techniques: BS ISO 21233, 19585:2019, 19586:2019, 21734, 23720, N3818, N3798/22140 BS ISO/WD 34502 scenario-based safety evaluation BS ISO/CD TR 4804 Safety and security	Chassis requirements – no human driver / Novel vehicle	Occupant physical safety	
Functional Safety	SAE J 2980 ASIL SAE J2945 (V2x) BS ISO 26262:2018 FuSA	GB/T 303-12 Remote assist	BS ISO/WD 24650 Sensor cleaning system	Driving Extension Off vehicle data	Full automated controllability	Sensor integrity
Safety of Probabilistic Systems	BS ISO/PAS 21448:2019 SoTIF	IEEE P2846 Safety of AV decisions Certainty modelling & management ML system V&V	Probabilistic system evaluation & integration into Safety Case			





# ISO and ITS/CAV Standardization – BSI represents UK interests



# BSI CAV Standards Roadmap - 2022

Roadmap covers six thematic areas

1. Safety & Assurance
2. Perception, Decision Making & AI
3. Data
4. Security
5. Digital Infrastructure
6. Human Factors

	Recently Published	In Development	Priority Gaps
Safety & Assurance	<b>PD/ISO PAS 21448:2019</b> Road vehicles – Safety of the intended functionality	<b>ISO/AWI 23793-1</b> MRM for automated driving – Framework, straight stop and in-lane stop	Standard behaviours in response to emergency vehicles (incl. high priority messages) ★
	<b>PAS 1881:2020</b> Assuring the operational safety of automated vehicles – Specification	<b>ISO 34501</b> Road vehicles - Terms and definitions for test scenarios for ADS	Library of scenarios/test cases for testing & type approval of CAVs & systems (may include by simulation) ★
	<b>SAE J3016</b> Taxonomy & definitions for terms related to driving automation systems for on-road motor vehicles	<b>ISO 34502</b> Road vehicles - Scenario-based safety evaluation framework for ADS	Guidance on how to apply SOTIF ISO 21448
	<b>UL 4600</b> Evaluation of autonomous products	<b>ISO/WD 34503</b> ODD taxonomy	Minimal risk manoeuvre & conditions for ADS failures & other malfunctions ★
	<b>BS ISO 26262:2018</b> Functional safety	<b>SAE J3259</b> Taxonomy & definitions for ODD	HMI standards for handover & takeback/fallback functionality includes monitoring of safety driver & training ★
	<b>BS ISO 22737:2021</b> LSAD systems for predefined routes – Performance requirements, system requirements & performance test procedures	<b>ISO/AWI TS 5083</b> Safety for ADS – Design, verification and validation	
	<b>ASAM OpenDRIVE®</b>		
Perception, Decision Making & AI	<b>PAS 1883:2020</b> ODD taxonomy for an automated driving system – Specification	<b>ISO/AWI PAS 8800</b> Road vehicles – Safety and artificial intelligence	Verification & validation of machine learning models, systems, & results suitable for safety cases
	<b>BS ISO 22735:2021</b> Road vehicles – Test method to evaluate the performance of lane-keeping assistance systems	<b>ISO/AWI 39003</b> Road traffic safety (RTS) – Guidance on safety ethical considerations for autonomous vehicles	Verification & validation of systems by simulation suitable for safety cases, to match real-world ground truth ★
	<b>PD ISO/SAE PAS 22736:2021</b> Taxonomy & definitions for terms related to driving automation systems for on-road motor vehicles		Performance metrics for perception including sensor integrity & calibration & data fusion

# BSI CAV Standards Roadmap

Indicates standards:

- In development
- Published
- Urgently needed/gaps

	Recently Published	In Development	Priority Gaps
<b>Data</b>	<p><b>PAS 1882:2021</b> Data collection and management for AV trials for the purposes of incident investigation – Specification</p> <p><b>ITU FGAI4AD-02</b> Automated driving safety data protocol – Ethical and legal considerations of continual monitoring</p> <p><b>ISO/TS 5255-1:2022</b> ITS – Low-speed automated driving system (LSADS) service - Part 1: Role and functional model</p> <p><b>BS ISO 20524-2:2020</b> ITS – Geographic data files (GDF) GDF5.1 – Map data used in automated driving systems, Cooperative ITS, and multimodal transport</p>	<p><b>ISO/PWI 7856</b> ITS – Remote support for LSAD - Performance requirements and test procedures</p>	<p>Benchmarking safety performance of manual &amp; automated vehicles</p> <p>Teleoperation system specifications</p> <p>Real-time monitoring of AVs (including performance of ADS) for safety</p> <p>Using Off-Vehicle Data from C-ITS V2X including perception &amp; situational awareness for safe driving decisions</p> <p>External communications for other road users &amp; public that self-driving mode is active and includes standardized behaviour</p>
<b>Security</b>	<p><b>BS ISO/SAE 21434:2021</b> Road vehicles – Cybersecurity engineering</p> <p><b>ISO/PAS 5112:2022</b> Road vehicles – Guidelines for auditing cybersecurity engineering</p>	<p><b>BS ISO 24089</b> Software update engineering</p> <p><b>GB/T 204-13</b> Software upgrades</p> <p><b>GB/T 204-14</b> Telematics service/management</p> <p><b>GB/T 204-16</b> Emergency response</p>	
<b>Digital Infrastructure</b>	<p><b>ASAM OpenSCENARIO®</b></p> <p><b>ASAM OpenLABEL®</b></p>	<p><b>ISO/PWI 7856</b> ITS – Remote support for LSAD – Performance requirements and test procedures</p> <p><b>ISO/WD 34503</b> ODD taxonomy</p>	
<b>Human Factors</b>	<p><b>PAS 1884:2021</b> Safety operators in automated vehicle testing &amp; trialling – Guide</p> <p><b>PD ISO/TR 21959-1:2020</b> Road vehicles – Human performance and state in the context of automated driving – Common underlying concepts</p> <p><b>PD ISO/TR 21959-2:2020</b> Road vehicles – Human performance and state in the context of automated driving – Considerations in designing experiments to investigate transition process</p>	<p><b>ISO/AWI TS 5283</b> Road vehicles – Ergonomic aspects of driver monitoring and system interventions in the context of automated driving</p> <p><b>BS ISO 39003</b> Road traffic safety (RTS) – Guidance on safety ethical considerations for autonomous vehicles</p> <p><b>PD ISO/PAS 11585</b> Road vehicles – Partial driving automation – Technical characteristics of conditional hands-free driving systems</p>	<p>Teleoperation human factors / training, testing and operator license</p> <p>Requirements for interior design for new vehicles without steering wheels / pedals etc.</p> <p>Internal communications to AV occupants to explain AV actions to gain trust (includes monitoring occupants for safety)</p>

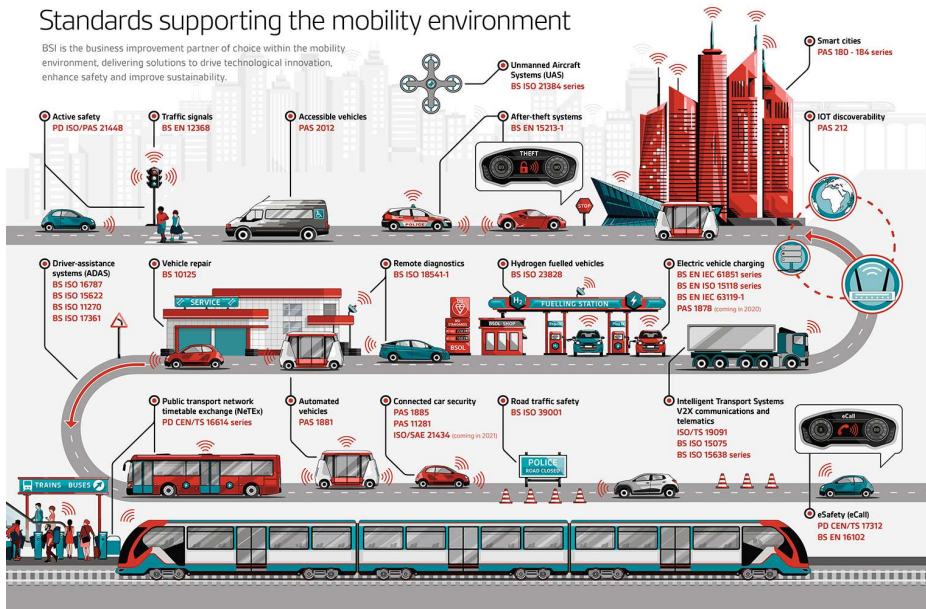
# More information

Find our standards and resources online:

[www.bsigroup.com/cav](http://www.bsigroup.com/cav)

## Standards supporting the mobility environment

BSI is the business improvement partner of choice within the mobility environment, delivering solutions to drive technological innovation, enhance safety and improve sustainability.



## Connected and automated vehicles: A review of the UK's legislation and good practice

A BSI white paper

