dg:cities

endeavour

CONNECTED & AUTONOMOUS VEHICLES:

TRIALS ON THE PUBLIC HIGHWAY

CONTENTS

1. Introduction

THE PROJECT

Project Endeavour was launched in September 2019 and brought together Oxbotica, a global leader in autonomous software, urban innovators DG Cities and Immense, a leading transport simulation company. In 2020 three new consortium partners joined the project: The Transport Research Laboratory (TRL), BSI (the British Standards Institution) and Oxfordshire County Council (OCC).

The consortium is part-funded by the Centre for Connected and Autonomous Vehicles (CCAV) and delivered in partnership with Innovate UK; it is using a combination of advanced simulations, public engagement and on-road demonstrations to help accelerate and scale the deployment and adoption of autonomous vehicles (AV) services.

THE ROLE OF THIS DOCUMENT

A key element of Project Endeavour is exploring the role of AVs in the urban transport landscape, and to examine the place they have in the wider transport offer.

This element of Endeavour, led by DG Cities, builds on the cumulative learnings of both this project and wider AV trial-based research (which consortium partners have been part of), to provide a guidance note for Local and Highway Authorities on trialling on the public highway, and the information which could be expected from the trialling organisation.

We'd like to thank the councils who helped in the framing of the content, by agreeing to take part in interviews to discuss their knowledge and expectations in relation to AV trials. Insights gathered from those interviews have helped to shape our work.

The output of this work package is designed for use both by local authorities and for those who may be approaching them to trial vehicles on the public highway.

This document is intended to answer some of the key questions relating to road trials and signpost the current guidance and codes of practice. At a high level it outlines the information/documentation which trialling organisations should currently be producing to comply with best practice.

The high-level descriptions are further detailed in a suite of additional documents which accompany this overview, these are detailed in Section 3.

2. Initial Engagement

This area looks at both existing guidance for testing on the public highway and what we have ascertained is helpful when an organisation first contacts the local council to inform them that they are intending to carry out live trials on their roads.

If specific infrastructure requirements are necessary for the organisation's trial phase then early informal engagement will be useful. Not least this would be helpful in flagging any existing planned works which could impact on routing.

AN INTRODUCTION TO THE TRIAL

Ideally this should be a short document, or presentation, provided on first contact with the council. It should give enough information for council officers to inform internal stakeholders (both at officer and elected level) of the trial and ascertain who, internally, is best placed to liaise with the trialling organisation.

As indicated in the DfT's document, information about the trial should be made freely available to the public, and this introductory piece should also serve that purpose.

The Introduction, which should be high level and non-technical, should include:

- Dates
- Proposed routes
- Vehicle type and numbers
- What the trial is seeking to establish, and
- The details of additional information that will be provided to the local authority before, during and after trial, including managing public involvement, emergency and communications plans and security (cyber and data).

EXISTING GUIDANCE

Guidance on trialling exists; this workstream does not seek to repeat or replace that, rather it acts as a 'plain English' guide, designed to help those not already familiar with what is considered best practice or aided by overarching, regional, organisations such as Transport for London (TfL). It also signposts existing agreed standards. However, this is a dynamic industry, these documents are in a state of constant development, and will require revisiting.

The Government's permissive approach to allowing trials on the public highway is detailed in the July 2019 CCAV/Department for Transport's (DfT) document as a Code of Practice on trialling.

TfL published a guidance document, also in July 2019, which helps to promote best practice and co-ordinate the dissemination of information on trials in London, both on behalf of those undertaking trials and for the borough where they will take place.

BSI is developing a series of Publicly Available Specifications (PASs) on various aspects of AV trail etiquette. These are detailed below.

Additionally, some local authorities (OCC for example) are already looking to create their own guidance.

EXISTING GUIDANCE 'REQUIREMENTS'

Department for Transport[1]

The DfT Code is permissive in as much as it supports trialling of any level of automated vehicle technology on any UK road if carried out in line with UK law. It is clear that trialling organisations do not need to obtain permits or pay surety bonds when conducting trials in the UK. It also clarifies that to comply with the law organisations must have:

- A driver or operator, in or out of the vehicle, who is ready, able, and willing to resume control of the vehicle;
- A roadworthy vehicle; and
- Appropriate insurance in place.

The Code also notes that those planning tests should speak with the road and enforcement authorities, develop engagement plans, and have data recorders fitted.

Sections of the Code give advice on aspects of best practice and guidance/standards including in the fields of the Safety Case, Data Protection and Cyber security.

Transport for London[2]

TfL's guidance document clearly references the DfT Code. As well as setting out the information and data it would wish to receive, TfL is also clear regarding the requirement for collaboration between developers and the various stakeholders/highway owners.

[1] https://www.gov.uk/government/publications/trialling-automated-vehicle-technologies-in-public/code-of-practice-automated-vehicle-trialling
[2] https://tfl.gov.uk/corporate/publications-and-reports/connected-and-autonomous-vehicles

It notes the complexities of understanding the roles of TfL itself and London's 32 boroughs (plus the City) and offers a first point of contact and coordination role for trials in London.

British Standards Institution's PAS - CAV Suite[3]

The development of BSI Standards for CAV is a programme sponsored by CCAV in conjunction with the DfT, Innovate UK and Zenzic. The programme aims to develop a suite of standardisation products to promote the safe testing and deployment of automated vehicles in the UK and inform wider international standardisation activity.

Key areas of focus include:

- Safety and testing
- Data
- Cyber security
- CAV infrastructure and communications
- Human Factors
- Common language and terminology

PAS 1881 now forms the primary reference for the Safety Case. Published in February 2020, it specifies requirements for operational safety cases for automated vehicle trials and development testing in the UK to demonstrate that trialling and testing activities can be undertaken safely and securely.

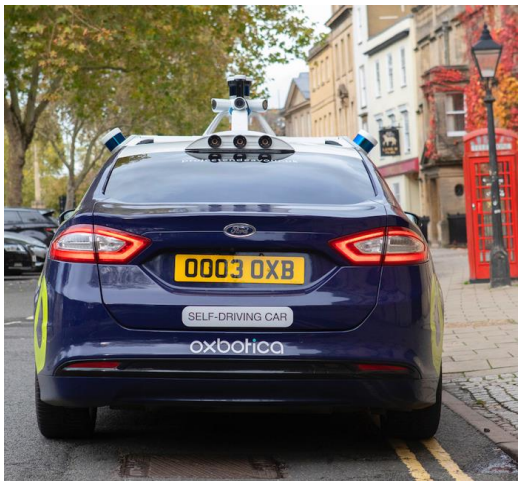
The Operational Domain is contained in PAS 1883, System Design (PAS 1880), and Cyber Security is contained in PAS 1885.

Work on PAS 1884, a guide for Safety drivers in automated vehicle testing and trialling, commences in early 2021, with publication expected in late summer.

The link below to the BSI CAV area allows access in full to the published PAS documents and will be revised as new guidance is developed.

[3] https://www.bsigroup.com/en-GB/CAV/

3. Supporting Documents



Prior to the trials commencing there are a number of documents which the trialling organisation is expected to produce to satisfy guidance outlined in the DfT's Code. As the trial is permitted as long as the DfT's basic requirements are met, the local authority does not currently have a role of agreeing documents (such as the safety case), or placing conditions on the trial.

Best practice however suggests the sharing of this relevant information before and during the trial period is beneficial to both parties. They create a structure to facilitate a managed response to any situation arising during the trial, and in addition provide the information required by the authority to respond directly to stakeholders' questions where appropriate. The trialling organisation may also want to consider offering a tailored presentation to the Council.

This section lists, and provides an outline description of, documents for communicating key information to the local council, and which are included in existing guidance as best practice.

Ideally the documents should be provided before the trials commence with time allowed for discussion with the appropriate authorities including councils and emergency services prior to their finalisation.

As part of this work example documents are being produced to help inform both those conducting the trials and the local authority of what they may reasonably expect to receive/input to.

Section 6 of this document contains links to example documents where appropriate.

THE SAFETY CASE

The safety case is specified as a requirement by the Code of Practice. It should be written with a view to mitigating implications for other road users - specifically Vulnerable Road Users - and with reference to and conformity with the BSI safety case PAS 1881.

Consideration should also be made to the production of an abridged public facing version of the safety case.

Government guidance states the mitigation should be 'proportionate' and inclusions should outline:

- information on the specific trial activity, vehicles, and operational domain of the trial
- evidence that the trial activity can be performed safely, whether with a safety driver in the vehicle or with a remote safety operator
- safety driver or operator training
- processes for managing the trial activity, and organisational responsibilities for managing the trial
- how the trial aligns with legislation and regulations
- evidence of engagement with relevant bodies, authorities, and other road users
- updates on milestones and progress reports of specific trial activity

From the perspective of the local authority, key to this is understanding if the trialling organisation has a location-specific safety case and if it follows best practice.

At a high level the safety case should include an overview of how it is compiled and structured, including:

- Route Selection and Analysis
- Overview of the technology, vehicles and systems
- Reference to the Emergency Management Plan and agreement on shared roles and responsibilities and the involvement of the Emergency Services.

Each of the areas below may either form part of the Safety Case, be annexed, or act as stand-alone reports:

- Risk assessment and method statement (understand the operating domain and operational mitigation)
- Contact Details, roles and responsibilities and communication during the trial
- Public engagement and the Communications Plan.

METHOD STATEMENT AND RISK ASSESSMENT

This document is closely related to the Safety Case, and is sometimes presented as part of, or an annex to, the Safety Case itself. It looks at how the trial will take place and be managed.

It also looks at (hypothetical) events which could be deemed a risk (and rates the seriousness of the risk) and their likelihood of occurring. It then looks at mitigating measures which could reduce the level of risk to one which is deemed acceptable.

The Risk Assessment (RA) frequently uses a traffic light system of red, amber, green (RAG) to give an immediate, visual, representation of the levels of risk. The RA is reviewed at agreed intervals throughout the trial.

The three primary areas of assessment are:

- Vehicle and Occupant Safety
- Trial Safety
- Security

Nested below these are a variety of trial specific variables including: the vehicle reliability and performance, changes and incidents on the route, training and competence, safety and emergency procedures accessibility, compliance, security (including cyber), incidents (reportable and other), incident avoidance, emergency response.

The RA itself looks to:

- Hazard Identification
- Safety Requirements and Mitigation
- Evaluation of Risks
- Implementation of mitigation and managing compliance.

DATA COLLECTION STATEMENT

Data collection needs to show compliance with processes set by the Information Commissioner's Office's www.ico.org.uk and also with local protocols. Contingency planning in the event of a data specific unintended situation or incident should form part of the Emergency Response Plan. A Data Collection Statement should be considered which clarifies how the project manages compliance with GDPR, privacy and other relevant guidance e.g. ethical use of Artificial Intelligence.

If data sharing has been agreed between the trailing organisation and the local authority, then a section in the statement confirming the content and format of this should be included.

THE EMERGENCY RESPONSE PLAN (ERS)

The ERS is designed to give an agreed response to any unplanned event. It should identify single points of contact in relevant organisations and detail internal planning and rehearsal of contingency measures.

It could also contain service level agreements for facilitation of any investigatory efforts (such as access to vehicle data).

For data specifically, agreement should be reached on:

- plans for public communications including agreed statements, releases, and any other publications across relevant organisations during an investigation or incident response
- plans for scaling down, pausing, or terminating activities during investigations or following an incident.

COMMUNICATIONS PLAN

Public and wider stakeholder engagement is a critical part of a safe and inclusive trial. The communications plan is a document which includes engagement with stakeholders and the wider public throughout the duration of planning, during the trial activity itself, and beyond where links to the trial outputs are of public/stakeholder interest.

The plan should be clear on how it will address the inclusion of hard to reach groups as part of its information dissemination.

Direct links with the Local Authority Communications team should form part of this for both promotion of the project and for dissemination of ongoing information through local authority channels to:

- explain the general nature of the trial to be undertaken
- understand and explain the implications for other road users and the mitigation measures, including how special consideration for vulnerable road users is addressed and could contain an abridged version of the Safety Case and links to the BRAKE doc
- more widely educate the public regarding the potential benefits of the trial and technology including the option to provide a channel for 2-way communication (e.g. service design using citizen's views).

4. Live Trial Period

'GO LIVE' SUMMARY NOTE

At the immediate outset of the trial period, and in addition to already having shared the agreed trial documentation, it is useful to again reconfirm, in summary form:

- Routes
- Exact timings
- Vehicle details: description and registration(s)
- Driver and stewarding details are as per the submitted documents
- Insurance confirmation

FREQUENTLY ASKED QUESTIONS

In order to be able to respond to questions directed to them, consideration should be given to the provision of a Question and Answer/FAQ sheet for the authority to use as a basis for its responses.

UPDATES

Regular progress updates (at agreed intervals) should be provided to the nominated Highways contact, and confirming the operation is still in line with the method statement provided before the commencement of on street operation.

Ongoing liaison with the council's Communications dept should take place in line with the detail contained in the Communications Plan.

5. Post-Trial

A summary note of the trial's outputs and achievements, which could be shared at an officer, elected member (and potentially public) level, is useful both for learning and dissemination processes.

If data sharing between the trialling organisation and the council was agreed as part of the original approach, and included in the Data Statement, then this needs to be supplied to the council in the manner and format outlined in the Data Statement. Local Authorities may already have Data Sharing Agreements and Non-Disclosure Agreements available to help inform this.

6. CAM trials and links to example documents

A number of trials involving AVs have, and are, taken place in the UK and on the UK's roads. This section provides a brief description of some of those (specifically those consortium members have been, or are, part of) and provides links to the various websites and publications.

PROJECT ENDEAVOUR

Project Endeavour's role is to be part of designing a future of mobility that benefits everyone, and this document is part of that output.

Our consortium already has the technology and toolkit needed to make connected and autonomous vehicles work. With Endeavour we want to explore how to build services using these vehicles, and to help local authorities incorporate those services into their future plans.

Setting up pilots for connected and autonomous vehicles in the public environment is a complex and time-consuming process. Before any autonomous vehicles are allowed on the road, it's necessary to coordinate with multiple different stakeholders and establish a robust safety case. And this process has to be repeated from the ground up for each new trial site.

Project Endeavour aims to create a flexible, scalable model that will make this process quicker, easier, and more efficient – whilst maintaining the highest safety standards.

View the project website here

GATEWAY

The GATEway project is now complete. The project saw a fleet of driverless pods providing a shuttle service around the Greenwich Peninsula to understand public acceptance of, and attitudes towards, driverless vehicles.

In a world first, members of the public were invited to take part in the research trial through riding in or engaging with the pods and sharing their opinions and experiences.
The shuttle trial was only one part of the GATEway project. Other trials included: automated urban deliveries, remote teleoperation demonstrations (including 'valet

parking'), exploring how automated vehicle systems work for people with additional travel needs, and high-fidelity simulator tests to investigate how drivers of regular vehicles respond and adapt their behaviour to the presence of automated vehicles on the roads.

Research from the GATEway project has helped advance the UK's position in the AV revolution, but what made it truly unique was its primary focus on people. Through exploring how people felt about using and sharing space with autonomous vehicles, GATEway provided valuable sociological insight into mobility solutions and the part they could play in our cities of the future.

View the project website here.

DRIVEN

A major part of the consortium's work included the use of a fleet of six inter-communicating vehicles equipped with Selenium, Oxbotica's vehicle manufacturer (OEM) agnostic software.

A key challenge was how to insure autonomous fleets of vehicles automatically considers data from the vehicle and external sources that surround it, for example, traffic control systems. The project was designed to help transform how insurance and autonomous vehicles will work together in connected cities.

The project also addressed data protection and cyber-security concerns raised by international policymakers and law enforcement agencies around the world by defining common security and privacy policies related to connected and autonomous vehicles.

View the project website here.

MERGE GREENWICH

MERGE Greenwich's aim was to develop a blueprint for a commercial pilot of an autonomous ride-sharing service, integrated with Greenwich's public transport system. The project focused on the social, commercial, and infrastructure challenge of autonomous vehicles and will consider the safety, ride-sharing, security, accessibility, and environmental factors of autonomous ground transport service.

The study also focused on how a flexible and responsive mobility service could benefit both the borough and its residents by reducing costs, the number of journeys and vehicles on our roads – helping both the environmental and improving road safety.

The project aims were to:

- Deliver a plan on how autonomous vehicles and ride-sharing will integrate into public transport systems, focused on the Royal Borough of Greenwich
- Create an advanced simulation and analysis to demonstrate how this integrated solution can benefit consumers, society, and the environment.
- Develop ideas on how to improve the efficiency of the way we travel around cities and how to reduce total vehicle journeys and reduce emissions
- Generate a detailed commercial and business model and optimal vehicle specification.
- Conduct a review of customer barriers to adoption and design considerations to overcome them.

View the end of project report here.

SMART MOBILITY LIVING LAB

The Smart Mobility Living Lab (SMLL) build was funded by Innovate UK and went 'live' in late 2020. It is a London-based real-world connected environment for testing and developing future transport and mobility solutions.

The dual locations in the Royal Borough of Greenwich and Queen Elizabeth Olympic Park in Stratford provide a complex uncontrolled testing environment, interacting with live traffic and other road users. The testbed is designed to demonstrate and evaluate the use, performance, environmental impact, safety and benefits of connected and automated mobility technology and future transport services.

View the testbed's website here.

D-RISK

Project D-RISK is focused on creating a taxonomy of "edge cases" - situations that are unusual or unexpected - for autonomous vehicles. Critically, through the use of simulation, the project aims to then ensure that autonomous vehicles are able to safely respond and manage these situations.

The project is Innovate UK funded and is being delivered by consortium partners DG Cities, dRISK.ai, Imperial College London, Transport for London and Claytex.

The ultimate goal of D-RISK is to create the world's largest driving scenario library, directly contributing to the safe deployment of CAVs into our towns and cities. The project aims to incorporate data from a variety of sources, to develop a multi-level framework with the capability to identify realistic edge-case test-scenarios. From there, representative test cases will be developed and fed into simulators which will directly test the vehicle control system (VCS). The ultimate goal is to have the world's

largest driving scenario library in the world, directly contributing to the safe deployment of CAVs into our towns and cities.

Learn more here.

EXAMPLE DOCUMENTS AND PROJECT OUTPUTS

https://www.oxbotica.com/safety/

https://www.amazon.co.uk/GATEway-Insurance-Ensuring-autonomous-Published/dp/1912433397

https://trl.co.uk/publications/smll-abridged-safety-case-for-automated-vehicle-technology-trials-in-london

https://trl.co.uk/Uploads/TRL/Documents/D2.2_-Safety-and-Insurance_PPR859_Optimized.pdf

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