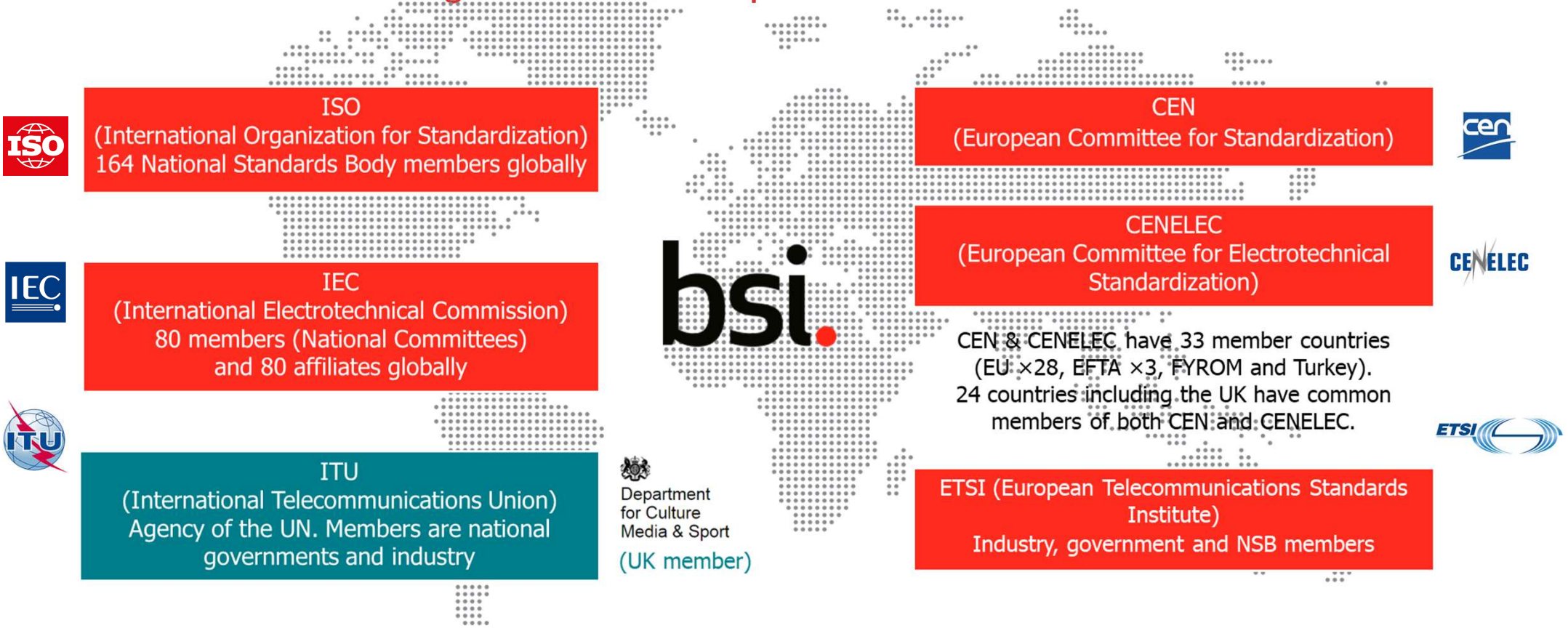
CAV Standards Update –
July 2022

Nick Fleming
Head of Transport and Mobility

BSI – Our function and global relationships



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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.

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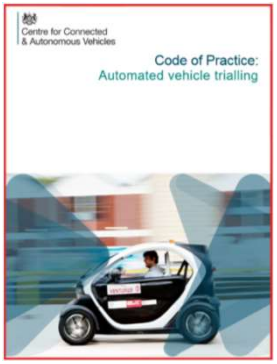
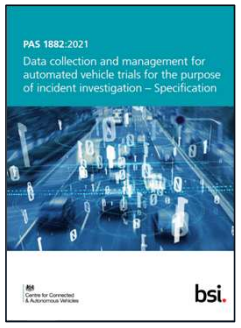
BSI PAS 1880 Series: good practice for CAV trials and testing



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

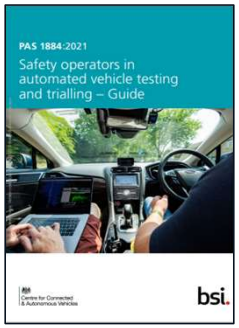
PAS 1880:2020
Guidelines for Developing and Assessing Control Systems

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



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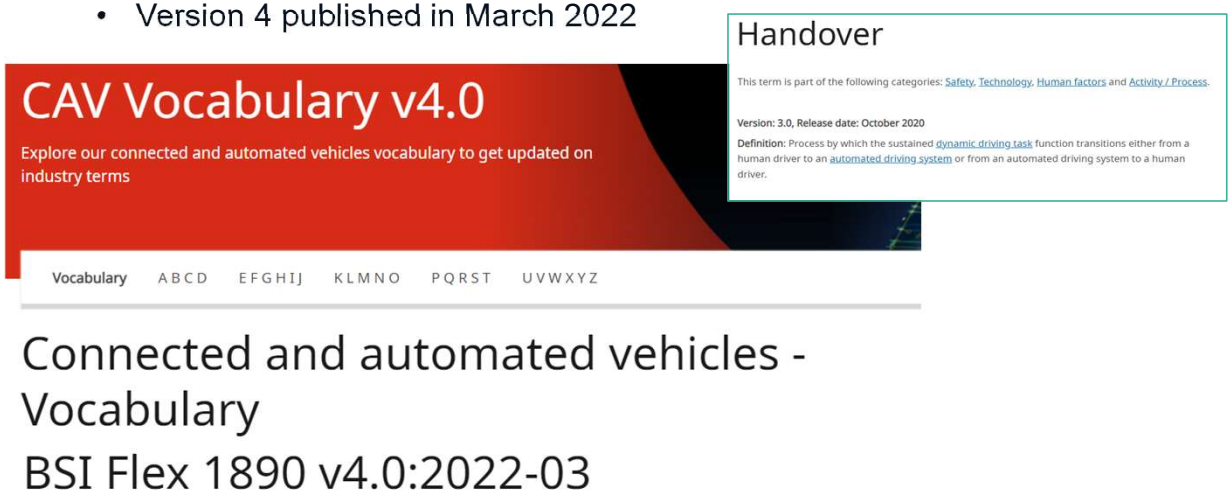
BSI's CAV Standards Programme

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



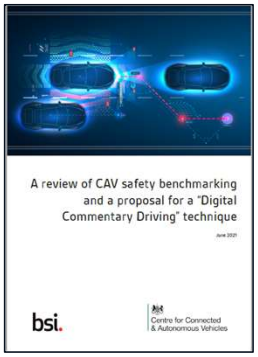
Connected and automated vehicles - Vocabulary

BSI Flex 1890 v4.0:2022-03

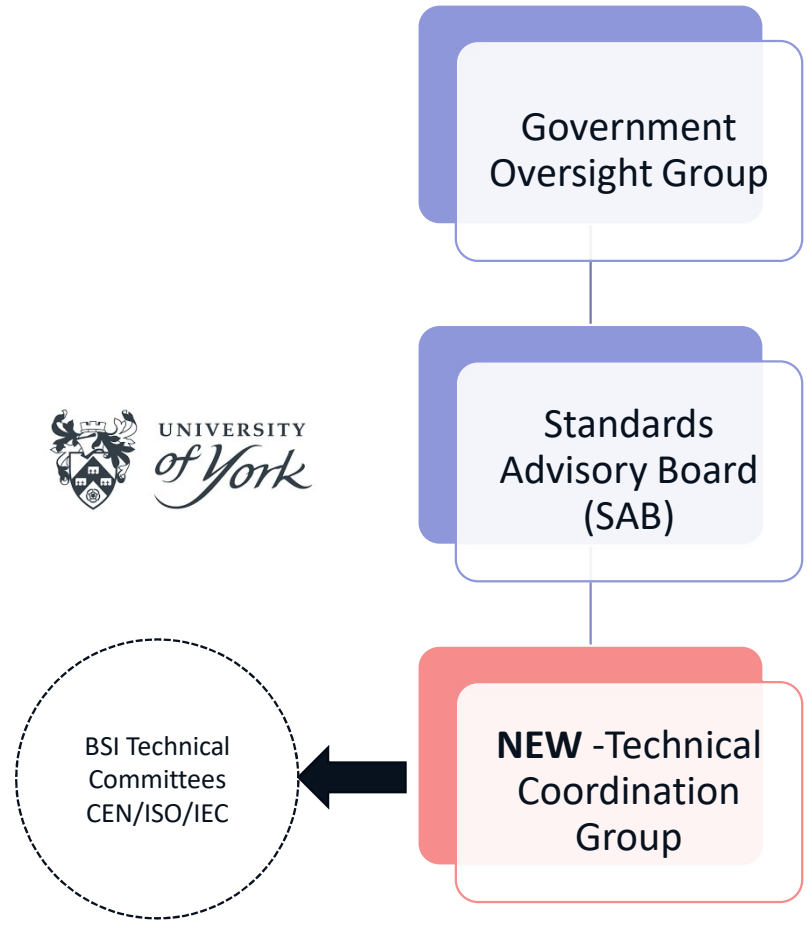
Supporting UK CAV trials and development.

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



- Provide overall strategic direction and aims
- Ensure alignment with relevant policy and technical workstreams outside of innovation programme
- Governance over BSI CAV programme

Centre for Connected & Autonomous Vehicles

Department for Transport

- Advises on programme priorities and gaps
- Considers/reviews proposals for new projects
- Shared insights on standards
- Guidance on international standardization
- Champion standards across eco-system

UNIVERSITY of York

- Reviews PAS series relevance and related global initiatives
- Acts as a liaison to BSI formal technical committees on related areas of development (e.g. CEN, ISO, SAE)
- Supports bi-lateral engagement and discussions (e.g. ITU, IEEE)
- Proposes future priority areas/projects and reports to SAB

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

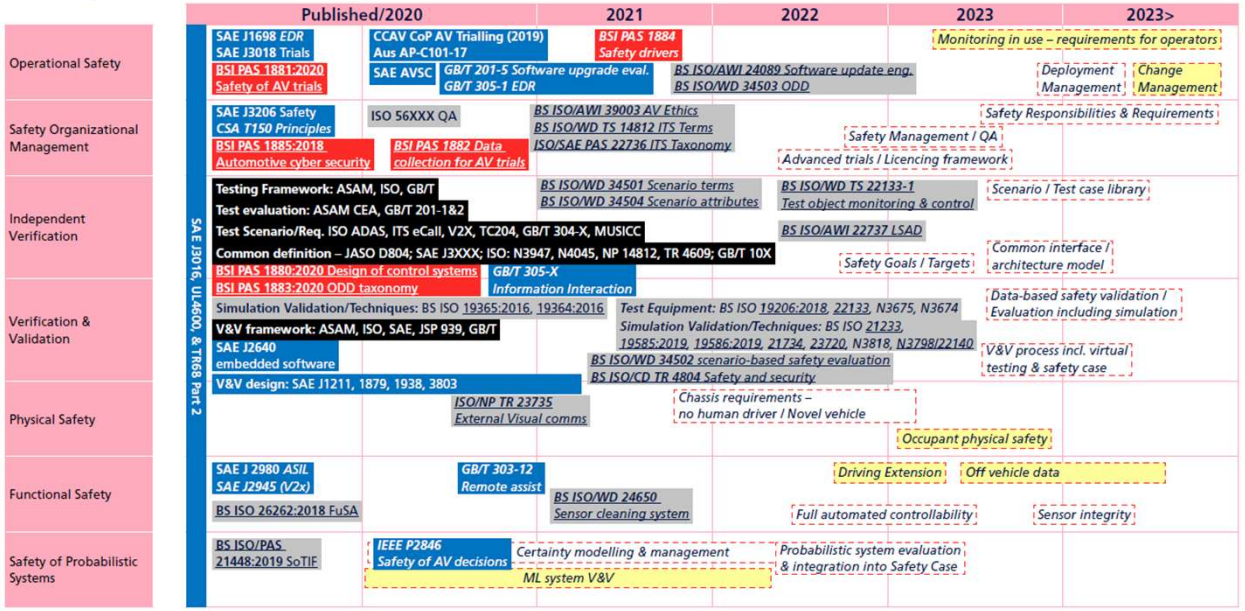
IEEE P2846 Assumptions for Models in Safety-Related Automated Vehicle Behaviour

SAE J3016_202104 Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles

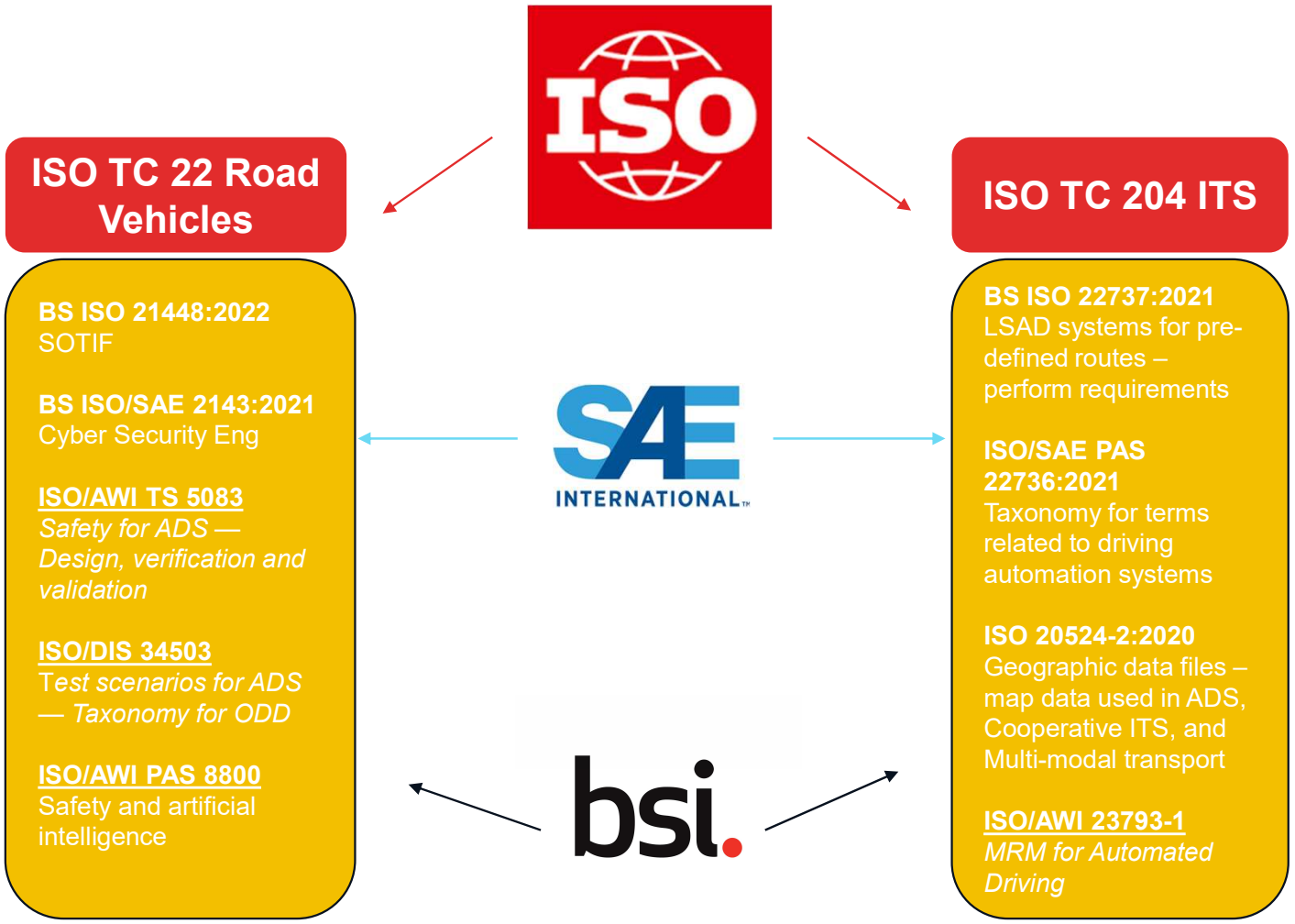
ITU TR-01 – 03 Safety data protocols for Autonomous Driving

ASAM OpenSCENARIO® March 2021 (Rel)

Roadmap for CAV standards: Safety & Assurance Theme



ISO and ITS/CAV Standardization – BSI represents UK interests



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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	**PD/ISO PAS 21448:2019** Road vehicles – Safety of the intended functionality **PAS 1881:2020** Assuring the operational safety of automated vehicles – Specification **SAE J3016** Taxonomy & definitions for terms related to driving automation systems for on-road motor vehicles **UL 4600** Evaluation of autonomous products **BS ISO 26262:2018** Functional safety **BS ISO 22737:2021** LSAD systems for predefined routes – Performance requirements, system requirements & performance test procedures **ASAM OpenDRIVE®**	**ISO/AWI 23793-1** MRM for automated driving – Framework, straight stop and in-lane stop **ISO 34501** Road vehicles - Terms and definitions for test scenarios for ADS **ISO 34502** Road vehicles - Scenario-based safety evaluation framework for ADS **ISO/WD 34503** ODD taxonomy **SAE J3259** Taxonomy & definitions for ODD **ISO/AWI TS 5083** Safety for ADS – Design, verification and validation	Standard behaviours in response to emergency vehicles (incl. high priority messages) Library of scenarios/test cases for testing & type approval of CAVs & systems (may include by simulation) Guidance on how to apply SOTIF ISO 21448 Minimal risk manoeuvre & conditions for ADS failures & other malfunctions HMI standards for handover & takeback/fallback functionality includes monitoring of safety driver & training
Perception, Decision Making & AI	**PAS 1883:2020** ODD taxonomy for an automated driving system – Specification **BS ISO 22735:2021** Road vehicles – Test method to evaluate the performance of lane-keeping assistance systems **PD ISO/SAE PAS 22736:2021** Taxonomy & definitions for terms related to driving automation systems for on-road motor vehicles	**ISO/AWI PAS 8800** Road vehicles – Safety and artificial intelligence **ISO/AWI 39003** Road traffic safety (RTS) – Guidance on safety ethical considerations for autonomous vehicles	Verification & validation of machine learning models, systems, & results suitable for safety cases Verification & validation of systems by simulation suitable for safety cases, to match real-world ground truth 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
Data	**PAS 1882:2021** Data collection and management for AV trials for the purposes of incident investigation – Specification **ITU FGAI4AD-02** Automated driving safety data protocol – Ethical and legal considerations of continual monitoring **ISO/TS 5255-1:2022** ITS – Low-speed automated driving system (LSADS) service – Part 1: Role and functional model **BS ISO 20524-2:2020** ITS – Geographic data files (GDF) GDF5.1 – Map data used in automated driving systems, Cooperative ITS, and multimodal transport	**ISO/PWI 7856** ITS – Remote support for LSAD - Performance requirements and test procedures	Benchmarking safety performance of manual & automated vehicles Teleoperation system specifications Real-time monitoring of AVs (including performance of ADS) for safety Using Off-Vehicle Data from C-ITS V2X including perception & situational awareness for safe driving decisions External communications for other road users & public that self-driving mode is active and includes standardized behaviour
Security	**BS ISO/SAE 21434:2021** Road vehicles – Cybersecurity engineering **ISO/PAS 5112:2022** Road vehicles – Guidelines for auditing cybersecurity engineering	**BS ISO 24089** Software update engineering **GB/T 204-13** Software upgrades **GB/T 204-14** Telematics service/management **GB/T 204-16** Emergency response	
Digital Infrastructure	**ASAM OpenSCENARIO®** **ASAM OpenLABEL®**	**ISO/PWI 7856** ITS – Remote support for LSAD – Performance requirements and test procedures **ISO/WD 34503** ODD taxonomy	
Human Factors	**PAS 1884:2021** Safety operators in automated vehicle testing & trialling – Guide **PD ISO/TR 21959-1:2020** Road vehicles – Human performance and state in the context of automated driving – Common underlying concepts **PD ISO/TR 21959-2:2020** Road vehicles – Human performance and state in the context of automated driving – Considerations in designing experiments to investigate transition process	**ISO/AWI TS 5283** Road vehicles – Ergonomic aspects of driver monitoring and system interventions in the context of automated driving **BS ISO 39003** Road traffic safety (RTS) – Guidance on safety ethical considerations for autonomous vehicles **PD ISO/PAS 11585** Road vehicles – Partial driving automation – Technical characteristics of conditional hands-free driving systems	Teleoperation human factors / training, testing and operator license Requirements for interior design for new vehicles without steering wheels / pedals etc. Internal communications to AV occupants to explain AV actions to gain trust (includes monitoring occupants for safety)

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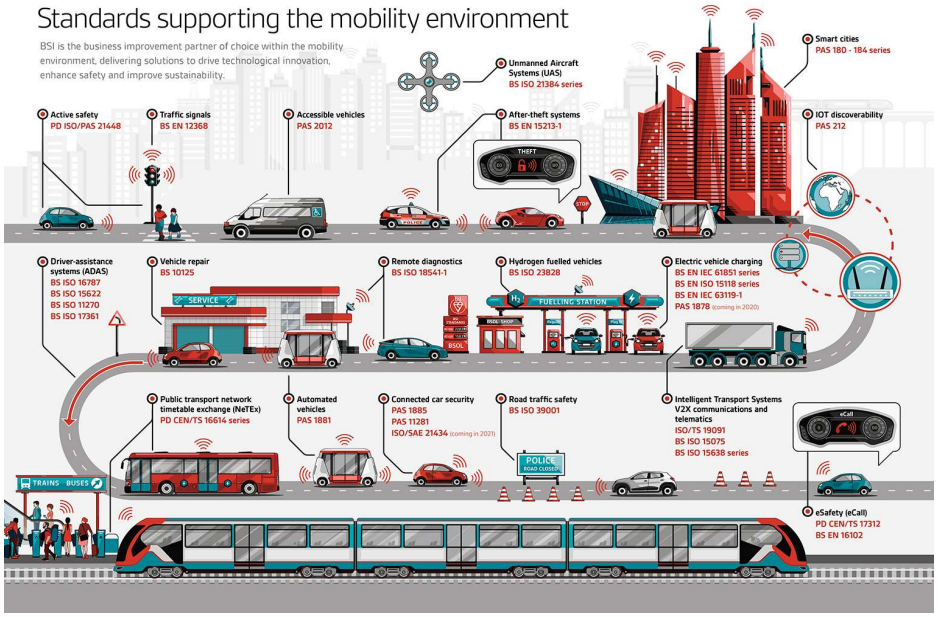
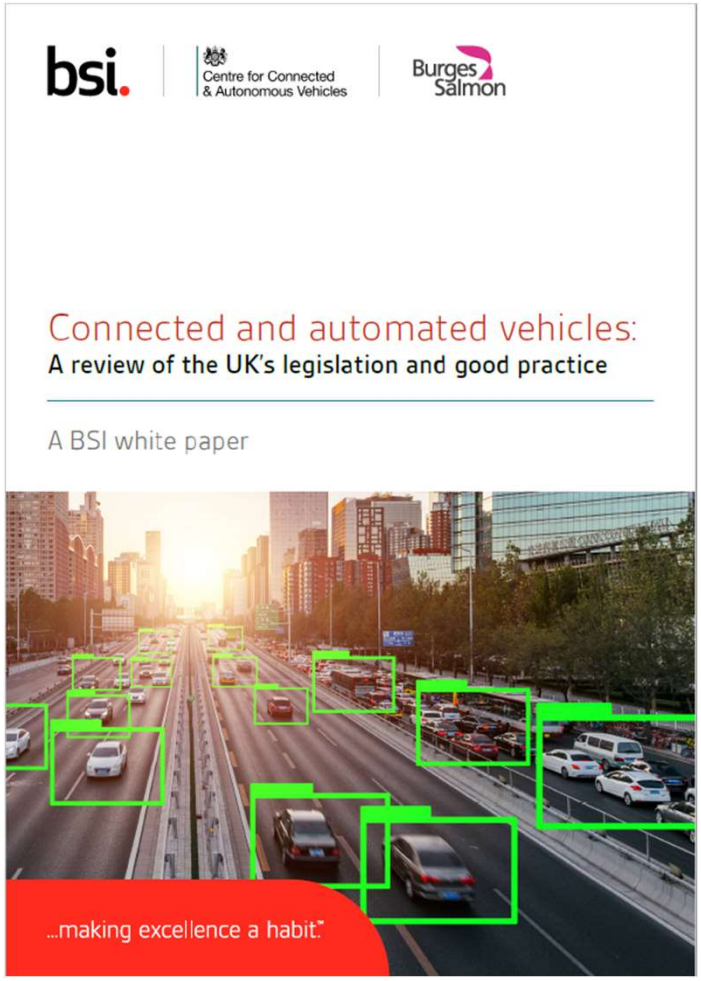
More information

Find our standards and resources online:

www.bsigroup.com/cav





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