Department for Transport

The Great Self-Driving Exploration

A citizen view of self-driving technology in future transport systems

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1. Executive summary

The UK is reaching a transition point in the emergence of self-driving vehicles (SDVs) with early uses approaching commercialisation. These new technologies have the potential to introduce a range of economic and societal benefits and it is government's role to understand how these could be realised while ensuring the safety and security of self-driving technology. Public understanding and acceptability of the technology as well as its governance will be vital for meeting these goals, including enabling the development and implementation of the required policies. Equally, it is necessary to understand what end users need from transport so that SDVs can be developed and deployed in a way that provides for those societal needs.

Findings from previous research have highlighted that while there is overall excitement among the public about the introduction of SDVs, more needs to be done before the technology and services are fully understood, considered safe enough to use, and are trusted by members of the public.

In 2022, the Department for Transport (DfT) commissioned Thinks Insight & Strategy, in partnership with University College London (UCL) and Aurrigo, to conduct a series of large-scale public engagement events, held in areas of the country where little or no engagement had occurred to date. The aim of this research was to provide an opportunity to increase exposure to and experience of SDVs among the public, in turn enabling DfT to bring together key elements of the Centre for Connected and Autonomous Vehicles (CCAV)'s engagement priorities: understanding public perceptions towards, and requirements from, SDV technologies, and increasing public awareness and understanding of the technology.

The aims and objectives of this research were as follows:

- To understand how to communicate safety information about SDVs effectively**.**
- To understand how different types of exposure to SDVs can influence awareness and understanding**.**
- To understand what role citizens see for SDVs in a future transport system**.**

An overview of the research approach is shown in Figure 1. Thinks Insight & Strategy worked in partnership with Aurrigo, an SDV manufacturer, to set up SDV trials in three locations across England in 2022. Three levels of exposure to SDVs were explored through the research, and these were used to define the three key audiences the research engaged with:

- **High exposure audience:** A total of 177 core audience participants across all three locations and a further 64 additional audience participants (young people aged 12-17, lower socio-economic groups (SEG), those with ethnic minority backgrounds, older people aged 65+, those who are digitally disengaged, and those with a disability/long-term health condition (LTHC)) took part in a three-week programme of deliberative engagement. During the sessions they learnt about and discussed SDVs and took part in the SDV trial. They also completed pre- and post-deliberative research surveys, pre- and post-ride surveys, and a six-month post-research follow up survey to quantitatively measure changes in views from taking part in the research.
- **Medium exposure audience:** Members of the public who took a ride in an SDV as part of the SDV trial but did not take part in the deliberative engagement. As this was open to anyone who wanted to participate, there was no target number of respondents. This audience was asked to complete pre- and post-ride surveys to measure views and any changes from taking part in the trial. Not all audience members completed these surveys, but responses were obtained from 450 participants for the pre-ride survey and 352 for the post-ride survey.
- **Low exposure audience:** Pre- and post-trial local polling, each with 250 residents living near the SDV trial in each location (750 respondents per wave in total) who did not take part in the deliberative engagement or take a ride in an SDV as part of the trial. These respondents may have been exposed to information about the trials or seen the trial vehicles during set up or the trial itself.

A national control survey (n=4027) was also conducted for a baseline comparison in areas not exposed to the technology through this research.

The deliberative approach for this research (used for the high exposure audience) consisted of three consecutive weeks of in-person workshops in each location (NB an online approach replaced one workshop in the final location due to external factors). During these workshops, participants engaged in a range of activities to build knowledge of the subject area, took part in an SDV trial in their local area, and discussed their informed views of their needs and expectations from SDVs if they were to be deployed in the local area.

Approaches	Activities	Audiences
In-person* deliberative workshops	**Three x one- or half-day workshops**, held on consecutive weekends • **Pre-deliberative research survey** • **Day 1**: Introduction and **initial views** • **Day 2**: **Vehicle trials** (incl. **pre- and post-ride surveys** +EEG test for sub-sample) • **Day 3**: Future scenarios and **informed opinions** • **Post-deliberative research survey**	**'High exposure audience'** of **264** members of the general public in Alnwick, Manchester and Taunton: • **192** core audience members (full-day workshops) • **72** additional audience members (younger; older; ethnic minority background; digitally disengaged; LTHCs) (half-day workshops)
Local engagement events	**Open event** for members of the general public to attend: • **Take a ride** in an SDV • Complete **pre- and post-ride surveys**	**'Medium exposure audience'** of members of the general public in Alnwick, Manchester and Taunton: • **450** respondents completed a pre-ride survey • **352** respondents completed a post-ride survey
Local surveys	**Pre- and post-trial local polling conducted in the local areas** to gather opinions of SDVs from people who were not involved in the deliberative research or vehicle trial events.	**'Low exposure audience'** of members of the general public in Alnwick, Manchester and Taunton: • **750** respondents completed the pre-trial survey • **750** respondents completed the post-trial survey
National survey	A **national control survey** used as a **comparison** to the areas where local populations were exposed to the workshops, vehicle trial events and local media coverage.	**Nationally representative** control sample of general public from across the UK: • Sample size of **4,027**
Follow up survey	A **six-month post-research survey**, conducted online to understand the longevity of participants' informed views.	A subset of the **high exposure audience**: • Sample size of **127**

** Due to death of HM Queen Elizabeth II, the first core audience workshop in Taunton was conducted online*

Figure 1 Overview of research methodology (repeated in each location)

1.1 Local transport landscape

At the start of the first workshop, the high exposure audience discussed how they currently travel in their local area and their views towards their local transport network. These discussions provided the context for later conversations, looking to understand how SDVs could help to address existing transport challenges and risks that need to be considered as part of their introduction in local areas.

Across all locations we established that travelling by private vehicle (car) remains the most popular option for the vast majority of participants in the deliberative research. It is viewed favourably both practically (e.g. convenient, quick, flexible) and emotionally (e.g. provides individual control and a sense of security and independence).

When thinking about their ideal transport system, participants in all locations primarily sought to address the gaps in their existing networks rather than radically overhauling or revolutionising transport in their local area. Specifically, improving public transport was seen as a top priority across all research locations.

In the rural location (Alnwick) we found that:

- Car ownership was considered a 'necessity' for all journey types as destinations tend to be far away from each other and public transport provision is typically limited. Non-drivers in the rural area used public transport because they had limited alternatives, but it was not considered a time efficient way to travel and was seen as difficult to rely on.
- Public transport provision was considered to have major gaps and issues, including indirect and poorly linked services, services running at inconvenient times (or not running at all), limited area of coverage, high costs and limited availability of taxis.

In the urban location (Manchester), by contrast we heard that:

- Participants preferred driving for all journeys except commuting, where public transport was preferred. This was due to the large number of public transport options and services, as well as the barriers to driving such as congestion and difficulty parking.
- Transport provision in the urban area was felt to have some small gaps and inefficiencies including: a lack of joined up services, increasing costs, congestion and difficulty parking, services not running at night, outdated infrastructure, concerns about personal safety on public transport and difficulty taking cycles on public transport services creating barriers to multi-modal journeys.

In the town location (Taunton) driving was also preferred:

- Participants preferred driving for all journeys except commuting, where public transport was preferred. Participants in the town reported similar difficulties with driving in the centre as in urban areas and similar limitations in public transport provision in the rural fringe to those experienced by participants in the rural location.
- Declining public transport provision was of concern in the town, including reduced service frequency, increased likelihood of service cancellation, services running at inconvenient times (or not running at all), indirect routes, high travel costs, and the removal of whole bus routes leaving some without any public transport links. This could result in increased dependency on use of cars or indeed some journeys being made less frequently than residents would prefer.

1.2 Baseline views of technology and SDVs

Quantitatively, the research collected baseline (pre-research) data on participants' views towards technology and SDVs. This provided important context to understand the impact that taking part in the research had on participants' views of SDV technology (see section 1.8). This summary focuses on the high exposure audience, with more detail on all audiences available in section 6.

- The deliberative element of the research supported previous studies which have indicated a strong correlation between positive attitudes towards science and technology, and positive views towards SDVs. This correlation was found to be strongest for men, younger people, those with higher incomes, those with higher education levels, and those living in urban areas. The high exposure audience had higher baseline levels of technological optimism compared to other audiences, suggesting that participants in the deliberative research might have more positive starting views towards SDV technology than the wider public would have.
- Baseline awareness of SDVs was high among the high exposure audience, and they tended to be cautiously optimistic about the use of SDVs. The majority had previously talked with others about SDVs but very few had seen one being trialled or trialled one themselves.
- Familiarity with SDVs was, however, low for this audience, with only 11% reporting that they knew 'a fair amount' about SDVs, and no one reporting knowing 'a great deal'.
- This audience reported being most likely to consider using a private SDV where the responsibility for driving is shared between the human driver and the vehicle; this was due to the perceived importance of retaining some element of human control.

- At the beginning of the research this audience was broadly unsure about the impact that SDVs could have on their local area, and the majority were unsure of whether SDVs would have more advantages or disadvantages (23% felt there were as many advantages as disadvantages and 26% said they were not sure and needed more information). However, those who did take a view tended to take a more positive one (more advantages than disadvantages to SDVs) and very few felt there were more disadvantages.

1.3 Views towards SDVs before the vehicle trial

In the first workshop the high exposure audience were provided with information about SDVs and discussed their views towards the technology in terms of key associations, support or opposition, and perceived benefits and drawbacks. This section summarises those initial discussions (with final considered opinions set out below in section 1.8)

Based on early information and discussion, participants in the deliberative workshops across all locations continued to develop their cautiously optimistic expectations and opinions about the potential for SDVs in their local area.

- Participants' initial reactions to introducing SDVs to their local area were primarily positive to neutral, with less than one in 10 opposed to the concept in principle across all locations.
- Key early associations with SDVs were around the themes of safety (both the potential for SDVs to be safer but also a need to see more evidence), technology, convenience and cost (e.g. an assumption that SDV technology would be expensive).
- However, there was a tension between positivity about the idea and ambition of SDVs in principle and concerns about how different aspects would work in practice.
- There was also a tension between what participants may, in the abstract, consider a practical and sensible solution to some of the issues in their local transport system, and their emotional attachment to current modes of travel.
- Early expectations and assumptions about SDVs were that they would be fully self-driving (no-user-in-charge), remotely managed, expensive and sustainable. There was also an assumption that SDVs would be used in public transport first before mainstream adoption for private vehicles.
- Perceived benefits of SDVs early in the research included better access to travel for non-drivers, better rural connectivity, improved road safety, and more efficient journeys. Being environmentally friendly, despite not being inherent to the technology itself, was also seen as a benefit that would come with any transition to SDVs.
- Perceived drawbacks of SDVs early in the research included concerns about diminished road and personal safety, loss of jobs, dehumanisation (e.g. more automation, fewer staff) and the loss of social interaction on public transport, but also relating to more general concerns about automation, the possibility of technological error, failure or impaired functionality in some locations (e.g. rural areas due to poor connectivity), being expensive to implement, concerns about data security and privacy, changes to licencing and concerns about accessibility.

1.4 Views on potential role of SDVs in local transport system

Building on perceived benefits and drawbacks (see section 1.3), the high exposure audience discussed what they saw as the opportunities and risks of introducing SDVs in their local area, in terms of the impact on other people, the local transport system and wider environment and society in general.

While participants were able to identify distinct opportunities and risks of SDVs, in many cases these perceived opportunities and risks crossed over and were either in tension with one another or were dependent on how the technology would be deployed, i.e. how widespread SDVs would be, how they would be used, and/or how they are run; these include in the areas of employment, safety, congestion, social impact, cost and accessibility.

- Participants broadly saw opportunities resulting from the introduction of SDVs in terms of boosting the local economy and employment, improvements for health and wellbeing and improving local transport networks and liveability.
- Despite being broadly optimistic about the opportunities presented by SDVs, there were several perceived risks that would need to be addressed to ensure SDVs were deployed in an acceptable way. These included reduced safety, high cost of implementation, unequal access to the technology, increased congestion especially under a private-user model and negative impacts on local employment.
- Participants in towns and rural areas were optimistic about the use of SDVs as a potential solution to some of the current gaps and pain points in their local transport system, feeling that SDVs could supplement existing transport options without entirely replacing or overhauling it.
- In urban areas, where the gaps in existing transport provision were smaller, participants did not feel that SDVs could offer much beyond what could be achieved with improvements or additions to what is already available (e.g. by extending the timetable for an existing bus service later into the night).
- Despite seeing potential for SDVs in theory, those in the town and rural areas felt that SDVs would be better suited to urban areas in practice; meanwhile, urban participants felt that SDVs would be better suited to rural areas and towns. This tension indicates the difficulty participants had in imagining the use of SDVs in practice within their local area and the need for concrete examples demonstrating how SDVs would manage different environments including participants' own. This could range from navigating busy city centres to dealing with windy rural roads.
- Across all locations, participants' expectations for SDV deployment in their local area included a gradual rollout, prioritisation of shared and public transport applications of SDVs, public ownership and operation to ensure affordability at the point of use, being able to book SDV services online, a variety of vehicle shapes and sizes being offered to suit specific user needs, and reassurance on the safety and security of vehicles and users.
- There were several factors that participants felt would need to be addressed prior to implementation of SDVs to ensure that their deployment would be designed and implemented in a way that addressed people's requirements and concerns. These included environmental and social planning such as infrastructure improvements, strong regulation from an early stage (proactive rather than reactive), new legislation regarding liability and safety for both users and non-users, and communication and education to build trust and subsequently encourage up-take of the technology.

1.5 Impact of information provision on views towards SDVs

Throughout the deliberative research, a key objective was to understand how information provision impacted views of SDVs, including what had the most impact.

Information provision vastly improved participants' understanding of the capability and implications of SDV technology, making it feel more tangible and 'real world' ready. Information provided in the research broadly met participants' expectations by covering what they wanted to know (such as on safety, functionality), as well as building and expanding in new areas that they had not yet fully considered (including legal definitions, liability, levels of autonomy, retrofitting SDV technology into existing vehicles).

In particular, the information developed participants' expectations of SDVs, broadening their views on what they could do and how they could be used to improve road safety and increase connectivity, particularly in rural areas.

- The most impactful aspect of the information provision was finding out about the high percentage of collisions which have human errors as a contributory factor from the introductory expert video on safety, as this helped participants to understand the scope for potential improvements in road safety using SDVs. It was also the most succinct way of communicating where exactly SDVs could improve upon human drivers in terms of safety, i.e. reducing collisions and fatalities. The potential for SDVs to improve road safety was broadly accepted as a given for the remainder of the research.
- Other impactful aspects of the information provision included finding out about the sophistication of SDV hazard recognition technology, as this gave a clear explanation of how the technology works and how it exceeds human capabilities to perceive obstacles; mentions of trials, regulations, standards, and certifications which were found to be reassuring; highly engaging visual evidence and statistics; and the concept of summoning, which seemingly opened up what participants imagined SDVs could do and the possibilities for them to change how we travel.

While the information provided reassurance at a hypothetical level, it also prompted a shift to a greater depth of engagement from participants on the finer practicalities of introducing SDVs. This caused some doubts over how easily SDVs could be deployed and the risk of teething issues in the early stages of their use.

- Practical concerns were counterbalanced to some extent by the concrete examples of use cases from Ocado, Stagecoach and Waymo, which were very persuasive and made SDVs feel more tangible, and technology that participants could more readily imagine being introduced in the near rather than distant future.
- In addition to the specific information presented, participants found the expert videos particularly reassuring as they communicated that experts in their respective fields were giving their time to this topic and considering the scenarios that might arise if SDVs were introduced. The high calibre of experts included in the research were considered credible, and therefore served to strengthen trust in the information provided.
- On balance, the shift to focusing on the practicalities of SDV use, as prompted by the information provision, helped to bring participants' priorities, needs and expectations for deployment into sharper focus.

1.6 Impact of trial experience on views towards SDVs

Beyond information provision, another key objective of the research was to understand how experiencing SDV technology first-hand impacted views of SDVs, including what had the most impact and any differences in stated versus actual emotional responses to trialling the technology.

Seeing and experiencing SDVs first-hand was a broadly positive experience that worked to move people towards a greater understanding of the potential application of SDV technology in their local area.

- Seeing the technology in action demonstrates, at a basic level, that self-driving technology exists and works. People accept that it is safe within the limitations of the trial environment (safety operator(s) present, defined routes used), and the experience starts to prompt people to imagine how SDVs could be used in their local area once the technology moves out of a trial phase (at which point safety is assumed).
- However, impressions of SDVs can be underwhelming if the journey does not go smoothly, including numerous and/or unexpected emergency stops and software glitches. For a minority of more sceptical participants, the presence of safety operators served as evidence that the technology was still quite far from being ready for widespread use and they found it quite difficult to look beyond this point. Less streamlined experiences could serve to entrench more negative views.
- Those in the high exposure audience reported high levels of comfort using and sharing the road with a variety of different applications of SDV technology (e.g. delivery vehicles, public transport, ride sharing, private vehicles), both before and after taking part in their trial experiences.
- By contrast, the medium exposure audience in the research demonstrated a statistically significant increase in their overall comfort using and sharing the road with a variety of different SDVs as a result of taking part in the trial. This indicates that first-hand experiences have a positive impact on comfort with SDVs when prior exposure to the technology is limited.

Overall, general excitement about using SDVs was reinforced by taking part in the trial. However, this remained in tension with some participants' pre-existing views on the practical constraints of using the technology, which were not challenged by their experience of the trial. After the trial, some participants in the high exposure audience still found it hard to imagine how SDVs would interact with human-driven vehicles during a ‘transition phase’, and what additional benefits they would bring over and above what could be provided by existing transport options when applied in their local area.

The experience of trialling SDVs particularly increased comfort levels (in relation to using or sharing the road with SDVs) for women in the high exposure audience who, prior to trialling each vehicle, started with a significantly lower level of average comfort than men for both measures. However, in each case women's comfort levels significantly rose such that post-trial average reported comfort levels across both measures were similar for men and women (within the margin of error).

1.7 Future scenario exploration for SDV deployment

In the final workshop, the high exposure audience took part in a role-playing scenario exploration game. This approach prompted participants to consider new perspectives and make tangible decisions about SDVs, in turn allowing the research to stress test the views that participants had expressed in earlier discussions and delve into more depth.

The scenario exploration game was a means to challenge the views that participants had articulated towards SDVs by asking them to put these views into practice; yet ultimately, the game revealed that participants rarely held contradictory views or views that were subsequently changed in the light of considering a future self-driving eco-system. Instead, the scenario exploration game resulted in participants taking the principles and ideas they had already started forming in the discussions and further developing these.

The role-playing nature of the game gave participants the opportunity to project their own views onto their allocated roles during the game play - opening up the possibility of potentially less outwardly enthusiastic or positive views coming into play (i.e. if they previously felt - consciously or subconsciously - that they had to be positive about this new technology).

- When exploring future scenarios for SDVs, participants overwhelmingly chose to take interventions that would promote rather than restrict their use in their local area, further evidencing a general acceptance and positivity towards future use of the technology.
- Furthermore, consistent with what participants said earlier in the research, scenarios where SDVs are predominantly shared use and/or public transport continued to be favoured over SDVs primarily being used as private vehicles.
- These views were consistent across all locations. When presented with potential negative consequences of chosen interventions in the game, as well as challenges likely to have a negative impact on SDVs, participants nonetheless continued to want to promote SDVs and chose subsequent actions to overcome and rectify these developments in the game.
- Specifically, the most popular interventions chosen by participants relate to physical environmental planning to develop SDV infrastructure in urban and rural areas and using fiscal measures to further promote and support the use of SDVs particularly in rural public transport.

1.8 Informed 'citizen' view of SDVs and their use in future local transport systems

Looking at participants' informed 'citizen' view by the end of the research gives insight into the impact of taking part on views towards SDVs, priorities for local deployment, and priorities for communicating with the wider public on the topic. Building on the baseline data (see section 1.2), the post-research data demonstrates this impact for specific measures.

Participants in the high exposure audience who felt they did not know enough about SDVs at the start of the research had formed their own opinions about SDVs by the end, and these opinions tended to be positive. Meanwhile, those who had already taken a view on SDVs at the outset tended to retain their views by the end of the research, regardless of whether these views were positive or negative.

- There was a significant increase in familiarity with SDVs among the high exposure audience, with more than two thirds saying they knew 'a fair amount' by the end of the research (68%, up from 11% pre). However, only a small proportion reported knowing 'a great deal' (14%, up from 0% pre); participants reported several practical questions that they felt could not be answered until SDVs were closer to deployment (e.g. cost, accessibility, how they would interact with human-driven vehicles).
- After taking part in the research participants felt they had a better understanding of the 'rules' for using SDVs and were more likely to accurately play back this understanding. However, there were still areas of potential confusion such as what level of autonomy is currently legal on UK roads.
- Reported comfort levels both for using and sharing the road with SDVs increased over the course of the research, particularly for the high exposure audience who benefited from additional information provision and time for reflection on the trial experience during the workshop discussions.
- The trial experience proved more effective than information provision alone in shifting reported levels of comfort with using and sharing SDVs in the high exposure audience.
- Participants in the high exposure audience continued to report being most likely to consider using a private SDV with shared responsibility for driving, however the biggest increase in consideration was for using SDVs for public transport. This suggests that the experience of the research (information and trial experience) has demonstrated the potential for SDVs to be deployed effectively in public transport, making public transport more appealing, but reservations remain about how the technology will work in practice.
- The research prompted the high exposure audience to feel more certain of the potential benefits of SDVs in their local area, with the largest increases among women and older people aged 65+. There was also an increase in positivity among the low exposure audience following the trial.
- The research resulted in less uncertainty and more positivity on the advantages and disadvantages of SDVs among the high exposure audience. This was driven primarily by a decline in those saying they were not sure or needed more information.

1.9 Conclusions

In answer to the key question of how best to communicate and engage with the public and communities about SDV technology the research concluded that the following are key themes and messages to address:

- **Safety:** Both the potential for improved road safety alongside reassurance of the safety of SDVs and users.
- **Reliability and security:** A key message to communicate balancing the application of advanced AI technology with human backup.
- **Accessibility:** It is important for users with additional needs and for the general public to see that SDVs would be fully accessible and would promote accessibility and mobility for all.
- **The benefits of shared and public transport applications:** Highlighting the potential for improved public transport provision as well as the environmental benefits of fewer private car journeys.
- **Costs:** Communicating that SDVs are cheaper or at least the same as existing provision would be a powerful message if this were the case (e.g. in public transport).

- **Ease of use and user comfort:** This included everything from hailing or summoning systems to on-board connectivity in vehicles and the benefits of not being responsible for inconvenient journeys or driving tasks such as parking.
- **Design and aesthetics:** There was an expectation that SDVs will not be limited in their design by current conventions, which could be impactful and also practical (e.g. wheelchair stowage).
- **Environmental impact:** The message that SDVs are part of a wider move to sustainable transport.
- **Evidence and statistics:** To provide concrete reassurance and 'proof' around SDV technology and deployment.
- There is a **key role for national government** in leading communication across fundamental messaging, with local government, service providers, independent safety experts and manufacturers also key stakeholders in communications.

In answer to the key question of how to deploy SDV technology in local areas in a way which is acceptable to people living and travelling in those areas, the research concluded that the following should be key features and considerations:

- **Safety** (demonstrated via extensive testing, including for different audiences with different needs (e.g. disabled users)).
- A **gradual rollout** (to allow the general public to get used to the technology, including choice of whether they wish to use it).
- **Public and shared** applications of SDVs (these applications were seen as the way of delivering the most benefit to those who need it, as well as offering user choice).
- **Integration with existing transport systems** (both to enable 'normalisation' of the technology but also to maximise the benefits to the local system and provide choice).
- **Affordability** (there was a strong theme around the need for fair deployment of the technology ensuring it was accessible to all, regardless of wealth (e.g. the same cost or cheaper than existing public transport provision)).
- **Accessibility** (both in terms of ensuring that vehicles and services are fully accessible but also maximising the potential for SDVs to make transport more accessible for people with disabilities and LTHCs).
- **Education** and engagement (to build public trust and understanding of the technology, including addressing perceived risks).
- **Consultation with local communities** (public engagement to ensure that local deployment meets actual needs of all parts of the community).
- **Sustainability** (a key expectation of SDV deployment was that they would be 'greener' than current vehicles/systems).
- It was felt that **government should play an active role** in addressing each of these, primarily through setting requirements and providing funding.

2. Background and objectives

2.1 Introduction to this research

The UK is reaching a transition point in the emergence of self-driving vehicles (SDVs) with early uses approaching commercialisation. These new technologies have the potential to deliver a wide range of economic and societal benefits and it is government's role to understand how, if at all, these could be realised while also ensuring the safety and security of self-driving technology. The Centre for Connected and Autonomous Vehicles (CCAV) has three aims: ensuring safety and security of self-driving technology; securing the industrial and economic benefits of self-driving technology and delivering the societal benefits of self-driving technology. Public understanding and acceptability of the technology as well as its governance will be vital for meeting these goals, including enabling the development and implementation of the required policies. Equally, it is necessary to understand end users' transport needs to ensure SDVs are developed and deployed in ways that retain elements that are working well, as well as addressing any currently unmet needs.

Findings from previous research, including the Future of Transport deliberative research carried out by Thinks Insight & Strategy on behalf of the Department for Transport (DfT) in 2021, have highlighted that while there is overall excitement among the public about the introduction of SDVs, more needs to be done before the technology and services are fully understood, considered safe enough to use, and are trusted by members of the public.

In 2022, DfT commissioned Thinks Insight & Strategy, in partnership with University College London (UCL) and Aurrigo, to conduct a large-scale public engagement research programme with events held in areas of the country where little or no engagement had occurred to date. The aim of this research was to provide an opportunity to increase exposure to and experience of SDVs among the public, in turn enabling DfT to bring together two key elements of CCAV's engagement priorities: understanding public perceptions towards, and requirements for, SDV technologies; and increasing public awareness and understanding of aspects of the technology.

2.2 Research objectives

The aims and objectives of the research programme were as follows:

To understand how to communicate safety information about SDVs effectively. Including to understand the types of information and best channels for educating the public about SDV technologies to have the greatest level of impact, focusing on:

- The diversity of technology options, including automated features such as Automated Lane Keeping Systems (ALKS).
- Their responsibility when in and around SDV technologies, and how these responsibilities differ from human-driven vehicles.
- The safe behaviours expected when engaging in and around SDVs for a range of different end users (e.g. demographic groups, transport mode users).

To understand how different types of exposure to SDVs can influence awareness and understanding:

- Enable the public to develop accurate mental models of the technologies.
- Improve understanding and awareness of SDV technologies by increasing exposure to and experience of SDVs, both through direct exposure and using innovative techniques to reach a wider audience.
- Understand what sorts of awareness are required (e.g. awareness of vehicles; awareness of vehicles' capabilities; awareness of vehicles' limits etc.)
- Evaluate the effectiveness of the programme to understand the extent to which exposure to the technology can impact overall knowledge, awareness and understanding of SDV technologies.

To understand what role citizens see for SDVs in a future transport system:

- Develop an accurate and in-depth understanding of both perceptions of self-driving technologies and what the public want from this technology.
- Develop evidence to inform future behavioural change interventions that will enable the successful introduction and acceptance of SDVs.
- Understand the needs and concerns of the public in relation to the deployment of SDVs, particularly in rural areas, as well as understand the potential for SDVs to address currently unmet transport needs.

3. Methodology

3.1 Overview

To address the research objectives, the research approach was designed around a series of **4-day in-person SDV trials** with a focus on using **deliberative** and **quantitative** methodologies to explore views towards SDVs and the impact of different levels of exposure to the technology. **Electroencephalography (EEG) analysis** was also used to understand physiological responses to the technology and how, if at all, this differed from self-reported sentiment.

The research was conducted in three locations in England: **Alnwick, Northumberland**, **Manchester**, and **Taunton, Somerset**. These locations ensured representation from places where there had been minimal exposure to SDV trials to date, as well as including a mix of rural (Alnwick), urban (Manchester) and town (Taunton) locations to ensure the research could explore a range of views and transport needs.

In each location, a 4-day SDV trial was undertaken consisting of two **public engagement days** (open to members of the public) and two days that were for research participants only. This enabled three levels of exposure to SDVs to be explored:

- **High exposure audience:** Participants recruited to take part in a 3-week programme of deliberative engagement during which they learnt about and discussed SDVs and took part in the SDV trial. These participants trialled two SDVs (a 6-passenger shuttle and a 2-passenger pod), as well as interacting with a static self-driving delivery pod display.
- **Medium exposure audience:** Members of the public who took part in the SDV trial on the public engagement days but did not participate in the full programme of deliberative engagement. This includes a mix of people who heard about the trial prior to attending or were walking past on the day. Passengers rode in the shuttle or pod, or both; they also had the opportunity to interact with the delivery pod.
- **Low exposure audience:** Residents living near the trial location who did not take part in the deliberative engagement or take a ride in an SDV as part of the public engagement days. This audience (as well as the other audiences) may have been exposed to SDVs by seeing the vehicles operating on local streets during set up or the trial itself, or by hearing about the trials taking place from sources other than the research itself (e.g. word of mouth, local community pages online, local media coverage on TV/radio/online).

Figure 2 shows an overview of the approach used for each exposure audience; this approach was repeated in each of the three research locations. Additionally, a national control survey was used to establish a baseline of public attitudes towards SDVs outside of the selected research locations (not depicted in Figure 2; more detail on the approach to the national control survey can be found in 3.3 Quantitative research).

Approaches	Activities	Audiences
In-person* deliberative workshops	**Three x one- or half-day workshops**, held on consecutive weekends • **Pre-deliberative research survey** • **Day 1**: Introduction and **initial views** • **Day 2**: **Vehicle trials** (incl. **pre- and post-ride surveys** +EEG test for sub-sample) • **Day 3**: Future scenarios and **informed opinions** • **Post-deliberative research survey**	**'High exposure audience'** of **264** members of the general public in Alnwick, Manchester and Taunton: • **192** core audience members (full-day workshops) • **72** additional audience members (younger; older; ethnic minority background; digitally disengaged; LTHCs) (half-day workshops)
Local engagement events	**Open event** for members of the general public to attend: • **Take a ride** in an SDV • Complete **pre- and post-ride surveys**	**'Medium exposure audience'** of members of the general public in Alnwick, Manchester and Taunton: • **450** respondents completed a pre-ride survey • **352** respondents completed a post-ride survey
Local surveys	**Pre- and post-trial local polling conducted in the local areas** to gather opinions of SDVs from people who were not involved in the deliberative research or vehicle trial events.	**'Low exposure audience'** of members of the general public in Alnwick, Manchester and Taunton: • **750** respondents completed the pre-trial survey • **750** respondents completed the post-trial survey
National survey	A **national control survey** used as a **comparison** to the areas where local populations were exposed to the workshops, vehicle trial events and local media coverage.	**Nationally representative** control sample of general public from across the UK: • Sample size of **4,027**
Follow up survey	A **six-month post-research survey**, conducted online to understand the longevity of participants' informed views.	A subset of the **high exposure audience**: • Sample size of **127**

** Due to death of HM Queen Elizabeth II, the first core audience workshop in Taunton was conducted online*

Figure 2 Overview of research methodology (repeated in each location)

When combined, the breadth and range of methodologies used in this research ensured that it could address the research objectives, providing in-depth insights into the views and requirements of participants in relation to SDVs as well as assessing the impact of the different types of exposure on participants' perceptions and understanding of these technologies.

3.2 Deliberative research

Deliberative research is an established method of generating in-depth insight to inform decision-making. It is a technique that helps to enable productive conversations on complicated or uncertain subjects.

In deliberative approaches, participants learn about a topic that they might know little about or may not typically think about in much depth in their day-to-day lives. Participants engage with information, evidence, and expert opinion (including written descriptions, images, and videos) as well as reflecting on their current habits. This enables them to develop informed views on complex topics that cannot be suitably covered by traditional research approaches alone (such as focus groups or surveys).

Deliberative approaches seek to understand the public's values and explore how they make difficult trade-offs, after weighing up different evidence and information. It is also an opportunity to see why 'logical' solutions might be rejected.

Approach

For this research, the deliberative approach primarily consisted of in-person workshops in each of the three research locations to understand the views of the **high exposure audience**. The research used a place-based approach to understand participants' views within the context of their local transport systems, with fieldwork taking place across five months in 2022:

- Alnwick, Northumberland (rural)**:** 11th - 26th June 2022
- Manchester (urban)**:** 16th - 31st July 2022
- Taunton, Somerset (town)**:** 17th September - 2nd October 2022

In each location, the deliberative sample was split into a 'core audience' and 'additional audiences'. The former represented the general population while the latter represented specific sub-segments of the general population whose views were particularly important for DfT to understand (more below under Sample).

Both the core and additional audience strands followed a similar process, with participants in each location taking part in three full-day (core audience) or half-day (additional audiences) deliberative workshops over three consecutive weeks (nine full-day core audience workshops and nine half-day additional audience workshops in total). Across the full deliberative programme, the approach taken with the additional audiences was adapted to reflect the smaller number of participants and the shorter length of workshops. Participants engaged in a range of live activities such as responding to videos and other stimulus material, taking part in discussions with other participants, and completing creative exercises such as designing information posters or their own SDV. This allowed them to gradually build knowledge of the subject area and provide them with time to reflect and absorb information.

In the third research location (Taunton), the initial workshop for the core audience was moved online due to external events (the death of HM Queen Elizabeth II); a combination of an online community and virtual discussion groups conducted on Zoom were used instead.

A rapid literature review was undertaken prior to designing the deliberative materials to ensure these were informed by the broader transport literature. A Specialist Group was also established to provide expert views, help shape the information provided to participants and ensure that the discussions were grounded in existing industry and academic knowledge.

Structure

The workshops consisted of a variety of breakout discussions, Q&As and creative sessions, accompanied by plenary presentations of information across workshops 1 and 2, the SDV trial experience during workshop 2, and culminating with a day-long role-playing game in the final workshop 3.

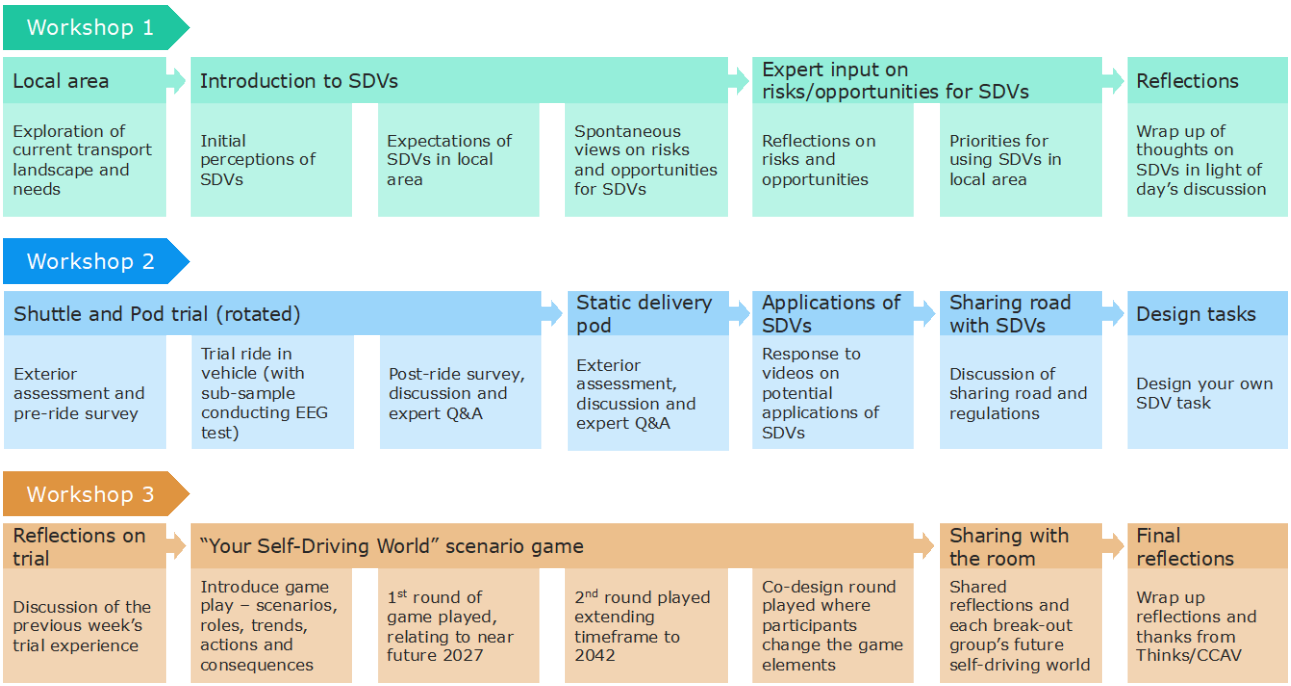

Figure 3 Overview of approach to the deliberative research (repeated in each location)

Workshop 1: The research initially explored participants' experiences and views of their current local transport system including any issues they currently face. SDVs were then introduced through three expert videos shown in plenary before breakout group discussions to discuss participants' initial perceptions and expectations of SDVs, as well as what they saw as the potential risks and opportunities of their deployment and use. These discussions were then elaborated on using three pairs of debate-style expert videos to provide participants with further information and different perspectives regarding SDVs. Breakout discussions sought to understand how, if at all, this information impacted participants' views on the potential risks and opportunities of SDVs as well as what, if any, further questions this information prompted. Finally, participants discussed what priorities they had for SDV deployment in their local area; this was grounded in initial discussions of existing unmet local transport needs and the extent to which SDVs could help to address these, if at all.

Workshop 2: Participants took part in the shuttle and pod SDV trials and interacted with the static self-driving delivery pod display. Participants shared their views on the vehicles before boarding as well as after riding, both in qualitative discussions and quantitative pre- and post-ride surveys (for more detail see 3.3 Quantitative research: Approach and sample). Some participants in the core audience wore EEG headsets to track their physiological responses during the trial. Alongside elements of the trial, several breakout discussions took place. Participants were shown videos about and discussed additional applications of SDVs beyond those demonstrated in the trial. Participants also discussed their views of sharing the road with SDVs, and rules and regulations regarding the use of SDVs on UK roads. A range of creative tasks were used to further explore participants' views, including developing an advertising or information campaign about SDVs and designing their own SDV. These tasks aimed to highlight the types of information that were most memorable or important to participants, as well as their requirements for SDV design based on what they believed to be the important benefits or drawbacks of the technology.

Workshop 3: The final workshop gave participants the chance to apply the knowledge and experiences they had gathered during the deliberative process in the form of a role-playing 'scenario exploration game'. In the game, participants were presented with a future scenario regarding the use of SDVs, as well as several social or economic trends that might impact future transport and how people interact with it. Participants were given roles to adopt as they debated the future deployment of SDVs, choosing from a series of actions that they wanted to take to either promote or restrict the future use of SDVs in their local area. A full description of the scenario exploration game is included in 14.4 Research design: 'Your self-driving world' scenario exploration game.

Sample

In each location, 64 participants were recruited as part of the 'core audience' (192 participants recruited in total across all locations). These participants were recruited to provide an inclusive sample reflective of English drivers and transport users, including:

- A spread of demographics, including gender, age, ethnicity, disability, mobility impairments and socio-economic groups.
- A range of attitudes and behaviours in relation to travel, modal use and technology.

The additional audience strand included groups traditionally under-represented in research, or where previous research has identified that they may have varying requirements. This ensured that the research could fully understand the specific or varying needs of these transport users. Two groups were included in the additional audience strand in each of the three locations (six additional audiences in total), with 12 participants recruited per group (72 participants recruited in total across all locations). The additional audiences were:

- Alnwick (rural): Young people aged 12-17 years old, and people who are digitally disengaged (i.e. those who prefer to use traditional methods over technology when able to).
- Manchester (urban): Low socio-economic grade (DE), and those of ethnic minority background.
- Taunton (town): Older people aged 65+, and those living with LTHCs or disabilities that impact their mobility.

In total, 264 participants were recruited to the high exposure strand of this research across both the core and additional audiences, with 241 completing the full research programme. Full details of the achieved core and additional audience samples are set out in 14.2 Sample breakdown.

3.3 Quantitative research

Quantitative surveys are structured methods conducted with larger samples of participants. In this research, they were used to supplement the deliberative engagement and provide statistical robustness, comparative data, and detailed sub-sample analysis. Quantitative surveys allow for analysis to identify statistical significance in results, for example between different demographic groups or geographical locations. However, they have relatively limited provision for education and information around a subject, as well as

limited ability to explore the views underpinning respondents' answers (the question of why they hold a particular view), compared with qualitative methods such as deliberative.

Approach and sample

A key focus for the quantitative surveys was to understand and compare the impact of different levels of exposure to SDVs on awareness and understanding of them. To achieve this, five quantitative approaches were used:

- **Pre- and post-trial local polling:** This approach was used to capture the views of the **low exposure audience.** 250 residents living near the SDV trial in each of the three locations (750 in total) took part in a telephone survey before and after the trial took place to understand if their views had changed after a low level of exposure to (but not taking part in) the trial.
- **Pre- and post-ride surveys:** This approach was used to capture the views of the **medium and high exposure audiences.** Those taking part in the SDV trial during the public engagement days or as part of the deliberative research were asked to complete a pre- and post-ride survey for each journey completed. Surveys were self-completed by respondents through a QR code for the online version or on paper if preferred. While there was no target number of respondents on the public engagement day as this was open to anyone wanting to take part, a total of 450 people completed a pre-ride survey and 352 completed a post-ride survey across all three locations to comprise the medium exposure audience. All in the high exposure audience were asked to take part (241 participants across all three locations).
- **Pre- and post-deliberative research surveys:** This approach was used to capture the views of the **high exposure audience**. These surveys were completed before and after taking part in the deliberative engagement (i.e. before attending workshop 1 and at the end of workshop 3) by all participants who completed the research except those aged under 18 (230 participants across all three locations).
- **Six-month post-research follow up survey:** This was used to understand whether taking part in the deliberative research had a sustained impact on the views of the **high exposure audience**. This survey was hosted online, with all participants aged 18+ who took part being sent a link approximately six months after the deliberative research took place (link sent to 230 participants across all three locations with responses received from 140 participants; see 14.3 Technical appendix, note 1).
- **National control survey:** Used to establish a baseline of public attitudes towards SDVs against which other audiences in the research could be compared. The national control sample consisted of 4,027 respondents (representative of the UK by age, gender, region and socio-economic group) who took part in an online omnibus survey.

Full details of the achieved quantitative samples across all audiences and quantitative approaches are set out in 14.2 Sample breakdown.

Quantitative data in this report is predominately grouped by fieldwork location or respondents' level of exposure. Surveys used in this research were designed to allow for comparison between groups, including with the national control survey.

3.4 SDV trials

The project ran a series of in-person SDV trials in partnership with Aurrigo, an SDV manufacturer. Priorities when choosing the sites and routes for each of the trial locations were:

- To demonstrate realistic potential use cases of SDVs, to aid the public in imagining how the technology could be deployed in their local area.
- To maximise public exposure to SDV technology while ensuring the safety of all road users, both those taking part in the research and those interacting with the vehicles more broadly. Safety cases were produced by Aurrigo prior to each trial; these were reviewed by Aurrigo's insurance provider and a third party independent reviewer in line with DfT's code of practice for trialling SDVs.

Three Aurrigo vehicles were used for the trials: the AUTO-SHUTTLE (six-passenger capacity), AUTO-POD (two-passenger capacity), and the AUTO-DELIVER (static display only - not operational for the trial). More detail about the trial vehicles and routes used can be found in 14.4 Research design: SDV trials.

Figure 4 Aurrigo vehicles used for the SDV trials

3.5 EEG analysis

Electroencephalography (EEG) is an electrophysical process used to record electrical activity from the brain. The analysis of these electric signals can then be used to study cognitive process and provides real-time insights into how people experience an environment. In this study, EEG was used to provide real-time insights into how participants experienced a journey on an SDV including how these experiences changed or are influenced by events throughout a journey. This method provided physiological responses in contrast to the other approaches used in the research which relied on self-reported attitudes, feelings and experiences which can be prone to biases.

For this research six emotional states (referred to as Performance Metrics) were measured: 'Engagement', 'Excitement', 'Focus', 'Interest', 'Stress' and 'Relaxation'. EEG data was collected for participants in the core strand of the deliberative research (high exposure audience) only.

EEG data during the SDV trials was analysed alongside baseline EEG readings (taken prior to boarding), video footage from inside and outside the trial vehicles, as well as

participants' self-completed pre- and post-ride surveys. The use of multiple data sources enabled the research to triangulate participants' **reported** responses with objective **observed** data, giving a more holistic understanding of participants' experiences.

More detail on the methodology, findings and implications of the EEG strand can be found in the supplementary report: 'The Great Self-Driving Exploration: EEG strand'.

4. About this report

4.1 Report structure

The report is structured as follows:

- Section 5 explores the high exposure audience's views of their local transport landscape, including current travel habits and modal choices, what people want and need from their local transport system, and identifies current challenges and gaps.
- Section 6 examines broader attitudes to new technology and views of SDVs at the outset of the research, including the extent to which people were aware of SDVs, what kind of knowledge and attitudes people had about SDVs, their openness to the use of SDVs in the future, and their comfort with SDVs.
- Section 7 further explores the high exposure audience's initial reactions, questions, and assumptions around the use of SDVs in their local transport system. This section identifies the perceived benefits and opportunities as well as the drawbacks and risks of SDVs. It also includes a closer look at participants' views and priorities on a potential rollout of SDVs within their local transport system including local applications and use cases, and considerations for local deployment.
- Section 8 examines the impact of information provision on the high exposure audience's views towards SDVs. Specifically, this section looks at what participants want to know about SDVs, the impact of information on participants' views, and key questions and gaps in current information provision.
- Section 9 explores the impact of the trial experience on participants' views towards SDVs, including a summary of how different elements of the trial experience impacted self-reported views, and reported versus actual reactions (EEG data) to the trial experience. This section focuses on the views of high and medium exposure audiences.
- Section 10 looks at the future scenario game exploration for SDV deployment. Specifically, how role play impacted the high exposure audience's views towards the deployment of SDVs and potential local use cases.
- Section 11 examines how taking part in the research has impacted views towards SDVs, building on the baseline data established in section 6 and with a focus on the high and low exposure audiences. It also explores participants' final ‘informed’ conclusions resulting from the deliberative process (high exposure audience) including their priorities for SDV deployment, vehicle design and communicating with the wider public.

- Section 12 is the conclusions section which draws together the key insights from all audiences and strands of the research along with implications for communication and the local acceptability of deployment of SDVs in the future, framed in terms of the COM-B model.
- Section 13 is divided into three sections for each of the locations to discuss key differences and location-specific findings.

4.2 How to read this report

Audience definitions

Throughout the report, we indicate findings from the qualitative strands by referring to ‘participants’ and from the survey by referring to ‘respondents’. Whenever we refer to ‘deliberative research participants’ or the 'high exposure audience', this includes participants from both the core and additional audience strands. The reason for this combination is because the base size of the additional audience groups is too small (two groups of 12 for each location) to be considered statistically significant alone.

Quotes

Verbatim quotes are taken from live sessions and excerpts from the online community with the high exposure audience. Quote attributions include the audience strand (core or additional audience) and the participant's location. **Quotes are participants' own views and are not always factually correct.**

Charted data

In this report, we have colour coded charts according to audience and whether data was collected before (pre) or after (post) a research activity. Statistically significant differences are noted using superscript lettering in the charts; the superscript letter next to a score or percentage denotes the initial of the sample that it is statistically more significant than. For example, a score which is significantly greater than the corresponding score from the low exposure audience will be marked with a superscript 'L'. Where multiple waves of data are shown for the same audience over time a superscript 'pre' indicates where the post-read data is significantly greater than the pre-read data and vice versa.

Cross-references

Cross-references are included throughout this report where additional information can be found elsewhere in the document. Cross-references are underlined and hyperlinked to the relevant place in the document for ease of navigation.

4.3 Behavioural frameworks used in the report

To help understand what role citizens see for SDVs in a future transport system, this research has drawn upon the 'Capability Opportunity Motivation – Behaviour' model (COM-B model), a key behavioural change theory (Figure 5). According to 'The Behaviour Change Wheel: A Guide to Designing Interventions' (Susan Michie, Lou Atkins & Robert West, 2014, p. 59-60), the COM-B model dictates that for any behaviour to occur:

1. There must be **capability**; this can be either 'physical' (e.g. physical skills, strength or stamina) or 'psychological' (having the cognitive skills, strength or stamina, as well as knowledge) to perform the behaviour.

2. There must be **opportunity**; this can be 'physical' (e.g. physically accessible) or 'social' (including cultural norms, interpersonal influences and social cues).

3. There must be sufficient **motivation**; this can be 'reflective' (involving self-conscious planning and beliefs about what is good or bad), or 'automatic' (processes involving wants and needs, desire, impulses and reflex responses).

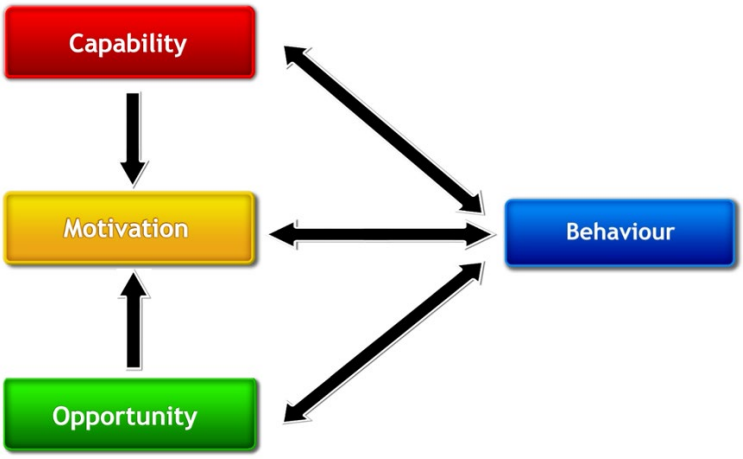

Figure 5 COM-B behaviour change model

Source: 'The Behaviour Change Wheel: A Guide to Designing Interventions' (Susan Michie, Lou Atkins & Robert West, 2014, p. 62)

The COM-B model provides us with a framework to understand and identify the drivers and/or barriers that need to be addressed and therefore explore what can be done to create meaningful behavioural change. We refer to COM-B throughout the report, using it as a model to focus on how to best influence behaviour, now and in the future, by filling in the gaps in people's capability, opportunity, and motivation.

5. Local transport landscape

At the start of the first workshop, the high exposure audience discussed how they currently travel in their local area and their views towards their local transport network. These discussions provided the context for later conversations, looking to understand how SDVs could help to address existing transport challenges, and risks that need to be considered as part of their introduction in local areas.

5.1 Current transport behaviours and perceptions

Driving a private vehicle such as a car is the preferred way to travel in the UK for those able to do so (Department for Transport, 2020). Consistent with this, 'driving a car, van or lorry' was the mode of transport selected by the highest number of participants in the high exposure audience across all journey types asked in this research - that is, for shopping (58%), leisure (53%), commuting (52%) and business travel (55%) (see 14.3 Technical appendix, note 2).

Findings across the wider transport literature indicate several **practical factors** that are valued when travelling by car, including speed, comfort, personal safety, reliability, and its door-to-door nature. There is a preference for driving when travelling to multiple stops on a single trip or when travelling with children, equipment, or luggage (which is difficult to load on and off public transport) due to the perceived ease (Department for Transport, 2020). This is in line with the views expressed by the high exposure audience in this research.

However, more so than just being considered the most practical option, people also have strong **emotional ties** to their cars and this can impact their propensity to travel in this way. This is consistent with findings from across the wider transport literature where the most valued emotional aspects of travelling by car include independence, flexibility, and control in choosing how and when to travel (Department for Transport, 2020).

Broadly speaking, participants found public transport options less appealing than driving. However, views were strongly influenced by both the level of public transport provision in the local area as well as the specific characteristics of local roads. This resulted in vastly different views of current local transport networks depending on whether participants lived in a rural, town or urban area.

Rural

Car ownership was considered a 'necessity' for all journey types - from routine, local trips through to longer journeys in the wider area. This was because destinations in these areas tend to be further away from each other and public transport provision is typically limited. Participants, especially those without a car, stated that there were limited reliable alternatives to driving, such as public transport or safe walking or cycling routes, resulting in them often having to rely on lifts from relatives or friends. Walking and cycling were not seen as safe options due to poor infrastructure, such as lack of pavements and narrow country lanes. This was felt to be a particular issue at night, as country roads are poorly lit. While both walking and cycling for leisure are enjoyed, they are rarely seen as viable alternatives to driving.

This is supported in the quantitative data. 'Driving a car, van or lorry' was not only the most commonly used mode of transport across all journey types for rural participants in the high exposure audience, but was also significantly more likely to be used by those in the rural location than those in the town or urban areas (67% of rural participants compared to an average of 57% across all locations).

Qualitatively, a minority of rural participants did report using public transport options - including bus services for local journeys into the nearby village(s) or train for travel into nearby cities (primarily to avoid having to find and pay for parking). Public transport was primarily used by non-drivers because they had limited alternatives, but it was broadly not considered a time efficient way to travel and was perceived as difficult to rely on. Walking was also occasionally used as an alternative to driving, but was only really feasible for short journeys in villages. Taxis were relied on heavily by school children where they were unable to access school bus services, making taxis particularly difficult to access for the broader population at school pick up and drop off times, as well as when trains arrive from nearby cities.

Rural transport systems were rated well in terms of safety and pollution. However, quantitatively, when asked about improvements to the local transport system, close to two thirds (63%) of rural participants wanted better public transport to be prioritised. Participants felt that there were major gaps and issues in the current public transport provision that needed to be addressed not only to help non-drivers travel more easily, but also to make public transport a more attractive proposition as an alternative to driving. These gaps and issues included:

- Indirect and poorly linked services, resulting in vastly prolonged travel times even across short distances. This is seen to make public transport a particularly untenable option for commuting.
- Services running at inconvenient times during weekdays and not running at all in evenings, at night, or on weekends. This makes travel more difficult for shift work and leisure, limits options for return journeys if plans change, and is seen to increase the risk of people drink driving.
- Limited area of coverage of public transport services often means that bus stops, train stations or park and ride services are far away from home, requiring users to travel by car to access public transport. This often undermined the argument to travel by public transport at all.
- High travel costs, especially when seen to be paying to travel in a vastly less convenient or reliable way than driving.

- High reliance on a small fleet of taxis to make up for poor public transport provision places strain on taxi services, making them difficult to secure without a pre-arranged booking and driving up costs. As a result, taxis are considered inaccessible both in terms of affordability and access, preventing them from being considered a reliable or consistent alternative to driving.

"Without a car it's not very easy. Other than the slight congestion you get at peak tourist times, it's not an issue compared to other places in the country." (Deliberative participant, core audience, rural)

"Basically, I walk if it's local, and drive elsewhere because public transport is lacking. The car gives me more flexibility." (Deliberative participant, digitally disengaged, rural)

"It's easy because I have a car and I can afford to run it, but anyone without access to this would find it very difficult." (Deliberative participant, core audience, rural)

"Getting to Newcastle is really tricky because the service ends so early, you can't go to watch a late film or a play, you have to stay overnight for that." (Deliberative participant, core audience, rural)

"My transport options are limited to walking and public transport. The cost of taxis is unaffordable unless in an emergency situation." (Deliberative participant, core audience, rural)

When asked to think about their **ideal transport system**, rural participants sought to address the major gaps and issues they identified. Suggestions for doing this included:

- Using smaller buses to provide more frequent, direct services - including to nearby urban centres.
- A shuttle bus service between the nearest train station and village centre to provide an alternative to taxis when they are unavailable.
- Options for evening, night, and weekend services - particularly for links to nearby urban centres and transport links (e.g. train station).
- The creation of park-and-ride services to improve access to nearby cities and towns via train and coordinated bus services.

It was also considered important to make these improvements without impacting the beauty and rural feel of the local area.

"If anything was possible, I'd put a train near me that would go into Alnwick then it would be way easier." (Deliberative participant, young person, rural)

"Public transport needs to be faster; it needs to be more efficient, more regular, and more accessible. It would be nice if there was a shuttle bus to Alnmouth station." (Deliberative participant, core audience, rural)

"If there was a cheaper and more convenient public transport option I could use to commute to Newcastle, I would take it." (Deliberative participant, core audience, rural)

Urban

Driving was the preferred option for all journey types except commuting, but particularly for longer journeys such as traveling outside of the city centre for work or leisure activities. However, when travelling into the city centre from a nearby town or suburban area, there is a preference for taking public transport. This is due to the good public transport links in and out of the city centre, as well as broader barriers to driving such as congestion and the cost or capacity of car parks. Walking was also a favoured option in city centres. Journeys between suburban areas around the city were often harder and less direct making driving the preferred mode for these trips instead of travelling into the city centre and back out again on public transport. Taxis are rarely relied upon, but when they are used it is typically for leisure, including travelling home from the city centre at night.

This is supported in the quantitative data, with broadly equal proportions of urban participants in the high exposure audience reporting driving compared to using non-driving alternatives (i.e. public transport or active travel) for most journeys. The only exception to this was for commuting, for which non-driving options were preferred (61% compared to 40% who reported driving).

Qualitatively, urban participants were broadly satisfied with public transport provision in their area. They have a variety of different modes to choose from, good service coverage, and a high frequency of service times. Especially for those who also drive, this allows them to pick and choose their preferred mode of transport for the journey they are making.

When asked to think about improvements to their local transport system, almost two thirds of urban participants felt that better public transport should be prioritised (65%), while three in five wanted to see reductions in the level of traffic and congestion prioritised (60%). Qualitatively, there were some gaps and inefficiencies in both the public transport provision and road networks in urban areas, with participants feeling that some adjustments could strengthen the overall local transport offer. These included:

- Lack of joined-up services, including different operators with unaligned service times and ticketing systems across the public transport network, and the lack of a card system for payment (such as an Oyster card in London).
- The high cost of public transport, particularly for longer journeys by train or tram, can prompt participants to consider cheaper alternatives even when public transport is their preference.
- Congestion, difficulty accessing parking, and high parking costs - especially when driving into the city centre.
- Services being more limited in the evenings and at night, making travel more difficult for both late shift work and leisure travel (e.g. for nightlife).
- Older and outdated infrastructure that could use improvements to make it more comfortable and accessible for a range of users, as well as to improve reliability and overcrowding (e.g. improving the quality and cleanliness of vehicles for a more pleasurable experience, adding Wi-Fi, or building better lit, covered bus stops).
- Concerns about personal safety when travelling on public transport, including instances of harassment and antisocial behaviour.
- Cycles being prohibited on public transport services, creating barriers to using bikes as part of multi-modal journeys.

"The only thing that bothers me is the traffic, sometimes it takes 20 minutes to reach the city centre, rather than five minutes." (Deliberative participant, core audience, urban)

"I used to get the metro to high school every day, it would be 7am there and back at 4pm and you'd be pressed against the window." (Deliberative participant, core audience, urban)

"If there's a game at the Etihad, there's going to be delays and the trams will be packed. They give you a few days' notice to say it'll be busy and to 'allow for delays' or whatever." (Deliberative participant, low SEG, urban)

"The rail service is appalling, the trains coming in from the west are 50-60 years old and you have two carriages, and they can be packed." (Deliberative participant, core audience, urban)

"You have different companies running on the same route, and they might not take your ticket." (Deliberative participant, core audience, urban)

When asked to think about their **ideal transport system**, urban participants had a small number of suggestions for tweaks to further strengthen the current transport offer. These included:

- Introducing an integrated ticketing system, with one ticket or card that works for all public transport options irrespective of the transport operator - to make travel easier and cheaper for users.
- Increasing late-night public transport services.
- Improving safety by adding more cameras, lights, and conductors on buses, and ensuring bus stops have dedicated waiting areas that are well lit and under cover, making waiting safer and more comfortable.
- Reducing pollution in the city centre (e.g. introducing a low emission zone).
- Ensuring improvements to infrastructure and public transport are based on the needs of the users, not the owners.

"Manchester has all the networks, but they're not connected well. It's not a system that is designed to work together. It's a patchwork." (Deliberative participant, core audience, urban)

"You have to pay for one and the other, whereas in London you don't have to pay when you swap. My bus pass has gone up in the past one and a half years, so I have to think about that now, how many buses I'm going to get." (Deliberative participant, low SEG, urban)

"When it's running right and on time, it's great. It's when you're waiting an hour for a bus that's meant to show up every 10 minutes, and it's chucking it down and you're just stood there." (Deliberative participant, low SEG, urban)

"Air pollution is bad. Where kids need to cross the roads, they are being exposed to pollution. That is probably the biggest issue they could solve." (Deliberative participant, core audience, urban)

Town

Driving was the preferred option across all journey types other than commuting, for which public transport was still preferred; this was despite reports of declining public transport services. While transport was felt to be better in the centre of town, congestion and the lack of availability of parking put strain on drivers - consistent with pressures felt by drivers in urban centres. Participants were more reliant on driving the further from the town centre they lived, noting that public transport becomes logistically more difficult and expensive the further out you go - with those living in satellite villages and remote areas reporting similar experiences to the rural participants in this research. In this sense, transport in towns represents a hybrid of experiences in urban and rural locations.

This is supported in the quantitative data, with driving the most used mode of transport for participants in the town location across all journey types.

Participants reported public transport services (primarily bus services) as being in decline in towns and likened access to public transport services as being 'like a lottery', with provision being different depending on where you live. Broadly speaking, this increases reliance on driving and limits options for non-drivers, particularly those living in satellite villages.

When asked what improvements to the local transport system should be prioritised, there was one clear priority with four in five participants in towns requesting better public transport (81%). Qualitatively, participants wanted to see investment in public transport provision to avoid further, or even reverse, the reduction in services and to address gaps including:

- Decreasing service frequency and increasing likelihood of service cancellation or services simply not showing up, reportedly due to low availability of drivers.
- Services running at inconvenient times during the day and extremely limited services at night and on weekends.
- Indirect routes and poor connectivity between different services and modes of transport, including long wait times for connections. There is a desire for more 'joined up' travel.
- High travel costs, especially in the context of decreasing frequency of services, making public transport less accessible and convenient.
- Whole bus routes being cancelled, leaving some villages without any public transport links to other nearby villages or town centres.

"Sometimes if shopping in the town centre, due to limited car parks, when I don't want to feel crammed I'll take the park and ride from the outskirts." (Deliberative participant, core audience, town)

"The thing is if you go by bus it goes to every little village in the area, so it takes forever to get where you're going so you have to be really patient." (Deliberative participant, digitally disengaged, town)

"The bus which takes me closest to home only arrives once at 8:10am and leaves my college at 4:45pm which means I'm often doing nothing for hours on end waiting to go home." (Deliberative participant, core audience, town)

When asked to think about their ideal transport system, participants in towns had a clear focus on public transport improvements and decreasing the reliance on cars (particularly for travelling into the town centre). Suggestions included:

- Increasing the quantity, range, and reliability of public bus services, including using smaller buses.
- Provide evening, night, and weekend bus services.
- Reducing the cost of public transport.
- Reintroducing bus services that have recently been lost, to ensure all villages are connected into the town centre.
- Continuing to expand park-and-ride options to reduce traffic in the town centre.
- Pedestrianising the town centre.

"Public transport should be more affordable and reliable to encourage people to use the services. It should be less expensive than driving." (Deliberative participant, core audience, town)

"I would like to have cheaper, more reliable buses which connect better across the town and county." (Deliberative participant, core audience, town)

"For me, buses are the first place to start, because the skeleton of a bus service we have in Taunton, you wouldn't lose anything, it's so unreliable and scant." (Deliberative participant, disability, town)

"I would like to see smaller buses so they can access some of the smaller villages and get rid of the double-deckers that are always half empty." (Deliberative participant, core audience, town)

5.2 Section summary

All locations

- Consistent with previous research, driving remains the most popular transport option for most, for both practical and emotional reasons.
- When thinking about their ideal transport system, participants primarily sought to address existing gaps rather than wanting to radically overhaul transport in their local area.
- Improving public transport was seen as a top priority across all locations.

Rural

- Car ownership was a 'necessity' in the rural location as destinations tend to be far away from each other and public transport provision is limited. Non-drivers in the rural location used public transport because they had limited alternatives, but it was considered inefficient and difficult to rely on.
- Public transport in the rural area was considered to have major gaps and issues, including indirect and poorly linked services, services running (or not running) at inconvenient times, limited area of coverage, high costs, and limited availability of taxis.

Urban

- Driving was preferred for all journeys except commuting, with public transport instead preferred for travelling into the city centre at peak times. This was because of the large number of public transport options and services available, as well as the barriers to driving such as congestion, difficulty parking, and high cost of parking.
- Participants were broadly satisfied with the transport network in the urban area; however it was felt to have some small gaps and inefficiencies including a lack of joined up services, increasing costs, congestion and difficulty parking, services not running at night, outdated infrastructure, concerns about personal safety on public transport, and difficulty using bikes as part of multi-modal journeys.

Town

- There was again a preference for driving for all journeys except commuting, for which public transport was preferred. Participants in the town location reported similar difficulties with driving in the town centre as those in larger urban areas. However, in line with what was heard from those in the rural location, they also faced similar limitations in public transport provision in the rural fringe.
- Declining public transport provision was of concern in the town location, including reduced service frequency, increased likelihood of service cancellation, services running (or not running) at inconvenient times, indirect routes, high travel costs, and the removal of whole bus routes leaving some without any public transport links at all.

6. Baseline views of SDVs

Data from the national control survey, in combination with what is known from the wider transport literature, is used as a baseline representing views of the UK public towards SDVs. This section of the report outlines these baseline views and compares them to the starting views of the low, medium, and high exposure audiences that took part in this research. This provides context for the views underpinning each audience's interactions with the research. It also allows us to understand the impact of taking part in the research on participants' views by providing a baseline for comparison with data obtained at the end of the research (covered in Section 12 of this report).

More detail on the quantitative approaches used in this research can be found in section 14.3 Technical appendix. The full data tables are also provided as a supplement to this report.

6.1 Views towards technology

There is **a strong correlation between positive attitudes towards science and technology, and positive attitudes towards SDVs** (Tennant, Stares, & Howard, 2019). It is therefore important to understand baseline views towards science and technology to contextualise views towards SDVs in this research.

When considering the **innovation adoption** curve, those identified as 'early adopters' tend to be most open to new technology and feel comfortable trying it before it becomes normalised, while those identified as 'traditionalists' are most resistant to new technology and prefer more traditional methods. 'Mainstream consumers' sit in the middle, tending to adopt new technology once it has become regarded as normal or conventional.

Early adopters are most likely to hold positive attitudes towards science and technology, and therefore positive attitudes towards SDVs. However, in the national control sample, they make up only 16% of respondents. The majority (59%) were identified as 'mainstream consumers' of technology, while a quarter (25%) were traditionalists.

This moderate view of science and technology is also reflected in the **technological optimism** of the national control sample. Respondents were most likely to be positive about science and technology making our lives healthier, easier and more comfortable (57% agree), and relying on technology when their safety is involved (42%). However, almost three in five (58%) agreed that machines are taking over some of the roles that

humans should have, demonstrating concern among the public about the role of automation in the future.

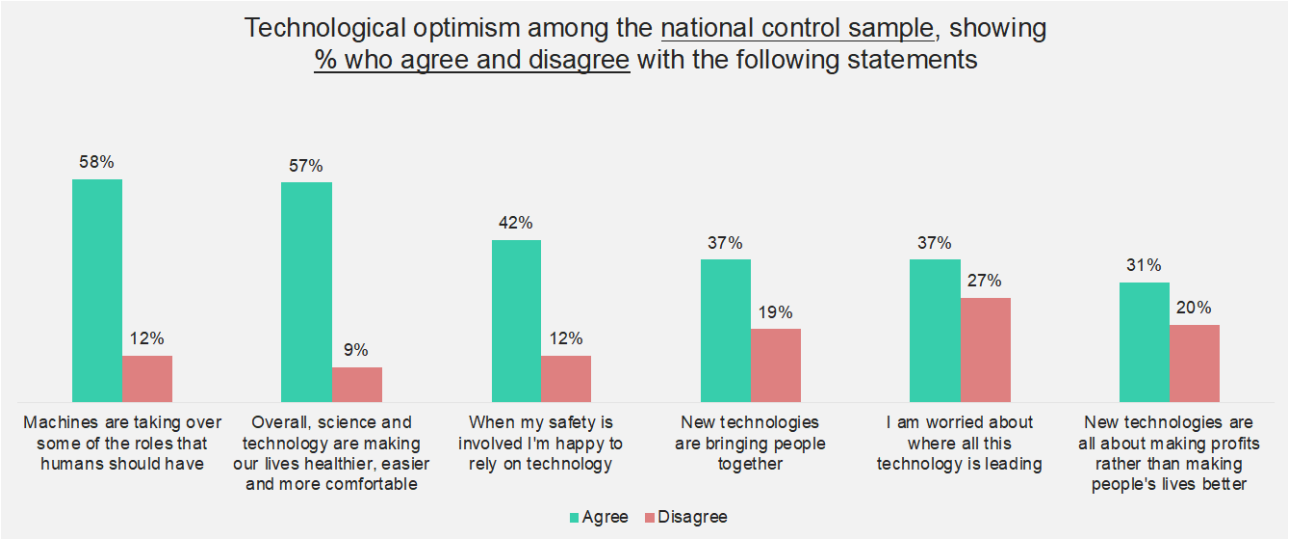

Figure 6 Technological optimism among the national control sample

P7: For each of the following statements about science and technology please state whether you agree, disagree or neither agree nor disagree? Base: National control n=4027.

Sub-group analysis

Sub-group analysis of the national control sample indicates that those most likely to be technologically optimistic also tend to be 'early adopters' of technology. **The typical profile includes men, younger people, those with higher incomes, those with higher education levels, and those living in urban areas.** This is broadly consistent with previous research (Becker & Axhausen, 2017) (Madigan, Louw, Wilbrink, Schieben, & Merat, 2017).

In the national control sample, these sub-groups were significantly more likely to hold positive views towards SDVs across most measures.

Views by exposure audience

Low exposure audience

This audience had lower positivity towards technology than the national control sample, indicating that they would likely be less positive towards SDVs than the baseline. There was a higher proportion of traditionalists (43% compared to 25% of the national control); accordingly, this audience demonstrated lower proportions of mainstream consumers (49% compared to 59% of the national control) and early adopters (8% compared to 16% of the national control) (see 14.3 Technical appendix, note 3).

Despite this, the average number of statements where respondents in the low exposure audience selected a view that was positive towards technology was similar to respondents to the national control survey (2.00 out of 6 compared to 2.04 out of 6 for the national control). While they were significantly more likely to agree that new technologies are

bringing people together (46% compared to 37% of the national control), they were also more likely to agree that new technologies are all about making profits rather than making people's lives better (40% compared to 31% of the national control), that they are worried about where all this technology is leading (44% compared to 37% of the national control), and that machines are taking over some of the roles that humans should have (66% compared to 58% of the national control).

High exposure audience

Attitudes towards technology were used as a screening question for recruitment into the deliberative research to ensure a spread of views were represented in the sample (see 14.3 Technical appendix, note 4). Despite this, the high exposure audience displayed comparatively higher levels of technological optimism than the national control sample, selecting a view that was positive towards technology on an average of 2.70 statements out of 6 (compared to 2.04 out of 6 for the national control).

They were significantly more likely than the national control sample to agree with positive statements about technology, including that new technologies are bringing people together (55% compared to 37% of the national control) and that science and technology are making our lives healthier, easier and more comfortable overall (71% compared to 57% of the national control). Correspondingly, they were significantly less likely to agree with negative statements about technology - although almost half still agree that machines are taking over some of the roles that humans should have (49%), indicating that this is still a key concern for this audience despite being more technologically optimistic overall.

6.2 Awareness and knowledge of SDVs

The wider transport literature suggests that **awareness and understanding of SDV technology is mixed among the UK public**. For example, recent research indicates that while awareness of SDVs is high, self-reported knowledge of them is low compared to other transport technologies (Department for Transport, 2023).

Previous research has found that there are two distinct barriers to the public feeling that they understand SDV technology. First, limited understanding of how the technology works, making it challenging to conceptualise or engage with the topic; and second, limited familiarity with the technology makes it challenging to conceptualise using SDVs in real life (Department for Transport, 2021).

Consistent with the literature, we found that while nearly all of the high exposure audience (99%) had heard of SDVs, more than half (51%) reported that they knew 'nothing' about them while around a third (36%) knew 'just a little'.

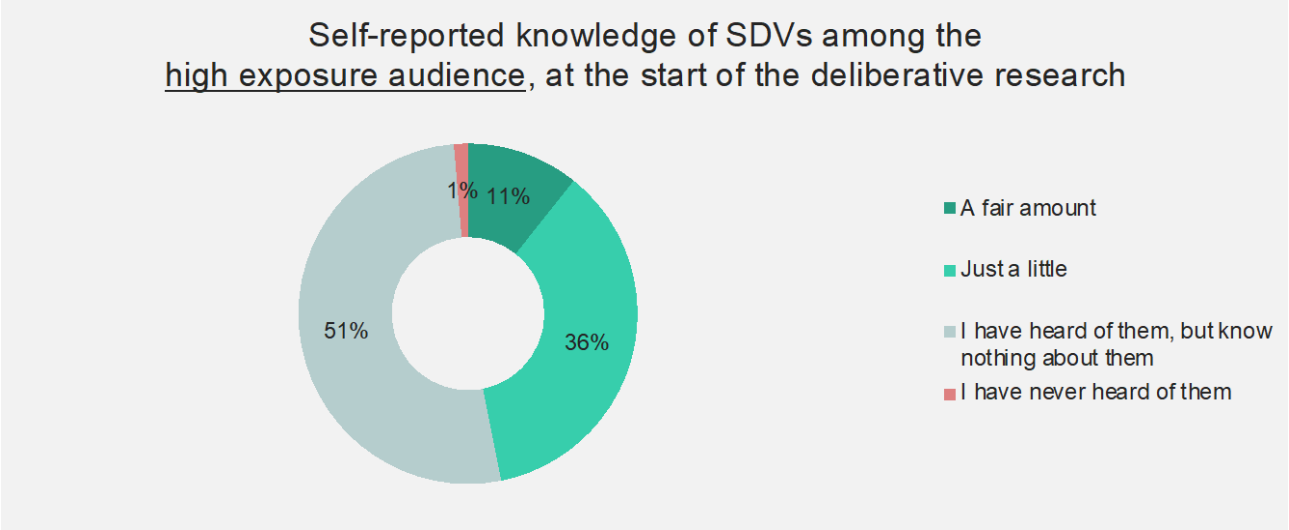

Figure 7 Self-reported knowledge of SDVs among the high exposure audience, pre-deliberative research

A1: How much would you say you know about self-driving vehicles? Base: High exposure audience (all locations): pre-deliberative research n=226.

Furthermore, our national control sample showed that while almost two thirds of respondents reported having talked with other people about SDVs in the past (64%), few had seen an SDV as part of a trial in the UK (13%) or trialled one themselves (6%). In line with the barriers stated above, this indicates that a lack of first-hand experience with SDVs could be contributing to low reported understanding of the technology.

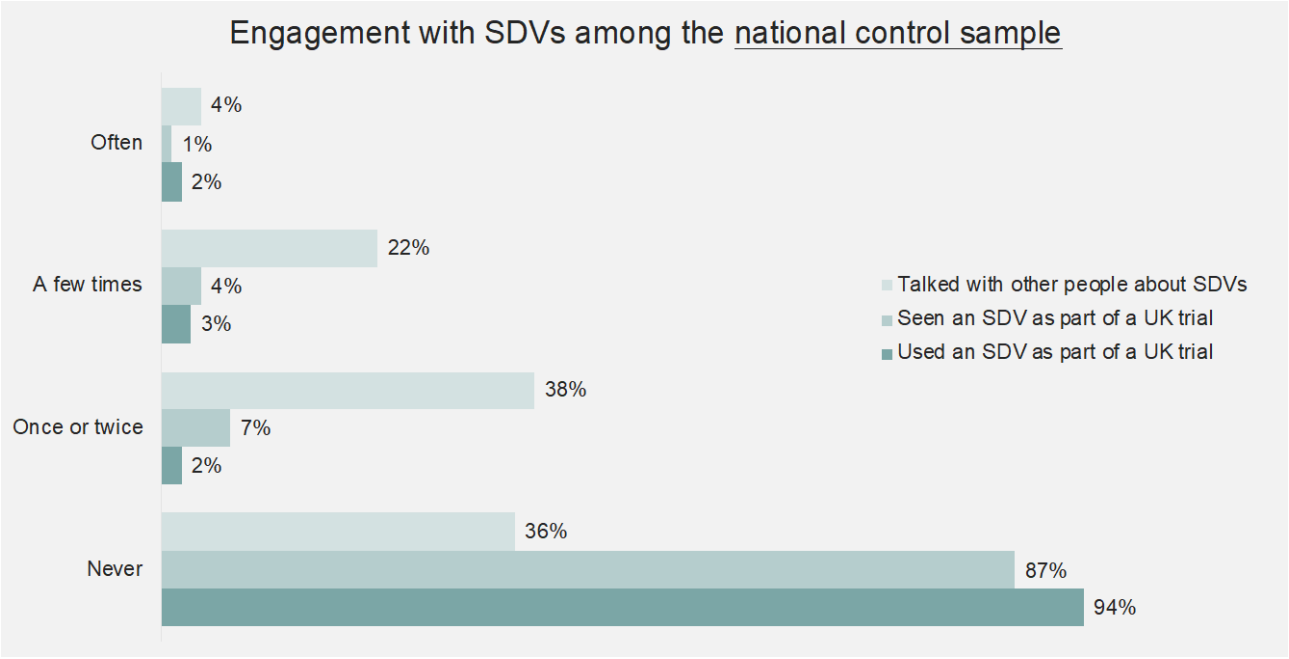

Figure 8 Engagement with SDVs among the national control sample

B2: Before today, how often have you done the following? 'Talked with other people about self-driving vehicles', 'Seen a self-driving vehicle as part of a trial in the UK', 'Used a self-driving vehicle as part of a trial in the UK' Base: National control n=4027.

Despite the high proportions of the national control sample who reported discussing SDVs with others, there were similarly high proportions who incorrectly identified the responsibilities of users of SDVs and what SDVs can currently legally do in the UK. This demonstrates a low understanding of the technology in line with the literature.

Just 29% of the national control sample correctly identified that they are not responsible for how an SDV drives as a public transport passenger (Figure 9, Option 1). Fewer still (16%) correctly identified that users of private SDVs are not responsible for the behaviour of the vehicle when the self-driving mode is on and that during this time they are allowed to perform some other activities, but cannot use a mobile phone and must be fit to drive throughout the journey if needed (Figure 9, Option 3). This is in contrast to almost half the sample (48%) who incorrectly thought that users of private SDVs are always responsible and are not allowed to perform other activities or use their mobile phone and must be fit to drive (Figure 9, Option 5).

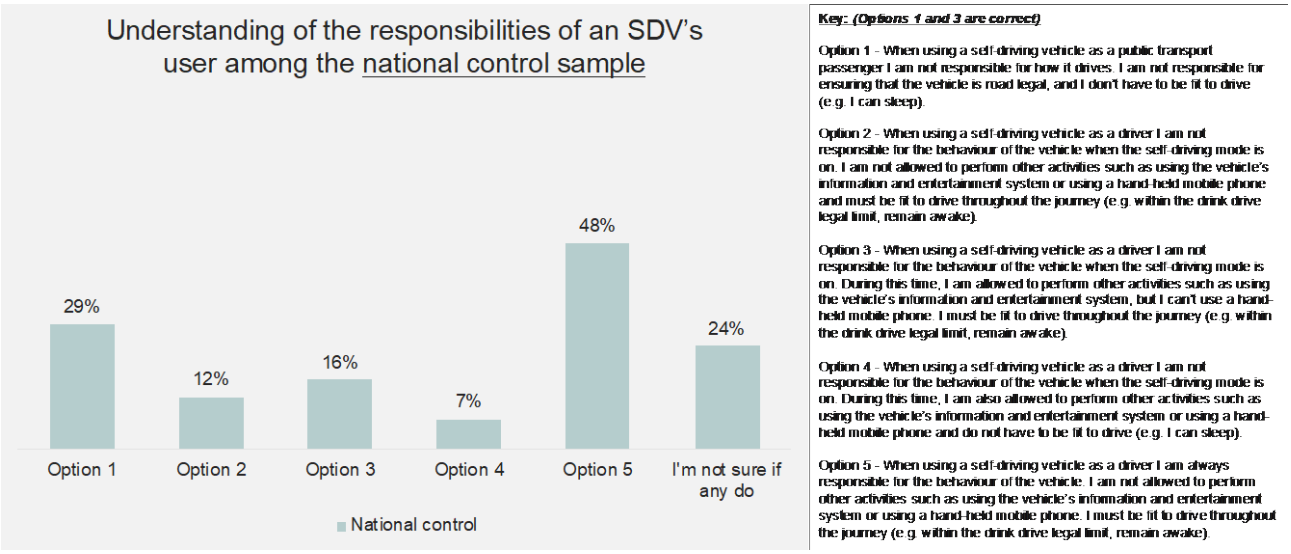

Figure 9 Understanding of the responsibilities of an SDV's user among the national control sample

A2: For each of the following paragraphs which do you think accurately describe the responsibility that a driver would have in a self-driving vehicle? Please tell me as many as you think apply. Base: National control n=4027.

In relation to what vehicles can currently legally do in the UK, slightly more than half (54%) of the national control sample correctly identified that vehicles can support a human driver but they remain in full control of the driving task, while slightly less than half (48%) correctly identified that vehicles cannot legally drive themselves without any input from a human driver. There was low incidence of participants having inaccurate understanding in relation to each of these statements, with most of the remaining participants instead being unsure.

By contrast, half of respondents in the national control sample (50%) were unsure whether a vehicle can currently legally drive itself within a limited and pre-determined area with oversight from a human driver in the UK. The remaining half were almost evenly split between thinking this is currently legal (26%) and illegal (24%), indicating that this is an area in which further clarification is required for the public.

Interestingly, early adopters were more likely than average to incorrectly state that vehicles can legally drive themselves without any input from or the need for a human driver (12% compared to 5% on average) and were more likely than average to incorrectly state that vehicles can currently legally drive themselves within a limited and pre-determined area with oversight from a human driver (36% compared to 26% on average). This demonstrates that higher levels of positivity towards technology do not necessarily lead to higher levels of accurate understanding of SDVs.

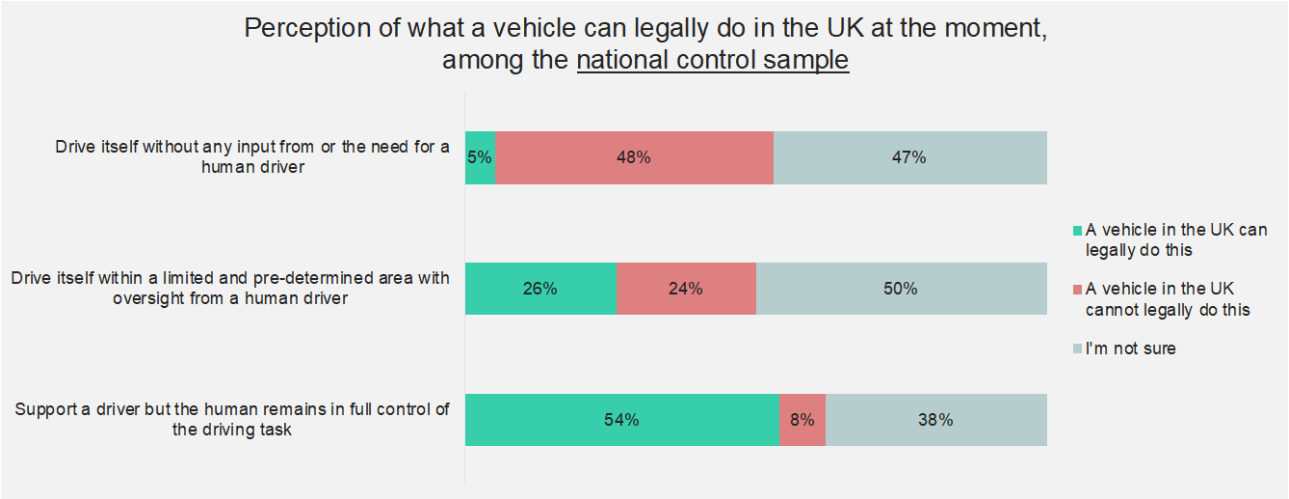

Figure 10 Perceptions of what a vehicle can legally do in the UK at the moment among the national control sample

A3: For each of the following statements, please tell me whether you think a vehicle can legally do this in the UK at the moment. Please just answer to the best of your knowledge. 'Drive itself without any input from a human driver or the need for a human driver', 'Drive itself within a limited and pre-determined area (e.g. on the motorway up to a certain speed) with oversight from a human driver', 'Support a driver by providing steering, braking or acceleration assistance but the human driver remains in full control of the driving task, (e.g. cruise control, automated emergency braking) (AEB).' Base: National control n=4027.

Views by exposure audience

Low exposure audience

When identifying the responsibilities that a person would have if using an SDV today, the low exposure audience gave mixed responses, indicating a lack of accurate understanding (see 14.3 Technical appendix, note 5). They were highly likely to select multiple options as being correct and were unlikely to indicate that none of the options were correct (5% answering 'I'm not sure if any do' compared to 24% of the national control). Therefore, while they were more likely to identify the correct responsibilities, they were also more likely to identify incorrect responsibilities.

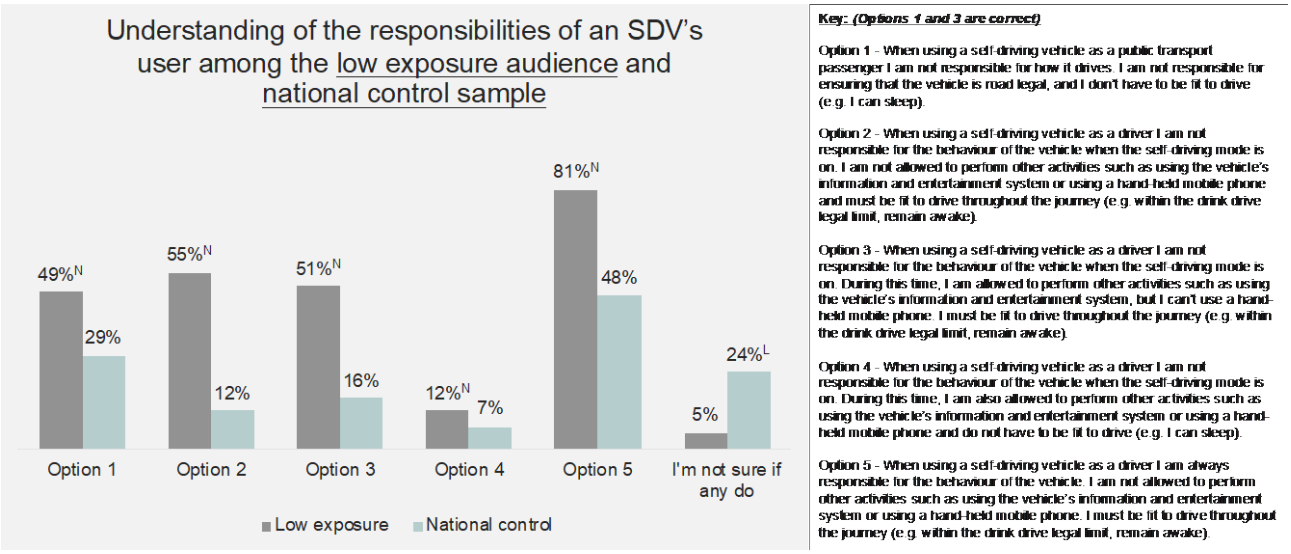

Figure 11 Understanding of the responsibilities of an SDV's user among the low exposure audience (pre-trial local polling) and national control sample

A2: For each of the following paragraphs which do you think accurately describe the responsibility that a driver would have in a self-driving vehicle? Please tell me as many as you think apply. Base: Low exposure audience (all locations) pre-trial local polling n=750; National control n=4027.

The low exposure audience were also less likely than the national control sample to report that they were not sure about what vehicles can currently legally do in the UK (see 14.3 Technical appendix, note 5). This meant that while there was a large proportion who correctly indicated that vehicles can support a human driver but they remain in full control of the driving task (74% compared to 54% of the national control) and vehicles cannot legally drive themselves without any input from a human driver (68% compared to 48% of the national control), there was also a high proportion of respondents selecting the incorrect answer.

Like the national control sample, responses were mixed concerning the legality of a vehicle driving itself within a limited and pre-determined area with oversight from a human driver.

High exposure audience

This audience were more likely to have talked with other people about SDVs prior to the research (71% compared to 64% of the national control), demonstrating potentially higher levels of engagement with SDVs than average for the UK public. However, they were very unlikely to have seen an SDV trial in the UK (4% compared to 13% of the national control) or have trialled an SDV (1% compared to 6% of the national control).

While the high exposure audience had higher levels of accurate knowledge of SDVs compared to the national control sample, their accuracy was still relatively low. Only 39% correctly identified that they are not responsible for how an SDV drives as a public transport passenger (compared to 29% of the national control), while 29% correctly identified that users of private SDVs are not responsible for the behaviour of the vehicle when self-driving mode is on and that during this time they are allowed to perform other activities, but cannot use a mobile phone and must be fit to drive throughout the journey if

needed (compared to 16% of the national control). In comparison, 53% (incorrectly) indicated that users of private SDVs are always responsible for the vehicle's behaviour (compared to 48% of the national control).

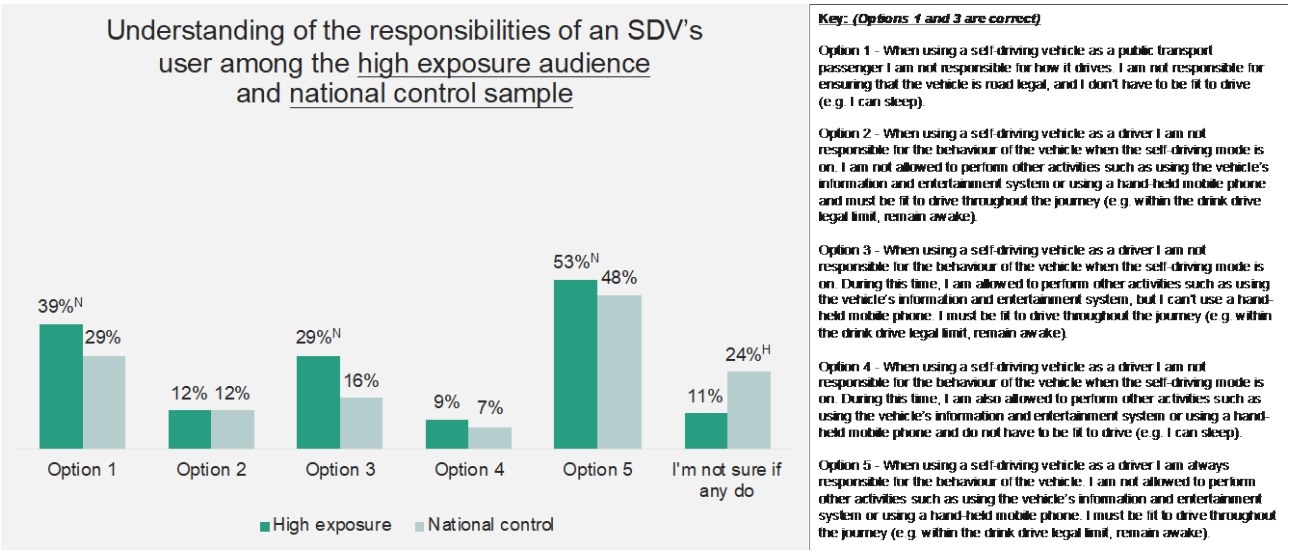

Figure 12 Understanding of the responsibilities of an SDV's user among the high exposure audience (pre-deliberative research) and the national control sample

A2: For each of the following paragraphs which do you think accurately describe the responsibility that a driver would have in a self-driving vehicle? Please tell me as many as you think apply. Base: High exposure audience (all locations) pre-deliberative research n=226; National control n=4027.

The high exposure audience were significantly more likely than the national control sample to correctly identify that vehicles can support a human driver but they remain in full control of the driving task (73% compared to 54% of the national control), and that vehicles cannot legally drive themselves without any input from a human driver (59% compared to 48% of the national control). However, like the national control sample, responses were mixed concerning the legality of a vehicle driving itself within a limited and pre-determined area with oversight from a human driver.

6.3 Perceptions of SDVs

Levels of comfort with the idea of using an SDV are relatively low in the literature, with two thirds (66%) of people feeling uncomfortable with the idea of travelling in an SDV (Institution of Mechanical Engineers, 2019) and more than half (55%) of people stating they would not feel comfortable using an SDV if given the opportunity (DG Cities, 2021).

Consistent with the literature, the national control survey found low levels of comfort with using or sharing the road with SDVs. Across all types of SDV asked, the proportion of respondents who gave low comfort ratings (0-2 out of 10) always significantly outweighed the proportion giving high comfort ratings (8-10 out of 10). While respondents reported feeling most comfortable both using and sharing the road with private SDVs with shared responsibility for driving, the average comfort rating was still quite low for both using and sharing the road with this type of SDV (see Figure 13).

Comfort with SDVs was considerably higher amongst the most technologically optimistic respondents in the national control sample, with an average comfort rating of 5.21 out of 10 for the most technologically optimistic compared to just 2.61 out of 10 for the least optimistic (see 14.3 Technical appendix, notes 6 and 7).

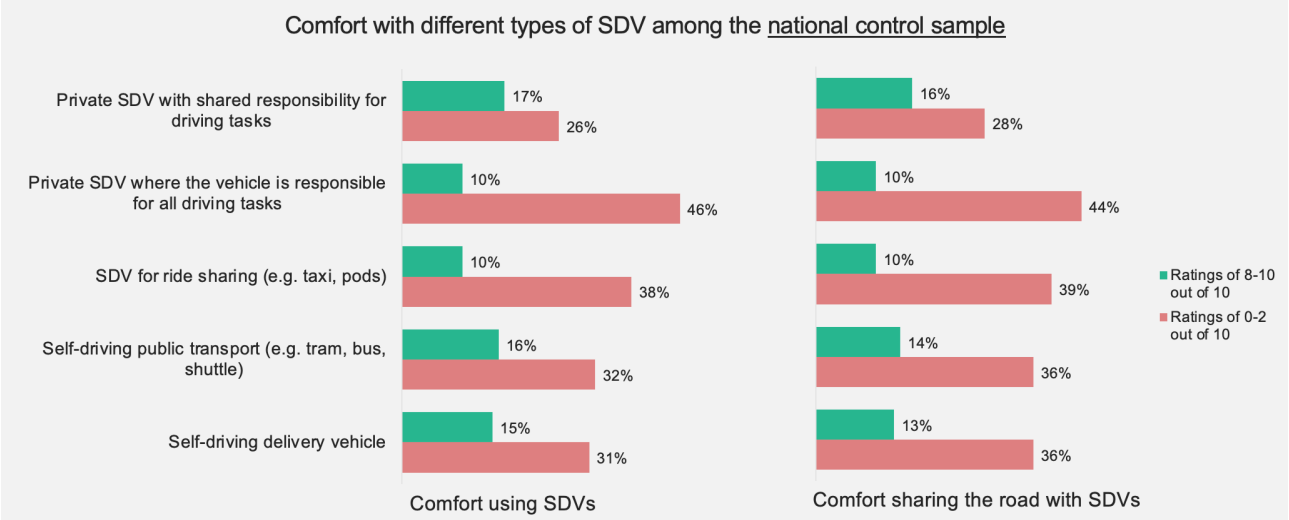

Figure 13 Comfort using and sharing the road with different types of SDV among the national control sample

C1: On a scale of 0 to 10 where 0 is totally uncomfortable and 10 is totally comfortable, how would you feel (a) using / (b) sharing the road with the following types of self-driving vehicles for any journeys? Base: National control n=4027.

Views by exposure audience

In all cases, the medium and high exposure audiences were more comfortable using and sharing the road with SDVs compared to respondents to the national control survey. The medium exposure audience was also more comfortable than the high exposure audience, which was not unexpected given that they had voluntarily chosen to attend the SDV trial events. The low exposure group was significantly less comfortable with using and sharing the road with SDVs which aligns with the higher proportion of traditionalists in the sample.

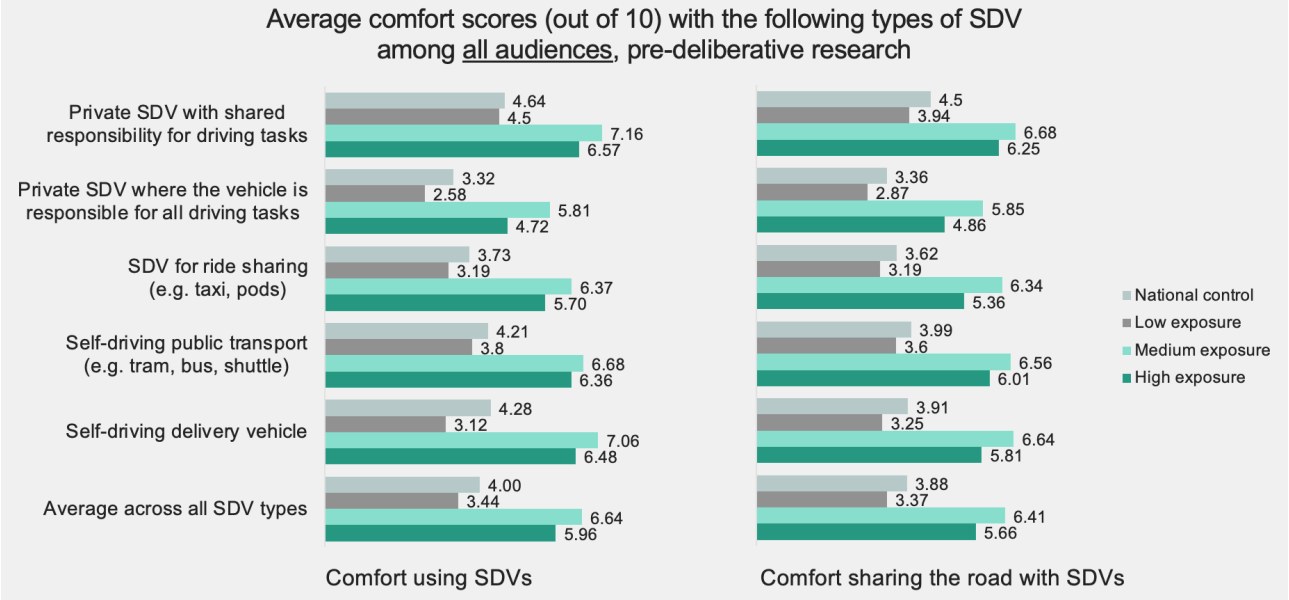

Figure 14 Comfort using and sharing the road with different types of SDV among all audiences, pre-deliberative research

C1: On a scale of 0 to 10 where 0 is totally uncomfortable and 10 is totally comfortable, how would you feel (a) using / (b) sharing the road with the following types of self-driving vehicles for any journeys? Base: High exposure (all locations) pre-deliberative research n=223; Medium exposure audience (all locations) pre-ride (pod and shuttle) n=450; Low exposure audience pre-trial local polling n=750; National control n=4027.

6.4 SDVs in the local transport system

The literature indicates that people can envisage use cases for SDVs in the future, particularly in the context of highways, airports, and hospitals (Shergold, Parkhurst, & Paddeu, 2020). However, **there are reservations about how SDVs could work in both urban and rural areas**. The perception that SDVs will drive in a cautious way and be unable to adopt more aggressive behaviours when required is seen to make them unsuitable for use in urban environments (DG Cities, 2021). In contrast, the overall viability of SDVs in rural areas is questioned and there is a belief that SDVs will be available in cities much sooner (Department for Transport, 2019).

In the national control sample, respondents expressed the highest level of consideration for using a private SDV with shared responsibility. However, a far greater proportion indicated that they would not use an SDV for any of the journey types asked, compared to those who said they would consider any of the options. Consistent with findings on other measures, those with the highest levels of technological optimism and comfort with SDVs were more likely to consider using any of the SDVs instead of indicating that they would not use them at all.

Urban respondents in the national control sample were most likely to consider an SDV that was responsible for all driving tasks, than respondents in town or rural areas for all journey types. Urban respondents in the national control sample were also significantly more likely to consider using a self-driving delivery vehicle for shopping (8% compared to 4% for rural and town).

Views on the impact that SDVs could have on the local transport system were mixed in the national control sample, and a large proportion of the public want more information before making up their minds. More than two in five respondents were unsure of the impact that

SDVs could have on their local transport system, with the remainder split between thinking SDVs will make it better (24%), worse (20%), or no different (14%). In line with the literature, respondents in all locations were somewhat sceptical; however, the national control survey found that those in urban locations were significantly more likely than those in rural areas to think SDVs could help improve their local transport (27% compared to 21% for rural).

Meanwhile, in the national control sample more than a third of respondents (34%) felt that SDVs had more disadvantages than advantages, while close to a quarter felt there were as many advantages as disadvantages (23%) or were not sure and needed more information to take a view (26%). Only one in 10 (13%) thought that SDVs had more advantages than disadvantages. Urban respondents were again more positive about SDVs, being significantly more likely to think that there are more advantages (16% compared to 10% for rural) while those in rural areas were significantly more likely to think there were more disadvantages (39% compared to 31% for urban).

Views by exposure audience

Low exposure audience

The low exposure audience was more likely to state a willingness to consider taking an SDV for all journey types than the national control sample across all types of SDVs asked. For example, averaged across journey types, 18% of the low exposure audience were likely to consider a private SDV compared to 8% of the national control sample. However, this may be in part due to differences in the survey design (see 14.3 Technical appendix, notes 5 and 8).

Among the low exposure audience, there was more scepticism about the potential for SDVs to impact their local transport network with almost equal proportions indicating that SDVs would make it better (23%), worse (27%), no different (22%) or not sure (28%). As with other measures, the data indicates that this audience were more likely to take a view, with a lower proportion indicating that they were unsure compared to the national control sample (28% compared to 43% of the national control); this could be an impact of how the survey was administered for this audience (see 14.3 Technical appendix, note 5).

Medium exposure audience

This audience was significantly more likely to believe that SDVs could make their local transport system better (63% compared to 24% of the national control) and were the most positive of all the audiences by a large margin. They were also more confident in taking a view, with only 23% indicating they were unsure (compared to 43% of the national control). This aligns with the fact that this audience were also most likely to feel comfortable with SDVs and were positive enough about the technology to voluntarily attend the SDV trials.

Positivity towards SDVs in the local transport system was high across all locations, and again the data for the medium exposure audience indicates that those in the rural area are most likely to think that SDVs could make their local transport system better (68% in rural area, 62% in urban area, 61% in town) however this difference is not statistically significant.

High exposure audience

Across all journey types, this audience were most likely to consider using a private SDV with shared responsibility for the driving task (see 14.3 Technical appendix, note 9). The primary reason given for this preference was the importance of retaining human control. This is consistent with previous research that indicates that concern about technology replacing human control is closely related to concerns about safety when travelling in an SDV (Department for Transport, 2021).

"As long there is a human in the car that can overlook the car while it is self-driving, it gives more peace of mind. If something were to happen, such as a mechanical failure, I think a human would give more reassurance." (Deliberative participant, low SEG, urban)

"I am comfortable using a self-driving vehicle where I still have a level of control. Until I'm more informed as to how efficient a fully autonomous car is, I think I would struggle to feel comfortable leaving it to a computer." (Deliberative participant, core audience, town)

The minority who would accept a private SDV where the vehicle is responsible for all driving tasks were most willing to do so when it came to shopping (31%), leisure (31%), and commuting (22%) journeys. These respondents felt they would benefit from being able to spend their travel time doing other activities if they were not responsible for any part of the driving task.

"I would consider using a self-driving vehicle to commute to and from work as it would allow me to prepare for any meetings I had that day by reading documents while in the car to work rather than having to be driving." (Deliberative participant, core audience, rural)

"It would be more relaxing. I can make notes or read on the journey, talk with other students - I can consume alcohol without the possibility of drink driving, can eat and drink while travelling." (Deliberative participant, core audience, rural)

Those in the high exposure audience were also more likely to consider using an SDV for journeys that they take regularly and are therefore felt to be highly predictable, such as commuting journeys. In these cases, an SDV would be able to learn a set route and follow it every time, with minimal chance of the vehicle having to make decisions during the journey. This felt more reassuring than the prospect of using an SDV to travel somewhere that the vehicle does not know, for which it would need to make decisions about the route as well as assess new risks and overcome them.

"If it was a regular route, I may feel more confident [using a self-driving vehicle]." (Deliberative participant, core audience, town)

"The journey commuting to work is a standard, designated journey. It never changes; therefore, I can rely on it being the same every day. I feel that a self-driving vehicle could follow this designated route fairly easily." (Deliberative participant, core audience, rural)

In general, there were limited significant differences in the willingness of participants in different locations to consider particular types of SDV for particular journeys. For the significant differences that did emerge, these were potentially related to differences in the types of journeys participants made in each location.

- Those in the urban location were significantly more likely than those in the rural location to consider using a private SDV with shared responsibility for the driving tasks for business journeys (38% compared to 23% in the rural location).
- Those in the town location were significantly more likely than those in the rural location to consider a private SDV where the vehicle is responsible for all driving tasks for leisure journeys (36% compared to 21% in the rural location).

The high exposure audience tended to hold positive views or be unsure about the potential impact of SDVs on their local transport system, with limited outright negativity compared to the national control sample. They were significantly more likely to think that SDVs could make their local transport network better (46% compared to 24% of the national control); however, a large proportion were unsure (45%). This was consistent across all locations.

This audience tended to be positive or neutral/unsure about the potential of SDVs when considering the balance of advantages and disadvantages from their use. Where roughly a third of respondents (34%) in the national control sample felt there were more disadvantages to SDVs, the opposite was true for the high exposure audience which saw a third indicating that there were more advantages (33%). A similar proportion (32%) were unsure and felt they needed further information to take a view and close to a quarter (26%) felt there were as many advantages as disadvantages. There was limited outright negativity among this audience, with only 8% believing there were more disadvantages to the use of SDVs. Again, there were no significant differences between locations.

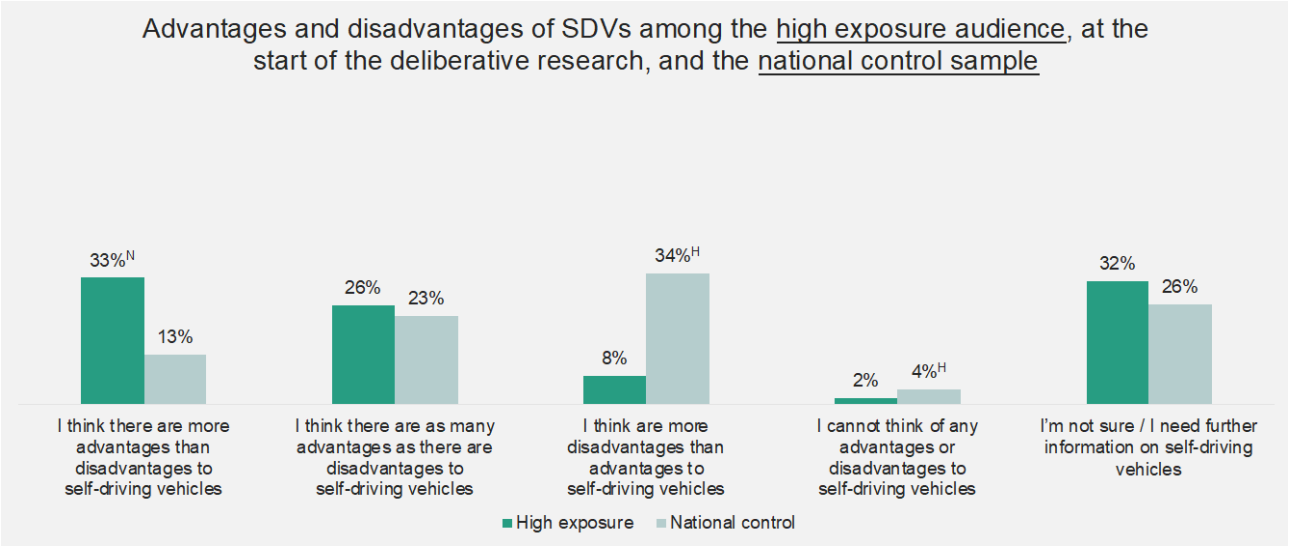

Figure 15 Perceived balance of advantages and disadvantages of SDVs among the high exposure audience (pre-deliberative research) and the national control sample

C3: Which of the following best describes your view on the advantages or disadvantages of self-driving vehicles? Base: High exposure audience (all locations) pre-deliberative research n=222; National control n=4027.

6.5 Section summary

- There is a strong correlation between positive attitudes towards technology and positivity towards SDVs. Those most likely to be positive include men, younger people, those with higher incomes, those with higher education levels, and those living in urban areas.
- While awareness of SDVs is high and almost two thirds of the national control sample report having talked to others about SDVs in the past, there is low accuracy of understanding of user responsibilities when travelling in SDVs and what vehicles can currently legally do on UK roads.
- Comfort with using or sharing the road with SDVs is low, with the proportion giving the lowest comfort ratings consistently and significantly outweighing the proportion giving the highest comfort ratings in the national control survey.
- However, the low, medium, and high exposure audiences in this research were consistently more comfortable with the prospect of SDVs than the national control sample, indicating higher starting positivity among research participants compared to the wider UK public.
- People are most willing to use a private SDV with shared responsibility for the driving task compared to other types of SDVs.
- Views were mixed in the national control survey about whether SDVs would make the local transport system better, worse or no different, as well as whether there were more advantages or disadvantages to their use.
- By contrast, the medium and high exposure audiences were significantly more positive about the potential impact of SDVs, and while many were still unsure or wanted more information, there was limited outright negativity.

7. Views towards SDVs and their potential role in local transport systems

Initial views towards SDVs among the high exposure audience were gathered in the first workshop. After being shown three introductory videos (see 14.4 Research design for full transcripts), participants were asked about their initial perceptions of the technology. They were also asked about their views of the potential benefits and drawbacks of SDVs in their local area. Participants views developed as they received more information and discussed with others taking part in the research.

7.1 Initial views of SDVs

The high exposure audience tended to hold positive to neutral views towards SDVs with limited outright negativity at the outset of the research. This was seen in section 6 in relation to the potential impact of SDVs on local transport networks and the balance of advantages and disadvantages of SDVs, and it was further evidenced in the deliberative workshops.

Slightly more than half (51%) of the high exposure audience gave a neutral response when asked about their level of support or opposition to the introduction of SDVs in their local area, with most of those remaining indicating their support. Broadly speaking, participants recognised that SDVs were likely 'the future' and even those who were neutral at this point tended to be cautiously optimistic about their use. However, few began the research with firm opinions on SDVs; instead, they were interested in learning more about them so they could 'make up their minds' and take a view.

"I don't think I know enough regarding autonomous vehicles to be supportive or opposing." (Deliberative participant, core audience, urban)

"This is a possibility that could work but it is too early to judge how." (Deliberative participant, core audience, urban)

"I think we have to embrace technology like we do modern medicine and I think we have to look forward to it." (Deliberative participant, core audience, rural)

Early in the first workshop there was a mix of positive and negative associations with SDVs, however the main focus was on the theme of **safety**. This included positive views, with the message that SDVs aim to be safer than current transport options and can address the issue of human error clearly taken on board by some. However, not all were convinced and there was a desire to see more evidence of SDV safety compared to existing technology and human drivers. It should be noted that safety was a key focus of the introductory information given to participants, which may be contributing to it being front of mind for many.

Figure 16 Word association when thinking about the introductory information about SDVs

Figure 17 Attitudes towards the introduction of SDVs to their local area among the high exposure audience

Q (asked in workbooks / online community for Workshop 1): 'Right now, would you say that you support, are neutral about, or oppose, using self-driving vehicles in your local area?' Base: High exposure audience: Rural (Alnwick) n=65, Town (Taunton) n=83, City (Manchester) n=75.

At this early stage, participants expressed some common assumptions about what SDVs would look like and how they would work, based on the information they had received and their own assumptions coming into the research:

- Spontaneously, participants assumed that SDVs would be **self-driving in all circumstances** (non-user-in-charge), using the latest and 'smartest' technology.
- Participants assumed that SDVs would be **remotely managed** through the use of apps to book services, as well as being remotely supervised during operation.
- The new technology would be **expensive**.
- Participants assumed that SDVs would be electric and therefore a more **sustainable** transport option compared to more traditional vehicles. While this was not inherent to SDV technology itself, it was seen as an important component of any transition to SDVs.

7.2 Benefits and opportunities for SDVs

Participants perceived numerous potential benefits and opportunities for the use of SDVs in their local area. These predominantly related to convenience and efficiency for users, and fell into the following categories (which are listed in order of importance as reported by participants, although it is important to note that the research did not include a formal ranking of these factors). A summary can be found at the end of this section in Figure 18.

Better access to travel

Participants saw SDVs as having the potential to fill some of the largest gaps in current transport networks for non-drivers, particularly those relying on public transport in rural areas. These benefits included:

- **Greater travel independence:** Participants assumed that a driving licence would not be required for non-user-in-charge SDVs, enabling access to the technology for non-drivers. Privately owned or shared SDVs were therefore seen to have the potential to increase the sense of independence and decrease the risk of social isolation for those who are currently least mobile, including people with disabilities, the elderly, young people, those poorly served by public transport, and those who cannot or do not drive. For these groups, SDVs would be more inclusive than existing transport options as they would provide reliable, independent, door-to-door travel options for all, not just those who can currently drive.
- **Stronger public transport networks:** Integrating SDVs into public transport was seen to have the potential to address existing gaps and unmet needs, improving the network for everyone, not just for those who are least mobile. Participants felt that current issues with driver shortages would be addressed by vehicles not needing human drivers. Further, despite an assumption of high initial costs to purchase and deploy SDVs, participants felt that they could help reduce public transport fares in the longer-term as there would be no need to pay drivers. With SDVs, participants envisioned public transport networks that were more reliable, with services running more frequently, the addition of night and weekend services where not currently available, and greater service coverage (such as using multiple, shorter routes) in both urban and rural areas.
- **Economic opportunities:** There was also a sense that these benefits could bring economic opportunities to local areas including improved access to local employment

and training opportunities, a larger pool of potential customers being able to access local businesses, and decentralisation of local businesses. SDVs were therefore felt to have the potential to bring a greater spread of economic development and entrepreneurial opportunities to the local area. SDVs could also potentially reduce the strain on existing local transport services and businesses in locations that act as local tourism hubs, by giving tourists access to a wider array of local destinations and landmarks, including those that are more rural or remote.

"[There is an opportunity to] improve people's lives and bring independence to people who don't have it. Especially if you're older and don't have the accessibility, you're given that chance to get to places you need to without the expensive option of a taxi."
(Deliberative participant, core audience, rural)

"It would be great if it could improve connectivity between the outlying areas."
(Deliberative participant, core audience, urban)

"It would help us get to places we don't normally have access to with buses and trams."
(Deliberative participant, core audience, urban)

Improved road safety

By reducing opportunities for human error, participants expected that the technology could help to improve road safety and minimise incidents, particularly reducing the risk of collisions. It was also seen to potentially counteract behaviours that are both dangerous and illegal, such as drink-driving and speeding. Intuitively, the main opportunity emerging from improving road safety was seen to be the ability to reduce the number of injuries and fatalities from road collisions.

"Eliminating even a small margin of human error would be beneficial." (Deliberative participant, core audience, urban)

"It could be safer, more inclusive, more time efficient. It can't be worse than human drivers; humans are idiots. People are on their phones or doing their makeup when they should be looking at the road. We should just take people out of the equation."
(Deliberative participant, core audience, urban)

More efficient journeys

SDVs were felt to have the potential to improve the travel experience for those who currently drive their own vehicles. Specifically, the benefits of privately owned SDVs were seen to include:

- **Streamlined journeys:** For private journeys that do not have to run to a set route (in contrast to buses, for example) there was a sense that SDVs could make journeys more efficient and streamlined by adapting to road conditions and identifying the most efficient route. They were also seen to minimise the risk of getting lost and arriving late at one's destination. The use of SDVs would therefore help to make journeys less stressful and reduce travel time for those who currently drive.

- **Reduced congestion:** There was optimism that SDVs could decrease congestion by improving traffic flow, using the available road space more efficiently, and reducing delayed reaction time to signal changes. This could again result in easier, less stressful journeys and reduced travel time for those who currently drive.
- **More productive journeys:** If travelling in a non-user-in-charge SDV, people who currently drive would be able to perform other tasks instead, including leisure or work activities.

"I think it's a very interesting way to travel and if it's safe it could make travelling much more convenient and less hassle." (Deliberative participant, core audience, urban)

"If you have a long journey, you can be more productive as a passenger. You can use your travel time as work time." (Deliberative participant, core audience, town)

"I think it would make life less stressful; if you're not having to do the driving, then you're more relaxed." (Deliberative participant, core audience, rural)

Decreased reliance on private vehicle ownership

In contrast to the above, participants suggested that SDVs could also reduce existing reliance on private vehicle ownership altogether. Perceived benefits and opportunities of this included:

- **Environmental benefits:** A move away from using a large number of private vehicles to a smaller number of public or shared vehicles, facilitated by SDVs strengthening these options, could reduce traffic and congestion. This would help to reduce air and noise pollution as well as making town and city centres more pleasant places for pedestrians and cyclists, potentially encouraging more people to switch to these more sustainable modes of travel.
- **Community benefits:** In addition to the above environmental benefits, a reduction in traffic and congestion, as well as reducing the need for parking provision in centralised areas, was felt to have the potential to improve streetscapes and enable public spaces to be reimagined for local and community use.
- **Decreased pressure on household finances:** If public or shared SDV provision were to be appealing and reliable enough to encourage a shift away from private vehicle ownership, then this would save people the cost of having to purchase, maintain and run their own vehicle. This could give people more money to spend at local businesses if the cost of using public or shared SDVs was the same, lower or not (significantly) higher than the cost of using these options today.

The following graphic summarises participants' views regarding the potential opportunities for SDVs and how they could help to address existing transport challenges across all trial locations. Graphs outlining the specific challenges and associated benefits and opportunities in each of the three research locations can be found in 13. Location-specific findings.

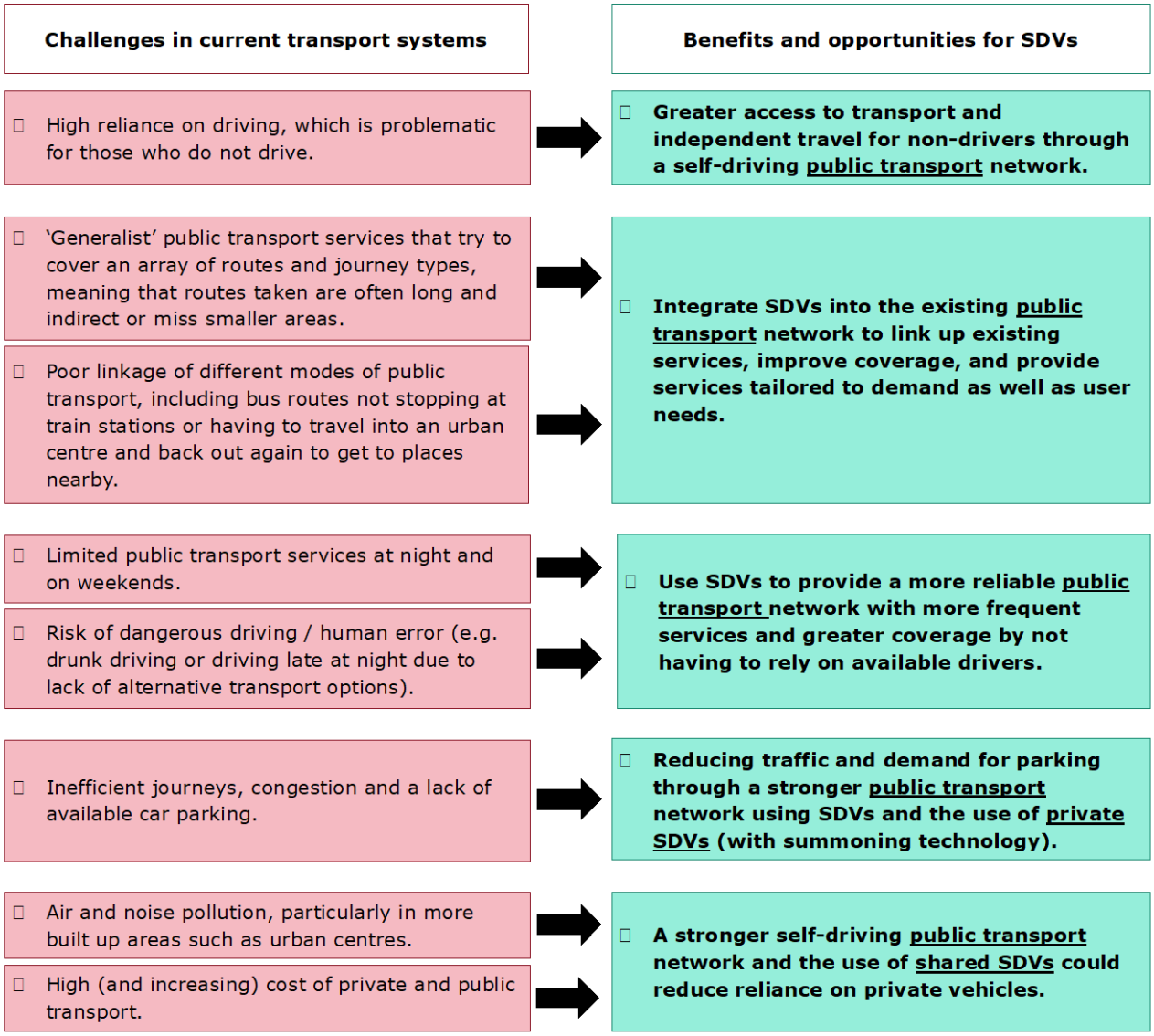

Figure 18 Summary of benefits and opportunities for SDVs in relation to existing transport challenges

7.3 Perceived drawbacks and risks of SDVs

In addition to benefits and opportunities, participants also had numerous concerns about the potential drawbacks and risks posed by SDVs. While these were not necessarily seen to negate or outweigh any of the perceived benefits and opportunities outlined in the previous section, they did undermine participants' confidence that these benefits and opportunities could be realised. Lack of clarity on the extent to which perceived drawbacks and risks of SDVs were likely to come about through any local deployment also discouraged participants from committing to support or oppose SDVs at this stage of the research. Perceived drawbacks and risks broadly fell into the following categories (as before these are listed broadly in order of importance as reported by participants but they were not formally ranked as part of the research).

Diminished road safety

While some saw that SDVs might benefit overall road safety, those who were more cautious felt there may be unanticipated safety implications leading to an increased risk of injuries and fatalities from road collisions. Much of this caution stemmed from a lack of clarity about how the technology works to improve safety and how it could be deployed. Key concerns were:

- **Inherent distrust of the technology:** Participants wanted to see more evidence of SDVs being safer than human-driven vehicles before being able to fully trust in their ability to avoid collisions with other vehicles, road users, and obstacles.
- **Discomfort relinquishing human control:** There were concerns about what would happen in case of an emergency (e.g. to avoid a collision), technology malfunction, or unforeseen circumstance that an SDV was not programmed for if there was no element of human control (i.e. non-user-in-charge). The inability to intervene in these circumstances led to many expressing a preference for human control in such instances, such as the option to take control via a 'system override'.
- **Uncertainty about safety measures:** Participants wondered what safety measures would be in place inside the vehicles, such as seat belts and fire extinguishers through to hygiene measures to prevent the spread of infectious diseases. They also wondered how passengers would be prevented from using private SDVs while under the influence of alcohol or other substances, or from falling asleep on board, if they are required to take control of the vehicle (i.e. user-in-charge).
- **Risk of vandalism:** There was concern that the lack of staff on board public or shared SDVs could lead to a high risk of vandalism, resulting in damage preventing use of the vehicle or potential malfunction during operation.

"What was interesting was the idea of satnavs came up, because satnavs only work about 50-70% of the time, and for me, why use something that only works some of the time when you could use a paper map which works 100% of the time? I've almost given up on satnavs, so if that's the future of driverless cars, no thanks!" (Deliberative participant, digitally disengaged, rural)

"I'm concerned with risks posed by giving control to machines and AI." (Deliberative participant, core audience, urban)

"I welcome new technology that removes human error, but there is still human error in software such as coding and glitches. Self-driving cars can also be confused in certain environments." (Deliberative participant, core audience, urban)

Diminished personal safety and security

Beyond just safety on the road, participants also perceived drawbacks and risks relating to personal safety and security when using or sharing the road with SDVs. Key concerns included:

- **Dangers onboard:** There were concerns that passenger safety and security while travelling would decrease due to the absence of staff on shared and public transport, removing a 'neutral' third party in the event of disputes or antisocial behaviour. Particularly among urban participants, it was felt that the use of SDVs could lead to an

increase in anti-social behaviour on public transport. The removal of staff was also seen as potentially providing opportunity for criminals (e.g. for drug dealing, theft). These perceived drawbacks and risks were raised particularly often by women and people who tended to travel at night.

- **Risks to personal data:** Secondarily, there was also a perception of increased risk to personal data and even identity theft for passengers through an increased risk of cybersecurity incidents. It was assumed that the use of both private and shared SDVs could require a large amount of data sharing, which participants feared could be used and exploited for profit at their expense by private companies, criminals and hackers.

"Technically it's safer, but not necessarily socially – there's a risk of crime and social isolation." (Deliberative participant, core audience, urban)

"It could increase crime levels, like the introduction of the tram made the distribution of drugs across Manchester easier." (Deliberative participant, core audience, urban)

Poor real-world functionality and integration

Participants wondered how long it would take for the vehicles to be introduced and for different systems to be integrated with existing transport systems, both for public and private use of the vehicles. Participants were concerned that the technology would not work in all locations and would thus be obsolete for large parts of the country. Key concerns related to the perceived poor functionality and integration of SDVs were:

- **Interaction between SDVs and human drivers:** The perceived lack of 'human intuition' and being unable to respond to human signals (e.g. waving someone through an intersection) underpinned concerns that SDVs and human-driven vehicles would not be able to co-exist on the roads. Participants envisioned 'stand-offs' between human-driven vehicles and SDVs as they would not be able to communicate with one another. They also imagined that SDVs may behave in a way that, while correct and lawful, is incongruent with real driving practices, or that differing reaction times could mean that SDVs react to obstacles in a way that could endanger others who are slower to react. This prompted questions over whether separate lanes and additional infrastructure would be required to accommodate both types of vehicles, as well as the longer-term feasibility of these vehicles co-existing, or if a transition completely away from human-driven vehicles would be required.
- **Ability of SDVs to accurately assess their surroundings:** There were concerns about the ability of SDVs to distinguish between different objects in their path (e.g. a plastic bag versus a child in the road) and therefore whether they would be able to respond appropriately to different hazards. This was of particular concern for those in rural areas where there could be animals such as sheep in the road, with concerns that vehicles would get stuck being unable to navigate around these obstacles appropriately. Those in the urban area worried that SDVs could be slow to adapt to the changing urban environment, especially in high-development areas.
- **Ability of SDVs to adapt to different conditions:** Participants were unclear on how well SDVs would operate in different conditions (e.g. weather, terrain, road types), with many voicing scepticism about their adaptability.
- **Stranding:** Participants were concerned about inconvenience for passengers if they were to be stranded because of the technology malfunctioning or losing connectivity

with the networks required for operation. This was particularly concerning for those in the rural location who were concerned about 'patchy' wireless and cellular networks in remote areas impacting the functionality of the vehicles.

- **SDV decision-making:** Participants also raised the issue of the 'trolley problem', questioning how the vehicle would decide what to do in situations where several risks needed to be weighed up, such as if the vehicle would swerve into oncoming traffic to protect a child in the road.

"If you've still got manual cars on the road, they won't be able to respond as quickly as the self-driving cars - you could go into the back of them because of the slower response time." (Deliberative participant, core audience, urban)

"What happens if there's a patch of black ice or something?" (Deliberative participant, digitally disengaged, rural)

"How can a driverless bus distinguish between if there were five pedestrians on one side and fewer on the other, which way to go? A human driver would have the ethics to pick the one that would cause fewer deaths." (Deliberative participant, young people, rural)

Loss of jobs

In most cases, participants did not spontaneously imagine new jobs being developed as a result of a transition to SDVs. Instead, they imagined 'mass redundancies' of train, bus and taxi drivers should SDVs become prevalent in public transport, as well as the potential loss of jobs for drivers transporting freight. This possibility was met with concern about what the impact of such redundancies could mean for local communities.

When challenged, participants did see potential for the creation of jobs, for example in the development, manufacturing and operating of SDVs. However, overall they did not think that the transition to SDVs would generate a comparable number of jobs to those which would be lost.

Furthermore, some felt that new roles such as onboard attendants would undermine the rationale for SDVs. These participants felt that a key opportunity of SDVs was to fill gaps in, rather than replace or upgrade, existing public transport services. They therefore struggled to see the improvement in replacing a vehicle and driver with an SDV and attendant.

"I'm concerned with the social changes it is going to bring about – what will happen with drivers who do it as a job?" (Deliberative participant, core audience, urban)

"I feel it will take away jobs from grocery deliveries etc. We'll get to a point where everyone's just sat at home with nothing to do." (Deliberative participant, disability, town)

Expensive to implement

In the absence of information about costs, participants assumed that introducing SDVs would be expensive, in large part because of the upfront cost to purchase the vehicles. This prompted the following concerns:

- **Greater cost than improving existing transport infrastructure:** Participants were concerned that introducing SDVs could be more expensive than simply improving the existing transport infrastructure. This was particularly voiced by participants in urban areas who already had good local transport provision, and therefore the benefits of SDVs over other existing modes of transport were less clear.
- **Lack of local authority funding:** There was scepticism that local authorities would have the funding available to introduce SDVs in the local area, particularly without having to deprioritise other local priorities or initiatives to do so. Even if local authorities were able to fund the purchase and deployment of SDVs, participants questioned their ability to pay to maintain the technology, including software updates, ensuring the most up-to-date technology is available, as well as repairs, maintenance, and call outs if SDVs malfunction or are damaged. These concerns were particularly strong in the town and rural locations, with participants worried that the inability to fund SDVs on an ongoing basis would limit the impact that the investment could have.
- **Higher taxes and personal cost:** The perceived risk of high costs also prompted concern that the introduction of SDVs could lead to higher personal taxes or higher fares for shared or public transport to fund the purchase and maintenance of the vehicles.

"We don't know where the money is coming from for this." (Deliberative participant, core audience, urban)

"I'm concerned about the government wasting money on unnecessary technology." (Deliberative participant, core audience, town)

"I can imagine it will be more expensive than manual cars to have them as private vehicles but would using them for public transport be more or less expensive than it is now?" (Deliberative participant, young people, rural)

Dehumanisation and loss of social interaction

For many there was an underlying fear of dehumanisation and an association of SDVs with a dystopian future. Not having a driver to greet passengers on public transport services was seen as likely to have a negative impact on individual travel experiences as well as wider negative effects at a community level through the loss of this point of social interaction. Further, there was some concern about the value of what they saw as 'progress for progress' sake', as well as the potential use of technology by corporations and governments to limit individual freedoms.

"In a rural community like ours, human drivers are quite important. Drivers help in many ways, like driving to the most helpful place to drop deliveries and helping the elderly bring their shopping in." (Deliberative participant, core audience, rural)

"I just think it's a bit sad. It will save them thousands of pounds to deliver by robots, but you miss that human contact." (Deliberative participant, core audience, town)

Unequal access

Participants felt that SDVs could improve access to a wider variety of transport options for those currently least mobile (see 7.2 Benefits and opportunities for SDVs). Yet there were concerns about some elements of SDV deployment that participants felt could instead create further barriers to access for these groups. This included:

- **Cost of using SDVs:** Participants were concerned that privately owned SDVs would be expensive to purchase, meaning only the wealthiest would be able to afford to benefit from the technology.
- **Licensing:** Requirements for additional driving tests to operate SDVs or share the road with them in a human-driven vehicle were felt to potentially limit access to the technology for non-drivers.
- **Physical access:** There were concerns that physical accessibility when boarding, riding, and disembarking would not be built into SDV design, which was seen as particularly problematic if no staff are onboard the vehicle to assist. This could negatively impact the ability of some groups to access the potential benefits of the technology, including those with physical or mental health conditions that impact their mobility, as well as those travelling with prams, equipment or luggage.
- **Digital literacy:** There were also concerns over accessibility for those who are not digitally literate or not comfortable with technology, under the assumption that accessing the service would require an app or other such technology.

"It's going to be one of those things that only rich people can afford because it's marketed that way that it's a luxury, not there to help the current situation. That's got to be really thought through." (Deliberative participant, core audience, urban)

"I think that we'd all have to be tested again, you'd probably have to have a basic knowledge of the technology." (Deliberative participant, core audience, urban)

"Education for the older person is essential, I haven't been educated in technology, and for me, there needs to be a lot of patience." (Deliberative participant, digitally disengaged, rural)

Liability

Some of the most frequently asked questions related to the issue of liability, with participants wanting to understand who would be responsible in the case of incidents or collisions involving SDVs and how those who are liable would be held to account. Specifically, there were concerns about the unknown implications for liability and prosecution that could lead to drawn out legal disputes and leave victims without justice.

"I read an article on it and they're legal in America and the car malfunctioned and killed a woman and he still got blamed. If you're asleep and it kills someone you still get the blame. It's not really your fault, but who's to blame?" (Deliberative participant, low SEG, urban)

"I'd say it makes human life easier. However, technology can go wrong anytime. So, if an accident occurs, who's at fault?" (Deliberative participant, core audience, urban)

Sustainability

While not inherent to SDV technology itself, the underlying assumption that SDVs would be electric did shape participants' overarching perceptions of the technology. Participants assumed that as electric vehicles, SDVs would be more environmentally friendly and cheaper to run. However, there were questions about the actual impact and cost of SDVs, with some wondering how they would compare to petrol and diesel vehicles currently in use. Furthermore, the impact of lithium batteries and the climate cost of the electricity needed to power them were questioned by more environmentally aware participants. Longevity was seen as a factor in sustainability, with questions of maintenance and upkeep also raised in relation to this topic.

"Maybe instead of focusing on self-driving vehicles I think they should focus on making cars better for the environment with this technology. Couldn't you focus all this energy into making cars more sustainable?" (Deliberative participant, core audience, rural)

"I need to know more. Going home after today I'm having a look and trying to find some documentaries about it. Something I would question is all the stuff about electric being greener, but it's got to come from somewhere." (Deliberative participant, low SEG, urban)

7.4 Uncertainties and tensions

There were numerous areas of uncertainty where perceived benefits and drawbacks crossed over and were either in tension with one another or were dependent on how widespread SDVs would be, how they would be used, and how they would be deployed. These tensions are summarised in Figure 19.

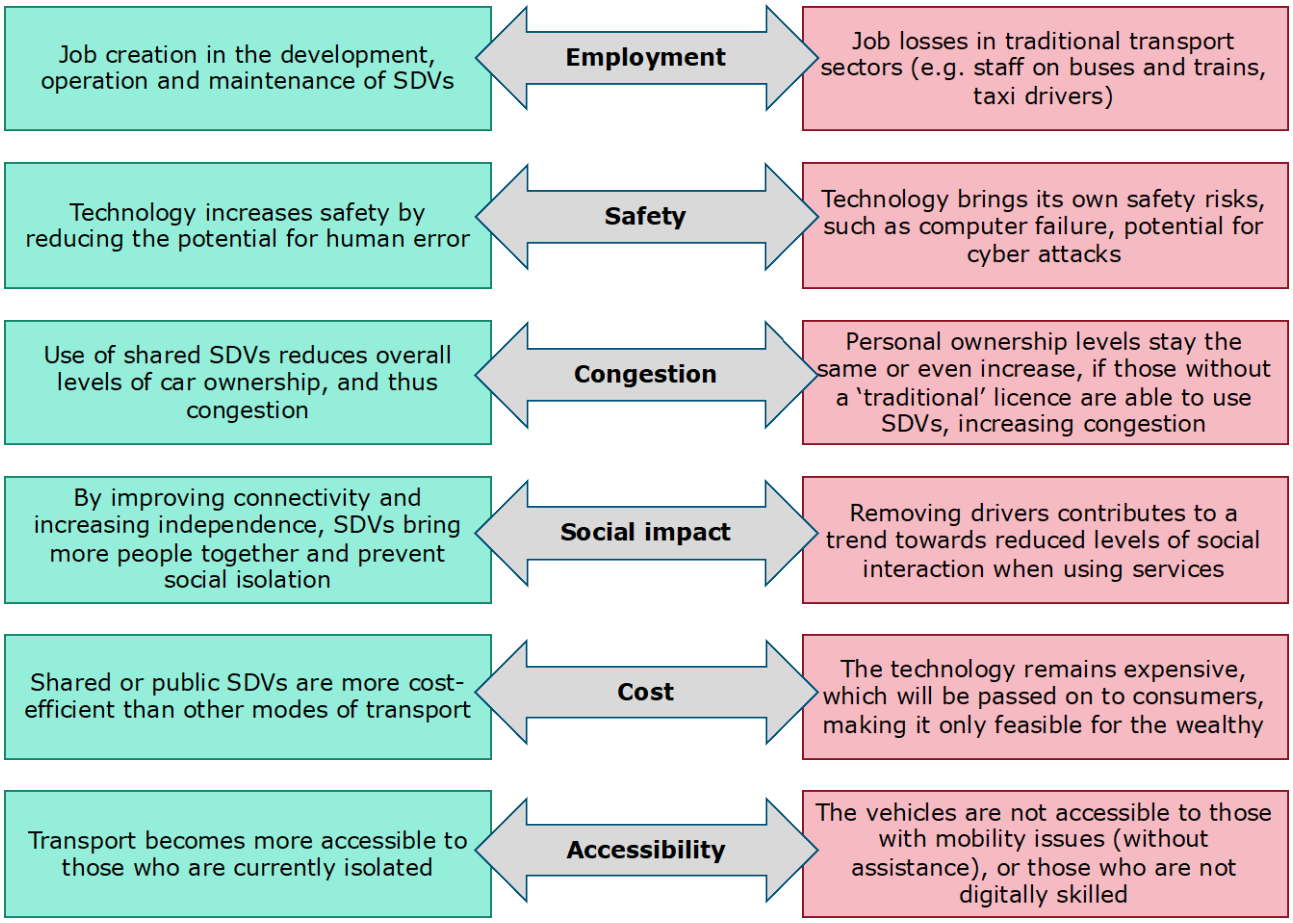

Figure 19 Summary of areas of uncertainty towards SDVs

There were also a number of overarching tensions felt by participants when weighing up their views towards SDVs.

- Tension between positivity about the idea and ambition of SDVs in principle, and concerns about how it would work in practice.
- Tension between seeing individualised transport as essential to personal independence, and the belief that prioritising SDVs in public transport is the best way to improve accessibility and mobility for non-drivers.
- Tension between what may, in the abstract, seem like a sensible solution to some of the issues in the local transport system, and participants' emotional attachment to how they currently travel. For many, it was difficult to imagine giving up the feelings of control and independence they have from driving their own vehicle in favour of handing control of the driving task over to a computer.

"I don't have enough information about them to make an informed decision on support or oppose. Hopefully I'll find out more from this and then say. I'm unsure at the moment." (Deliberative participant, core audience, town)

"Being honest, my first impression is that it's too futuristic and for our area I can't see it. It seems a bit pointless... I can be proven wrong, I'm open to it. I was probably on the fence about mobile phones when they came about as well." (Deliberative participant, core audience, rural)

"It's exciting - like there are a lot of people that line up out of the Apple store when a new phone comes out." (Deliberative participant, core audience, urban)

"Technology that improves lives is a good thing. At first, people might be sceptical just like when mobile phones were being trialled but look at us now! Advancing in the future." (Deliberative participant, low SEG, urban)

"I would need to see more evidence that it is beneficial. And I worry that it could be more dangerous if not all cars are autonomous." (Deliberative participant, core audience, rural)

"I think at the minute until we know a bit more it's scary." (Deliberative participant, core audience, urban)

7.5 Role of SDVs in local transport systems

Potential local applications for SDVs

It was seen as important for SDVs to be deployed locally in a way that would meet current needs and address existing gaps in the transport network. Broadly speaking, there was a desire for SDVs to be used in public transport first before any mainstream adoption of private vehicles. This was due to the perceived benefits of SDVs providing more individualised and accessible options within the public transport system for those who do not drive, as well as the high anticipated cost of private SDVs. The tensions outlined in section 7.4 also likely contributed to this view, as deploying SDVs in public transport would feel 'lower stakes' to people, allowing them to get used to the technology and iron out those tensions before considering private SDVs.

There was a preference for SDVs in public transport to be publicly owned and managed. There was a strong expectation that private companies would be too profit-orientated and would make the use of SDVs too expensive, pricing out those who would need it most, or would choose to not run certain routes, such as rural to urban services due to lower demand. However, participants were concerned that government would not be able to afford implementing such a system of SDVs and that a government-run model might lead to it being less efficient than a commercial model.

Views on the specifics of whether and how SDVs could fit into the local transport system varied between locations, and typically were influenced by **perceptions of the existing transport infrastructure** as well as the **perceived ability for SDVs** to cope with different terrains, road layouts, road types, and road conditions (e.g. in bad weather).

Towns and rural areas

For participants in the town and rural areas, there was optimism about the use of SDVs to solve some of the current gaps and pain points in their local transport system (see 5.1 Current transport behaviours and perceptions).

Taxis or, at most, mini-bus services running a short route to connect people to local locations, town centres, and public transport services (like park-and-ride) were the primary suggestion for using SDVs locally. This would overcome key challenges of

connecting people to their nearest train station or bus stop without the need to drive, and catering to low and inconsistent demand resulting from small and widely spread populations. There was also a hope that SDVs could be used as **an alternative to human-driven vehicles in villages and town centres**, helping to ease congestion by reducing the need for cars and parking spaces.

Additional ideas for SDV applications in towns and rural areas included:

- Additional bus services to overcome driver shortages and declining services, including to directly connect local villages together (rather than having to travel via a larger town or city centre) and providing options for evenings and weekends.
- Better delivery coverage to rural areas (e.g. grocery delivery), while also potentially reducing congestion and the number of large delivery vehicles on small/rural roads.
- Long-distance driving using self-driving features on motorways and A roads.
- School services to help reduce the reliance on local taxi services in rural areas.
- Hospital transfers and transfers to medical centres for appointments.
- Options for travelling home at night, including from pubs to reduce the risk of people driving under the influence of drugs or alcohol.
- Support in agriculture (e.g. bringing in the harvest 24/7).

Despite seeing opportunities for SDV applications to improve their local transport offer, in practical terms participants in town and rural areas had a sense that SDV technology was better suited to urban environments. This was for a variety of reasons including cities having more predictable road conditions, higher populations to take up SDVs, and assumptions that poor satellite coverage and 'dead spots' would negatively impact functionality in rural and remote areas. Other areas where SDVs were felt to be well suited included controlled and contained areas such as airports or sport venues, and/or motorways where they could have a dedicated lane. There was also scepticism about the local authority being able to afford or justify the expense of these new technologies, which made the prospect of SDV introduction in rural areas and towns feel unlikely.

"I think it could address the need of autonomy for people who don't have the option right now – especially the elderly people who have to schedule their medical appointments when they know a family member can take them. Even things like church services." (Deliberative participant, core audience, rural)

"One of the biggest opportunities to really make a massive difference here... It could reduce the number of vehicles on the road, people could use communal rather than individual facilities. However they are powered, you are reducing emissions and the amount needed to power it. That has massive benefits to all of us... worldwide potentially." (Deliberative participant, core audience, town)

"Parcel services could be delivered this way which could be cheaper and mean you could deliver more frequently (e.g. overnight)." (Deliberative participant, core audience, town)

"How would it work with the country roads... Things you might not come across as often like a cow or a sheep, what will happen then?" (Deliberative participant, core audience, town)

"It might work in big cities but in rural areas the older people won't understand the technology, they might be worried about if the cars will brake for them or not." (Deliberative participant, young people, rural)

"I just don't think this area is ready for this sort of technology yet. There's so many little lanes and back routes to use." (Deliberative participant, core audience, rural)

Urban centres

Broadly speaking, those in the urban area tended to be satisfied with the transport options already on offer and therefore felt there were minimal obvious potential use cases for SDVs. Many struggled to see what the technology might have to offer that couldn't be addressed by improving existing service provision, and as such SDVs were not seen to offer anything that was significantly more advantageous than what could be achieved with improvements or additions to what is already available.

This may be because the gaps in public transport were generally perceived to be less significant compared to other types of location. As a result, participants were more likely to suggest, for example, additional buses on the road rather than making large-scale adjustments to the system to integrate SDVs. There were questions about the feasibility of achieving an integrated system, both in terms of joining up timetables and adjusting the infrastructure to accommodate SDVs in terms of road space.

However, participants were able to think of some ways in which SDVs could play a role in their local transport system by:

- Improving and increasing the provision of public transport services, including night-time options, for example a late-night (past midnight) public transport or taxi service taking people from the city centre to suburbs, for those who work unsociable hours or are out for leisure.
- SDV private vehicles being used for longer-distance journeys such as inter-city travel, thereby freeing up the driver to use their travel time in other ways.
- Providing shuttle services at airports, festivals and large campuses where they can connect large but often self-contained areas.
- Supporting goods delivery services.

"Very often in jobs you have to have your own transport if you have to work unsociable hours. You could have a car which doesn't matter what time it is, and vehicles could be useful there. If you have to start early or finish late, and you might be tired and that increases a risk of accidents." (Deliberative participant, core audience, urban)

"It might be possible but needs to be integrated within the transport system at the moment. At the moment different transport systems are not integrated." (Deliberative participant, core audience, urban)

"I don't believe it would be possible for our existing infrastructure to support individual driverless cars. They may have a role in public transport and goods delivery." (Deliberative participant, core audience, urban)

Expectations for SDV deployment in local area

Following deliberation, participants had some clear views on how they would want to see SDV technology implemented in their local area. There were commonalities across different areas, with a shared desire for a gradual rollout that prioritises safety and convenience.

Across locations, participants expected that any introduction of SDV technology would be done gradually. A slow rollout would be necessary to allow infrastructure, planning and for people to adjust to the new technology, and would help build trust over time. There was an expectation of SDVs building on and enhancing current transport options, rather than a drastic transition from one day to the next, and participants felt that SDVs would need to prove that they are beneficial compared to other solutions by offering something different and improved before becoming widespread.

"Make sure it's a gradual, slow transition so as not to overwhelm people." (Deliberative participant, 65+, town)

Participants were most likely to imagine a world of shared SDVs, with prioritisation of public transport over private travel - particularly in the early stages of adoption. For example, as part of park-and-ride or other shuttle systems, but also similar to a car-sharing or ride-hailing service such as Zipcar or Uber. Again, this stemmed from a desire for a gradual rollout and having time to build trust and confidence in the new technology, as well as a desire for the technology to be available to those who need it most, not just those who could afford to purchase their own SDV.

"I could imagine something with public ownership, shared, you don't need to own your own car, you can keep it for a day or a journey." (Deliberative participant, core audience, urban)

"Public transport rather than private, if it's 1-for-1 car the congestion won't be solved, but if it can be shared. They used to run a shuttle to the supermarket that could be used by the elderly or those who couldn't drive, so if they could do this with the self-driving that would work." (Deliberative participant, core audience, town)

Participants largely wanted SDVs to be publicly owned and operated, which they hoped would mean that the service would be more affordable with money more likely to be re-invested into the system for further improvements. This was felt to better meet the needs of local people and communities while also having clear governance structures and accountability in place. However, they felt that private ownership was the more likely outcome, as they expected the technology would require significant funds both to acquire and manage. Regardless of the ownership model, participants hoped that shared SDVs would be affordable enough to be used by and accessible to everyone.

"I would like SDVs both owned and regulated nationally to see real investment and the money coming back into the economy, if it is privatised the money is not re-invested." (Deliberative participant, core audience, urban)

Participants expected the vehicles to be easy to use and accessible via a smartphone app, thus providing flexible, on-demand service including in evenings (e.g. a 24-hour service you can order to your home). Onboard, there was an expectation there would be features such as information screens, free Wi-Fi, and interactive maps.

"I would use it all the time if there was an app on your phone and you set pick up and arrival time." (Deliberative participant, core audience, rural)

The vehicles themselves were expected to come in different shapes and sizes, depending on their function and the context they were being used in, with design focused on passenger and user needs. They were also expected to be electric and, as such, more sustainable and better for the environment - with some feeling it would be a missed opportunity to simply retrofit SDV technology into polluting vehicles.

In terms of security, participants expected safety assurances and back-up systems in place, with expectations that safety would be heavily regulated, with procedures and technological features to be used in the event of emergencies. Participants often assumed there would be a process to gain control over the vehicle if required. In addition, there was an expectation for some human presence or a safety operator on board public transport services before potentially gradually transitioning to an alternative system that would facilitate the same amount of security and reassurance (although others felt this would negate some of the benefit of the self-driving aspect).

"We already have similar technologies such as cruise control, and certain vehicles that slow down once you get too close to things, but still with the human being sat there just in case. It is the next step of the car taking over the control. I think I would still like the option of having some kind of control when I want to." (Deliberative participant, core audience, urban)

Factors to be addressed prior to SDV rollout

Participants felt it was crucial to ensure that there is an actual need for, and benefits to be gained from, SDVs before introducing them in the local area. There was a strong desire to see a gradual roll out of SDVs with public transport applications prioritised, as well as the incorporation of SDVs into wider transport planning to ensure they can fill current gaps in transport provision. Once these basic criteria were met, there were then several factors that participants felt would need to be addressed prior to implementation; these are explored in detail below.

"It will be a very costly development, ensure that the cost is acceptable and that they are actually necessary, is it actually going to be superior to a train that has got a driver? I

think the argument for self-driving cars is different from what it would be for trains or trams." (Deliberative participant, core audience, urban)

Environmental and social planning: Infrastructure improvements were a clear priority for participants, who felt that the built environment is not currently suited to accommodate a mix of both SDVs and traditional vehicles. There was a strong sense that for this to work, particularly in more rural areas, substantial investment in infrastructure would be needed, including:

- Widened roads and extra lanes, as well as improvements to road surfaces (e.g. fixing potholes) and road markings.
- Improved charging infrastructure for electric vehicles across the country, as SDVs were assumed to be electric.

"We've got cycling paths in the area, specific lanes for cyclists. I wouldn't want different types of vehicles mixing because I think that's a recipe for disaster. I'd be happier if I was in a specific lane with barriers either side if we are mixing with other vehicles." (Deliberative participant, core audience, town)

Regulation: Participants called for robust evidence of the SDV functionality through rigorous testing, particularly of safety measures, and strong regulation from an early stage (i.e. not reactive regulation, which some participants felt had been the case with e-scooters). They felt the technology should be rolled out to the wider public only once all safety features, mechanisms and protocols were well-evidenced and proven in long-term trials.

- Participants wanted to see the vehicles rigorously tested in multiple situations, circumstances and scenarios, as well as on multiple types of roads, to ensure they are safe in both urban and rural settings. These safety tests should also include cyber security, ensuring the technology stays ahead of hackers and others who may tamper with it - whether with malicious intent or not. However, they did not have a clear view on what these tests would entail or what specifically would be sufficient to prove that SDVs are 'safe enough' for deployment.
- Participants also expected that insurance policies for all vehicles would need to be updated ahead of any SDV rollout.

"I would like confidence that it is a safe way of travelling, like certain safety standards from government." (Deliberative participant, core audience, urban)

"I would like to see safety mechanisms proven to the public before it's on the roads as I think it would make a difference to people's opinion." (Deliberative participant, core audience, town)

Legislation: Participants expected that there would need to be new legislation regarding both users and non-users of SDVs, particularly regarding liability and safety. They felt the highway code would need to be updated to reflect the presence of SDVs on roads.

Communication and education: Participants expected that there would need to be a large-scale awareness-raising campaign about SDVs, what they are and how they work. They felt this would encourage buy-in and take-up among the wider population and help to address concerns about their usefulness and safety. Following a national-level campaign, there would also need to be communications in specific local areas where SDVs were planned to be introduced, to ensure targeted and relevant situational information provision.

"There should be engagement so that everybody knows, just like the NHS. So that nobody gets behind and everybody is represented, like focus groups." (Deliberative participant, core audience, town)

"People like you who are educating us. The general public will also need the same level of education and exposure to develop a sense of the risks and benefits for them." (Deliberative participant, core audience, rural)

There is also a need for an education campaign alongside these communications to reinforce buy-in and make people feel safe around and using SDVs:

- Driving tests - both the exam itself, as well as the theoretical content and practical exercises - were felt to require updates to ensure drivers know how to interact with SDVs and how to expect them to behave.
- There was also an expectation that there would be training for all road users - including pedestrians and cyclists - on how to interact with SDVs and that this training should be provided by government.
- There was seen to be a need for support and help for users in the early stages of any SDV rollout to ensure confidence and safety when using the new technology.

7.6 Section summary

This is a summary of the key research insights on participants' views towards advantages and disadvantages of SDVs and expectations of their potential role and deployment in local transport systems, before trialling vehicles.

Initial views

- Initial views of SDV technology tended to be neutral to positive (among 'high exposure' deliberative participants), with limited overt negativity at the outset of the project and a sense that SDVs were likely to be introduced in the future.
- While this cautious optimism was not underpinned by detailed knowledge there were some common assumptions that people brought to the research (e.g. that SDVs would be self-driving all the time/in all situations and that they would be electric and thus more sustainable than current internal combustion engine (ICE) vehicles).
- Safety was a key area of interest, both in terms of how safe SDV technology actually is and the potential safety benefits that could be delivered.

Opportunities, benefits and role of SDVs in local transport systems

- As participants learned more, reactions towards SDVs remained generally positive. They identified multiple benefits and opportunities for their local area relating predominantly to convenience, efficiency, greater access to transport and improved safety.
- In the town and rural locations, participants could see the potential for a range of use cases such as taxis and small buses making short trips to connect to town centres and other transport hubs (e.g. park-and-ride, train station, rural delivery services, better school transport (instead of taxis), hospital transfers and late-night transport).
- SDVs could improve what was perceived to be poor public transport, for example by addressing issues of driver shortage.
- In the urban location, participants felt the opportunity was more about plugging gaps than large scale improvements to the transport system. However, SDVs could offer improvements in public transport (e.g. extending operating hours later into the night), as well as being deployed as shuttle services at airports or campuses.
- Participants in the urban location also highlighted the advantages of SDVs for longer car journeys where the driver could make more efficient use of their time.
- Broadly speaking, across all locations there was an unprompted desire/expectation for SDVs to be used in public transport first before any mainstream adoption of private vehicles.

Perceived drawbacks and risks of deployment of SDVs

- Some participants expressed caution around the safety of the vehicles in use; they raised concerns relating to unanticipated safety risks, risks of malfunction of the technology or malicious interference with the vehicles while they were operating. Some also expressed an intuitive mistrust in the safety of technology compared with human control, especially relating to navigating obstacles in the road, other vehicles, or when driving on unpredictable rural roads.
- Risks around diminished personal safety and security were also raised due to the perceived absence of staff on shared vehicles such as buses, which could lead to anti-social behaviour, and abuse of technology by criminals.
- Some also identified risks around personal data, notably theft and hacking, as they assumed personal data would need to be shared to use SDVs.
- Poor real-world functionality and integration was raised as a concern and potential risk, especially in the period when SDVs are first introduced; this included concerns around the technology's ability to work in all locations (e.g. ability to interact with and respond to unpredictable human drivers, adaptability to different conditions, and impaired functionality due to poor connectivity).
- A potential disadvantage to the wider community and society of SDV deployment related to loss of jobs in communities (e.g. amongst professional drivers).
- An additional risk was the perceived high cost of implementation - from the costs of vehicles themselves to the infrastructure upgrades required. Some also raised the potential lack of local government funding available, and the related risk of SDV deployment taking funding from other transport or wider priorities.
- Emotional risks were also raised by a minority, from the dehumanisation associated with a sense of a dystopian automated future, through to use of the technology by governments and corporations to control behaviour/mobility.

- Finally, some expressed unease that SDVs would be deployed in a way that created unequal access to their potential benefits, due to the presumed high cost of use as well as the physical accessibility and digital literacy required to access them.

Expectations for SDV deployment in local areas

- Given the high potential to realise personal and societal benefits from introducing SDVs, balanced with the risks that participants could also envisage, the research identified a number of early expectations that people had for the successful deployment of SDVs in their local area.
- The majority expected a gradual roll out of the technology that prioritised safety and convenience for all users. There was an expectation that adequate time would be allowed for proper planning of infrastructure and services, full testing of vehicles and systems.
- Participants expected that SDVs would build on rather than replace existing transport system and services, at least in the short to medium term; they expected SDV deployment to prioritise public transport and shared mobility over private use, to plug gaps in current access and service provision and thus realise greater societal and local benefits.
- Participants expected security and safety assurances and back-up systems to be built into any deployment (which could mean a human presence in shared vehicles).
- Communication and education were also felt to be key for any successful deployment; participants expected a large-scale campaign to educate everyone about SDV technology, particularly in relation to addressing safety concerns and educating about operation; this would be alongside an updated driving test.

8. Impact of information provision on views towards SDVs

An important component of this research was to understand how different information impacts participants' views of SDVs, and what the public's information and communications needs are on this topic as a result. Information provided to participants in the deliberative research, including transcripts from expert videos, is included in full in the appendix (see 14.4 Research design).

8.1 Detailed response to information about SDVs

Introduction to SDVs

Overview of impact: These videos served to start building participants' knowledge of SDVs, giving them basic definitions and information about fundamental concepts (technological capability, applications, safety) to serve as a framework within which to receive more detailed information. The potential for SDVs to be safer was well received, with participants taking SDV safety as a given for the remainder of the research. Participants felt positively about SDVs after watching these videos and were keen to continue finding out more.

Having discussed the current transport infrastructure in their local area, participants in the first deliberative workshop were shown a set of videos which served as an introduction to the topic of SDVs. These included:

- Expert video from Rebecca Posner, Head of Social and Behavioural Research at CCAV, **introducing SDVs and the purpose of the research.**
- Expert video from Camilla Fowler, Head of Safety Assurance at Oxbotica, **introducing applications of SDV technology.**
- Expert video from Siddartha Khastgir, Head of Verification and Validation at Warwick Manufacturing Group, University of Warwick, **introducing the topic of SDV safety.**

Participants responded positively to the information provided. The videos succeeded in communicating the potential of SDVs, and the range of possible benefits from introducing them to local transport systems. While the benefits presented were seen as 'hypothetical', and the videos prompted questions about the negative possibilities resulting from the

introduction of SDVs (such as high cost, loss of jobs), the videos did serve to start delivering the information that participants were seeking.

"I'd say we're still at the development stage, but I am confident that we will be seeing [SDVs] before too long. Cost is still a bit of a question mark; they will be expensive but eventually it could be what everybody is doing, it will be normal." (Deliberative participant, core audience, urban)

"It would be nice to know if there are any examples where they are being used and they are working well." (Deliberative participant, 65+, town)

After watching the videos, safety was considered the primary benefit of introducing SDVs, with the high percentage of collisions caused by human error seen to be the most compelling logic for SDVs being 'safer' than human drivers. In general, the following statistics, used in Siddartha's video, successfully captured participants' attention, and communicated the scale and potential impact of this topic:

- *'Globally, over 1.35 million people die due to road collisions every year, of which over 1,700 are in the UK. 88% of these collisions are caused by user error.'*
- *'Introducing self-driving vehicles that are even 10% safer than the way you and I drive, we could save over 100,000 lives in the next 30 years.'*

Indeed, in much of subsequent workshop discussions, the fact that SDVs were safer than human drivers was often taken as a given because of these statistics.

"I didn't realise how many people died annually from road accidents." (Deliberative participant, young people, rural)

However, despite rationally understanding the safety argument for SDVs, some participants still struggled to reconcile this with their emotional reactions around not being 'in control' or relinquishing control of the driving task to a machine. While safety information was influential to participants' views at this stage, the first-hand trial experience served to shift the dial further (more on this in 9. Impact of the trial experience on views towards SDVs).

"I like driving, I see the driverless car as a good option for when I'm older and can't drive, but at the moment I don't want to give that up." (Deliberative participant, core audience, rural)

How self-driving are they?

Overview of impact: Finding out that discussions were already taking place on the legal frameworks for SDVs was reassuring and made the technology feel closer to being ready for deployment than participants had initially thought. However, the videos also served to demonstrate how complex the legal implications of SDV deployment are. Participants

wanted more detailed information about liability in different situations and how to ensure people will not take advantage of a system where they are not deemed to be liable.

Participants were then presented with three pairs of 'debate-style' expert videos before discussing the potential risks and opportunities they now perceived after receiving more information. The first of these pairs was titled 'How self-driving are they?' and included (in the order shown):

1. Expert video from Jessica Uguccioni, Lead Lawyer of Automated Vehicle Review at the Law Commission, talking about **legal definitions of 'user-in-charge' and 'non-user-in-charge' SDV features** as well as **introducing information on liability.**

2. Expert video from Nick Reed, an independent consultant and Chief Road Safety Advisor for National Highways, talking about **how SDV technology works in comparison to human driving behaviours** as well as **introducing some of the possibilities for SDV functionality.**

The first video garnered the most response and discussion. The video made it clear to participants that legal frameworks would have to be in place for the successful implementation of SDVs and this was positively received. Knowing that these legal frameworks were already being developed and implemented was not only reassuring, but also made the technology feel closer to being ready, where previously it had seemed quite futuristic.

"It stood out that there's already an Automated Vehicles Act - we talked about legislation and how that might come in, but I was surprised to hear it's already in place." (Deliberative participant, core audience, rural)

"The [expert] videos answered some of my questions and the information has made me feel more positive towards self-driving cars now." (Deliberative participant, young people, rural)

However, this was considered a complex issue and there was concern about a 'minefield' of new legal terminology associated with SDVs. It was felt that this could cause confusion for road users, with a minority of more sceptical participants picking out the fact that '*there is currently no single definition of what a 'self-driving vehicle' is'* (a phrase used in the first video) as evidence of this. This made participants unsure of how easy new systems around SDVs will be to navigate for them as drivers/users, with anything lacking in clarity seen to provide opportunities for manufacturers or individuals to take advantage of the system.

"I have changed my mind from being pro to being sceptical, there seems to be many more issues I had not thought about." (Deliberative participant, core audience, town)

The broad responsibilities of 'user-in-charge' and 'non-user-in-charge' were understood in principle but participants had lingering questions about the practicalities of these shifting responsibilities. It was felt that it could be difficult for drivers to 'give up' the mindset of responsibility (control) for their vehicle, as the idea is deeply engrained in current driving

behaviours. Participants wanted more clarity on who would be responsible for the driving task, under what circumstances, and what this responsibility would entail in practice. Participants wanted to understand in more granular detail how legal responsibility would vary according to a vehicle's degree of autonomy. Specifically, they were keen to understand how many 'levels' of responsibility there would be, and if there would be more than what was mentioned in the video. Other questions centred around how much notice would be given by the vehicle when handing back control of the driving task to the user-in-charge.

> *"I feel like there needs to be clarity of responsibility because I think we were getting some mixed messages in the videos. As it stands, it would be a disadvantage for passengers, whether they will be responsible or not."* (Deliberative participant, core audience, rural)

Despite good engagement on the concepts of 'user-in-charge' and 'non-user-in-charge', few used this 'formal' terminology in the discussions that followed. Some participants referred to this terminology when they felt they needed to add clarity or distinguish between types of SDVs, particularly if being asked to explain their views in detail, however this was not common. Instead of using these terms, descriptions such as 'sharing the driving' or 'switching between the vehicle and the person' were more pertinent and felt more intuitive during the discussions.

Also mentioned in the first video was the point that the driver cannot be liable for any malfunctions while a vehicle is in self-driving mode, and this point largely landed with participants. The video prompted questions concerning who has liability for an SDV and when, how insuring an SDV would work, and how people would be prevented from taking advantage of a system that does not hold them responsible.

For the second video, there was positivity towards the perceived benefits of SDVs raised, namely increased accessibility for those with mobility issues (i.e. older people, people with disabilities), the potential for safer journeys, and less congestion on the roads. These all resonated with participants, with the idea of SDVs resulting in less congestion being a more novel concept for participants at this stage of the research.

> *"It's an opportunity to make public transport more accessible which will give more independence particularly to isolated groups such as disabled and elderly people."* (Deliberative participant, core audience, rural)

At this point, questions were raised about SDVs' use of data, which was not covered in either of the two videos. Participants wanted to know whether connection to the internet or mobile data was required, like with satnavs, and whether this would be a problem for vehicles in more remote rural locations lacking connectivity. Equally, some were curious about the fact that SDVs would be collecting, storing, and sharing data in real time, and wanted to hear more on the rules and regulations around this.

> *"I would like to see the data around accidents - it looks safe, but I do like to know how things work."* (Deliberative participant, core audience, town)

"It concerns me if it's owned by Google - they harvest all our data and sell it." (Deliberative participant, core audience, urban)

Shared versus private SDVs

Overview of impact: Participants had already expressed an interest in public/shared applications of SDVs over private models, and these videos served to further strengthen participants' preference for using SDVs for public transport in the first instance. On balance, participants felt positive about the theoretical use of SDVs at this point but were starting to consider the practical implications in more detail.

The second pair of 'debate-style' expert videos was titled 'Shared versus private vehicles' and included (in the order shown):

1. Expert video from Brian Matthews, Head of Transport Innovation at Milton Keynes Council, talking about **shared or public transport models for the deployment of SDVs to benefit communities.**

2. Expert video from Steve Gooding, Director of the RAC Foundation, talking about **considerations for private SDV ownership and use according to a variety of potential functionalities.**

Creating a stronger and more comprehensive shared and public transport network by incorporating SDVs, as described in the first video, was an attractive prospect and seen to have many potential benefits, particularly for those who do not drive or cannot afford their own vehicle(s). It was seen as particularly attractive if it did not limit options for private vehicle ownership alongside it and was therefore seen as a win-win.

Shared mobility is a novel concept for most, especially for those outside of major cities where car clubs are less prevalent. Interestingly, the concept of sharing SDVs was quite attractive and more positively received than previous research on shared mobility suggested it might be (Department for Transport, 2021). This could be because SDVs represent an approach to transport that strongly deviates from the existing norms, and in this context other novel concepts were also easier for participants to consider as part of a changing transport system; or broader societal factors such as decreased concerns about Covid-19.

"I like the idea of shared vehicles as you [the user] do not have to maintain it, and if it is stored in a shared facility there is more space for parking - and you can summon it when you need it." (Deliberative participant, ethnic minority, urban)

"Shared cars solve the issue or at least minimises them being expensive or unaffordable. And they could be subsidised by the government." (Deliberative participant, young people, rural)

Despite being an attractive idea in theory, some felt that broad preferences for private vehicle ownership (SDV or otherwise) would be difficult to shake. This would mean that shared SDVs would be supplementary to, rather than a replacement for, privately owned vehicles - and therefore add to congestion and increase carbon emissions, rather than

reduce them. A minority spontaneously acknowledged that shared SDVs could prompt some multi-vehicle households to reduce the number of vehicles that they own.

> *"With a car club, I could potentially get rid of my second car. Maybe you could hire an SDV for long journeys so you don't have to drive yourself and it could be cheaper, you're not paying for petrol and you're not putting miles on your own car."* (Deliberative participant, core audience, rural)

There were also other questions about the practicalities of shared SDVs, including:

- In shared vehicles: Whether passengers would ever be asked to take control of the vehicle at a point in the journey such as in an emergency and, if so, whether a driving license would be required; who would maintain and be liable for shared SDVs; whether an app would be required to access shared SDVs, as this was felt to potentially limit access for those who are digitally disengaged.
- In public transport: How would troublesome passengers or inconsiderate behaviour from other users be dealt with; whether vehicles would have a safety operator and, if so, what the benefit of using shared SDVs would be over existing, human-driven vehicles if staff were still required for operation.

The second video covered four areas of private SDV applications – motorway driving, self-parking, summoning and end-to-end journey – and there was sympathy for the challenges raised.

The concept of summoning a vehicle, new to most participants, generated the most discussion out of these four areas, and was discussed in relation to both private and shared SDVs. The impact which summoning could add to a journey, by removing certain 'tricky' parts, was particularly attractive. An example of this in private SDVs was parking; participants imagined summoning would be useful in letting their vehicle get out of a tight parking spot by itself before meeting the user in a more accessible place. It was also felt that summoning shared SDVs could facilitate truly end-to-end journeys, by removing the time spent travelling between starting destinations and public transport routes. This was seen as a key benefit for those in more remote areas, where it currently requires more time and money to get to and from local transport routes.

> *"I think being able to summon cars is a helpful feature if it works properly. For example, if its late at night and you've parked in a massive car park."* (Deliberative participant, young people, rural)

Self-parking and motorway driving were discussed less by participants. However, the question – raised in the video – about what a driver on the motorway would do while their vehicle was in self-driving mode (and whether they could fall asleep at the wheel) did spark further questions about what the exact responsibilities of a user-in-charge would, and should, be.

Participants sometimes struggled to visualise what the introduction of SDVs might look like in practice based on the information given, and this undermined the credibility of the claims being made at this point for some. There was a sense from these participants that some of

the benefits raised in the videos – for example, whether SDVs would reduce congestion, lower carbon emissions, and lead to fewer road collisions – were hypothetical and speculative, and that the extent to which these would be realised would depend upon the practicalities of SDVs' rollout.

"[These videos are] talking mostly about future concepts rather than concrete work they already have." (Deliberative participant, core audience, urban)

"I'm still a little bit dubious because it was a lot of ifs and 'this is what could happen'. But if what they said they hope would happen happens, then that would be good." (Deliberative participant, core audience, rural)

There also remained further questions around the trade-off between accessibility, inclusivity, and affordability of SDVs - for example, where in the country would they be invested in, and would only richer areas and people be able to access them? While concerns around equality of access to SDVs had already been mentioned spontaneously by participants, these videos strengthened calls for this to be a key consideration in rolling them out.

"If the government decide this technology is not a priority and step away from it for 50 years then it's going to fall solely into the hands of the private sector. They will be the ones funding the development and then you have a divide of it being something only for the rich." (Deliberative participant, core audience, rural)

Passenger versus freight transport

Overview of impact: The visual examples in the freight video had a big impact, with participants engaging strongly with this video as a result. The visual examples prompted participants to be surprised and impressed at how advanced SDV technology in freight already is and made the concept of using SDVs in this industry feel much more tangible. However, while participants were still positive towards SDVs on balance, both videos further confirmed that there were not yet answers to some of the 'big', practical questions relating to SDV deployment.

The third and final pair of 'debate-style' expert videos was titled 'Passenger versus freight transport' and included (in the order shown):

1. Expert video from Tom Cohen, Senior Lecturer in Transport at University of Westminster, talking about **potential benefits and risks when implementing passenger and freight SDVs.**

2. Expert video from David Sharpe, Head of Autonomous Mobility at Ocado, talking about **current and future use of SDVs in grocery delivery.**

The first video in this pair largely reiterated the issues that had already been raised by participants, either spontaneously or in response to other videos, in relation to using SDVs for passenger transport. This included whether SDVs will be accessible and affordable for all, whether they will be beneficial or harmful in terms of carbon emissions, and whether

they will lead to increased or reduced congestion on the roads. While there was some reassurance that the 'experts' were also considering the issues that participants found important, it primarily served to confirm that there are not yet answers to some of the key questions that they have on this topic.

"It's a fantastic opportunity for advancement in technology but it does pose a risk as well because of how fast technology progresses and the cost and waste of constantly keeping it up to date. Particularly the actual waste from the cars and the out-of-date models that will keep being churned out." (Deliberative participant, core audience, rural)

"If more people are able to go out more, would there be more congestion?" (Deliberative participant, disability, town)

Up until this point, very few had considered the wider applications of SDVs for freight transportation. Furthermore, in contrast to previous videos, the second video in this pair showed visual examples of current uses for automated technology, such as robotic warehouses and prototypes of self-driving delivery vehicles. Participants were surprised and impressed at the advancement of the automated technology and thought that the benefits and drawbacks of SDVs for freight felt more tangible than they had previously. It also prompted participants to ask which retailers (other than Ocado) were taking similar steps towards using SDVs for delivery.

While impressed, participants did have concerns about how using SDVs in freight would impact employment in related sectors, with job losses seen by many as an inevitable and unwanted outcome of increased automation. This video also prompted consideration of the human aspect of freight and what would be lost for customers, particularly those with disabilities and the elderly, without a driver to interact with and aid with unloading deliveries - a theme that had not commonly been raised prior to watching this video but persisted throughout remaining discussions.

"I imagine there would be more factory jobs for making [SDVs], but fewer driving jobs?" (Deliberative participant, core audience, rural)

"I was reading about Ocado doing automated deliveries for the groceries, but for many people having the home delivery means that the bags would be carried inside by somebody. While it is technically fantastic, socially it might not be." (Deliberative participant, core audience, urban)

Other concerns included automated deliveries signalling the (continued) decline of the high street, delivery vehicles potentially adding to congestion and emissions, and self-driving deliveries becoming 'exclusive' because of higher prices. While rural residents thought that self-driving deliveries could help rural inclusivity and coverage for delivery services, they had ongoing concerns about how these SDVs would manage rural road conditions. There were also concerns around improper use of self-driving delivery services, such as vandalism or tampering, without staff to supervise and assist, and how the vehicles would be able to identify where to stop to allow customers to collect their goods safely.

"Who will police vandals on the bus? Kids left to their own devices will break things! I'm concerned." (Deliberative participant, core audience, rural)

"In our area there are no road markings, so what do they use to know where they are in the road?" (Deliberative participant, core audience, rural)

Real-world applications of SDV technology: Stagecoach, Waymo

Overview of impact: The visuals included in both of these videos helped to bring the information to life, made the technology feel more tangible, and made SDVs feel closer to being 'real-world' ready. Finding out that SDV technology can be retrofitted into existing vehicles had a big, positive impact. Being able to continue using current vehicles that are still in working order was broadly seen as a sustainability benefit. It also prompted participants to consider whether SDVs should look the same or different to traditional human-driven vehicles.

In the second deliberative workshop, breakout sessions were interspersed with first-hand experience of SDVs to introduce participants to more information and generate further discussion. In the first of these sessions, two videos were shown that each related to a real-world use case of SDVs (in the order shown):

1. **Stagecoach**, introducing their work deploying a self-driving public bus service across the Forth Road Bridge in Scotland, and what they see as the benefits of self-driving technology for their industry.

2. **Waymo**, introducing their work on self-driving cars in the USA, including how the technology has been developed and how it works to read the road and make safe decisions.

Stagecoach

Stagecoach's self-driving buses were received positively overall and to a certain extent were in line with what many had expected an SDV to be coming into the research - something which looks like a current vehicle, but which drives itself. Seeing the hazard-spotting technology (e.g. sensors) assisting drivers was a clear and concrete way of communicating how self-driving technology can make journeys safer. The fact that self-driving bus trials were under development and planned to take place soon made it feel like SDVs were closer to being introduced than participants had initially thought.

"I like that the technology is being constructed for this; the thought that this could be in use soon, with improved safety and efficiency; a real-world application." (Deliberative participant, core audience, urban)

[What did you like about the video?] "The fact that this is so close to being put live on the roads. I'd assumed we were still years from that point." (Deliberative participant, core audience, town)

The most impactful new piece of information in the video was that self-driving technology could be retrofitted to existing vehicles - until this point, it had predominantly been assumed that SDVs would be built for this purpose. Retrofitting SDV technology was felt to be an innovative way of improving current services without requiring major (and costly) changes to wider infrastructure or user behaviours. The familiar look and feel of the buses was thought to provide reassurance to those who may be more nervous engaging with the new technology, since they are already commonplace and easily recognisable.

"If they have retrofitted technology onto buses, can you do this with all buses? It would save so much money." (Deliberative participant, core audience, town)

"It's great that they're repurposing and refitting old vehicles - I was worried about the carbon footprint." (Deliberative participant, core audience, town)

While not inherent to SDV technology itself, it was assumed by participants that SDVs would be electric, with many perceiving environmental ambitions for SDVs as a large factor in their support for deploying the technology in future. With this in mind, the most prominent concern with the retrofitted buses was the fact that they would be ICE vehicles. Very few spontaneously considered that the self-driving aspect might lead the bus to use fuel more efficiently.

"It's still diesel - they shouldn't be doing this unless it can also go emissions free." (Deliberative participant, core audience, urban)

"It's diesel. I prefer these vehicles to be electric." (Deliberative participant, core audience, town)

On balance, participants felt there were clear benefits to retaining a driver as suggested in the video, in particular the thought of reconfiguring or adapting jobs rather than cutting them; participants were reassured by the phrase in the video *'we need to take staff, employees and customers with us and, so far, the drivers are supportive of the learning'*. Having a safety operator on board was also seen to put passenger comfort and safety first, while simultaneously making the driving task easier for the driver as an added benefit.

"It's resemblant of public transport and most importantly the original bus drivers are sufficiently relocated which is a huge positive." (Deliberative participant, core audience, urban)

In addition, many of the concerns that participants had already raised in relation to self-driving public transport would be mitigated with the presence of a driver or safety operator as discussed in sections 7.5 and 8.1.

"[Without a safety operator] you would miss the benefits of drivers, like local knowledge, and the ability to help elderly with baggage or social safety." (Deliberative participant, core audience, town)

"When fully automated, the driving area will need to have access restricted for the safety of the passengers." (Deliberative participant, core audience, urban)

"Having a safety driver on board does seem pointless, what if they switch off?" (Deliberative participant, core audience, town)

"I'm kind of against [having a driver on permanently], I think it negates the whole idea and limits the benefits of having a 24-hour service." (Deliberative participant, core audience, rural)

Additional questions centred on what changes were required to convert an existing vehicle to be self-driving. Specifically, participants had several questions around what additional features would need to be installed (such as blind spot detection, the number of sensors, and modifications to steering and breaking) and the costs of implementing these. Some also questioned how these retrofitted vehicles would be integrated in rural areas where public transport provision is already very low, and how proven these vehicles were for covering longer distances in self-driving mode in practice.

Waymo

The main impact from the Waymo video was that participants were impressed at how advanced the technology was. It was particularly helpful for participants to have a visual display of how the sensors, LiDAR and RADAR, work in practice. Equally, participants were impressed by the claims made by the narrator which made it clear where the vehicles could improve upon the skill of human drivers (e.g. *'The car can identify objects around it in full 360 degrees and predict what those things might do next. And it doesn't just do that for the objects you can see, it can do that for things up to three football fields away'*).

"I liked the advanced features that allowed it to recognise hazards. This appeared to be far superior to humans." (Deliberative participant, core audience, urban)

After watching this video, the main benefit of private SDVs was thought to be additional comfort and safety, as well as the potential to make particular driving tasks easier such as parking. However, a minority felt that this technology would not just tackle the difficult driving tasks, but also take the joy or interest away from driving in doing so. The same participants tended to enjoy driving and expressed a strong desire not to lose the option to drive themselves in future.

"It could be a bit boring to ride." (Deliberative participant, core audience, urban)

The Waymo video prompted questions about why this technology seemed to be more advanced in the USA than in the UK, and whether it was already widely available to the American public. Some noted the difference between the US grid system for roads versus the winding roads and narrow country lanes in the UK as a potential barrier to making SDVs work here. Furthermore, some questioned how the vehicle learns and predicts behaviour as described in the video, feeling that there could still be unexpected instances where a computer wouldn't know how to react.

"I'm just [concerned about] the safety aspect with no actual driver and putting my 100% trust in the vehicle allowing it to predict everything. Some unexpected real-life scenarios could happen that the vehicle isn't able to predict!" (Deliberative participant, core audience, urban)

Like for the self-driving buses, there was widespread positivity about the ability to retrofit self-driving technology into existing vehicles. However, when it came to private transport it was felt to be important for other human drivers to be able to identify when a vehicle is being self-driven, especially if it looks like a 'normal' vehicle, so drivers can be alert that the vehicle may act differently to a human-driven vehicle. More found the interior disconcerting, for example:

- The fact that there is a driver's seat and steering wheel that works without a driver caused confusion for some, particularly about whether the vehicle is self-driving, has assistive features, or can switch between human-driven and self-driving modes.
- Others found it 'jarring' or 'creepy' to see the steering wheel move by itself.
- A few felt that it is a poor use of space to have an area for the driver that is made redundant using self-driving technology.

"It's a bit daunting seeing nobody in the driver's seat and the wheel spinning on its own." (Deliberative participant, core audience, town)

"Is there really a need for the steering wheel? Unless it can be also manually driven, the space could be utilised better." (Deliberative participant, core audience, urban)

Participants also had a range of questions relating to the practicalities of rolling out SDVs such as Waymo's. These included whether Waymo's vehicles are already in use in the UK (and if not, when they could be), whether these vehicles are being designed for public or private use, what the costs to the user would be, who would be liable in the event of a collision or malfunction, whether they would replace taxis / ride-sharing services, and what the impact on jobs could be if so. As before, participants still wanted to understand whether the vehicles would require satellite signals to operate and, if so, what would happen in rural areas which lack connectivity - questions that were recurring but not yet felt to be answered by this stage in the research.

"It's demonstrating on US roads. It would be interesting to see how it performed on UK roads." (Deliberative participant, core audience, town)

Rules and regulations

Overview of impact: Participants were reassured to hear that rules, regulations, and standards for SDV deployment and use were already being planned, and they strongly supported the proactive development of these legal frameworks prior to any rollout commencing. This information further demonstrated how complex the deployment of SDVs will be, but it did not serve to turn participants away from supporting SDVs in principle.

One of the sessions in the second deliberative workshop focused on providing information on and discussing desired rules and regulations for SDV deployment and use in the UK. Written information was provided to participants about the current extent of assistive and self-driving technology being used in the UK, as well as what the near and longer-term future might look like - for example, automated lane-keeping systems (ALKS) and the responsibilities of user-in-charge versus non-user-in-charge.

While positive about the prospect of SDVs being introduced overall, participants felt that SDVs bring with them numerous possibilities that could negatively impact on the current transport system and road users. They were therefore reassured when hearing about the different rules, regulations and standards that were planned, believing them to be an essential part in the successful implementation of SDVs.

One point which participants across locations saw as key was establishing who would be responsible for each element of an SDVs performance. For example, there was seen to be a variety of scenarios in which an incident could occur, such as:

- An SDV operating with no human input.
- An SDV while it is issuing a transition demand.
- An SDV while it is undertaking an emergency manoeuvre.
- An SDV that should have been taken over by a human (i.e., due to a transition demand) but was not.

Laying out who would be liable in each of these situations was thought to be a minimum for authorities in charge of setting regulations.

Likewise, participants thought that regulations around the maintenance of SDVs were essential, believing that a lack of regular MOTs and software updates would lead to collisions on the roads. They therefore wanted clarity over what the manufacturer's liability would be compared to the owner/operator's liability, for example in the event of a technical fault or need for an update. In a similar vein, participants were keen to see insurance practices revisited to accommodate SDVs, in the context of both private and public models. Additionally, some participants wanted to know more about how SDVs use, store, and share data, and whether data relevant to the user (e.g. CCTV/video footage, journey history) is kept private; this concern was with respect to both current practice and what regulations would be put in place to control data storage and data sharing.

"I wonder whether insurance premiums would go up or down?" (Deliberative participant, core audience, urban)

In terms of the responsibility of the operators of SDVs, participants did want to see additional measures put in place to ensure proper and responsible use of SDVs. Participants welcomed the idea that immunity was necessary for passengers when a vehicle is in self-driving mode - in the same way that passengers on public transport do not currently have any liability for collisions. However, some think that for private vehicles in the event of user-in-charge, lack of liability could be naïve or give drivers a 'false sense of security'. Equally, participants wanted reassurance that disorderly behaviour on self-driving public transport would be managed and/or penalised, so not to encourage abuse

towards the technology or other passengers, which would introduce new risks on the roads.

> *"A lot of people would be keener to use them if there was a problem and they would not be held personally responsible for it."* (Deliberative participant, core audience, urban)

> *"So, we potentially improve safety on the roads by reducing human error but then you look at personal safety, potentially putting people in the situation of a confined space with strangers and no employee or driver on board..."* (Deliberative participant, core audience, rural)

Very few participants were aware of any recent updates to the Highway Code prior to being informed about them during the workshop. Among those who were aware, none knew of changes which related to SDVs. Updating the Highway Code was perceived by participants to be important, both in defining what an SDV is, and in informing drivers and operators about the intricacies and responsibilities of SDV use. This is because participants thought a large part of SDVs' safety would rely not just on the technology itself, but on how other road users interacted with the vehicles. They were therefore optimistic at the thought of established rules, such as the Highway Code, encouraging both the safe integration and responsible use of SDVs.

As well as informing drivers through the Highway Code, there was a strong call for public education about SDVs, both in terms of using them and sharing the road with them. Ideas for this included testing 'basic' knowledge of SDVs (e.g. what they are, how they work and how to behave around them as another road user) in driving tests, subsidising refresher safety courses for current drivers, and having signs or warnings outside public places where SDVs would likely be operating such as on bus routes and outside schools.

> *"Education on how it works, what it does. Education is the only way to get people on board and get people's confidence up."* (Deliberative participant, core audience, rural)

There were two further areas where participants thought it necessary for there to be standardised rules for all SDVs, set within regulation:

- **Speed:** Participants felt SDVs should always abide by speed limits (and in certain cases go slower than them, for example when road conditions are difficult or when carrying more vulnerable passengers) to ensure they are safe and predictable for other road users, and do not frustrate other drivers by tailgating them. However, they also need to not be too slow, which might also irritate drivers, increase congestion, and potentially create unsafe situations on roads. Thus, the public want reassurance that SDVs will operate at speeds that are appropriate to the environment they are operating in.

- **Right of way:** This was an issue that participants thought could have a large impact when considered at scale. The majority felt that having standardised rules about right of way would not only minimise the number of 'grey areas' which currently require spontaneous communication between human drivers, but also ensure the safety of other road users. There was also a perceived link between whether public or shared

SDVs have right of way and how much the public would feel incentivised to use them over other types of transport. For example, if the SDVs were to always give way to other road users, such as other cars, cyclists or pedestrians, then the public might question why they would take the SDV rather than another mode of transport. It was important to participants that SDV use was encouraged alongside other forms of active travel, such as walking and cycling, and so there was less resistance to SDVs giving way to these modes of transport, as opposed to other cars on the road.

Finally, some participants felt that the current suggested rules and regulations represent a good stepping-stone for the introduction of SDVs, but that they are limiting in the short term. However, given the current novelty of SDVs this was not necessarily perceived to be a bad thing.

For example, a rule which caught attention was that the user-in-charge in a private SDV needs to be able to take over the driving task when instructed to, and therefore cannot be asleep, intoxicated or using their phone. Most participants believed this demonstrated thought being given towards safety and how SDVs will impact other road users. However, some also noted that this goes some way to negating the previously imagined benefits of travelling in an SDV and, ultimately, these participants hoped that there would be a point in the future when the rules could be relaxed further as technology develops to be even better than it is now.

"What if you've been drinking and you don't want to take over the vehicle?" (Deliberative participant, core audience, rural)

8.2 Section summary

- Information provision vastly improved participants' understanding of SDV technology, making it feel more tangible and 'real world' ready. It broadened participants' views on what SDVs could achieve, bringing their priorities, needs and expectations for SDVs into sharper focus.
- Information provided in the research broadly met participants' expectations by covering what they wanted to know (such as on safety, functionality) as well as building and expanding in new areas that they had not yet fully considered (including legal definitions, liability, levels of autonomy, retrofitting SDV technology into existing vehicles).
- The most impactful ways of communicating about SDVs were to present real world use cases such as trials, present evidence and statistics including about changes to regulations and standards, and clearly state how SDVs differ from human-driven vehicles and the benefits of these differences.
- Examples of the latter include information about the high proportion of collisions caused by human error and how SDVs would remove this factor, and hazard recognition technology in contrast to human blind spots and more limited fields of vision. Summoning also captured participants imaginations, opening up the possibilities for SDVs to change how people travel.
- Hearing that experts in their respective fields were giving their time to this topic and considering the scenarios that might arise if SDVs were introduced carried a lot of

weight. The high calibre of experts included in the research were considered credible, and therefore served to strengthen trust in the information provided.

- However, while it did provide reassurance, information provision did not resolve the tension between theoretical support and concern about the practicalities of SDV use. Instead, it prompted a shift to a greater depth of engagement from participants on the finer practicalities of SDV use, prompting some doubts over how easily they will be deployed and the risk of teething issues in the early stages of their use.
- The entirety of the deliberative engagement prompted participants to think of additional questions or information needs about SDVs. These are summarised in 11.4 Communication needs.

9. Impact of trial experience on views towards SDVs

A core aspect of this research was understanding how different levels of exposure to SDV technology influences views towards them and their potential application in future local transport systems. To do this, trials were designed around realistic local use cases and routes to give a meaningful demonstration of the technology. More information on the trial routes used in this research can be found in the appendix (see 14.4 Research design).

This section focuses on views before, during and after the SDV trials among the medium and high exposure audiences who took part. Some findings from the EEG research with the high exposure audience are included in this section where relevant; the EEG findings can be found in full in the supplementary report.

9.1 Impressions of the trial

Seeing and experiencing SDVs first-hand was a broadly positive experience that worked to move participants towards acceptance. Seeing the technology in action demonstrated, at a basic level, that self-driving technology exists and works.

Participants tended to accept that SDVs were safe within the limitations of the trial environment (safety operator(s) present, defined routes used). With this reassurance on safety, the experience was then able to prompt participants to imagine how SDVs could be used in their local area once the technology moves out of a trial phase (at which point safety is assumed).

However, impressions of SDVs can be underwhelming if the journey does not go smoothly, including numerous and/or unexpected emergency stops and software glitches. For a minority of more sceptical participants, the presence of safety operators served as evidence that the technology was still quite far from being ready for widespread use and they found it quite difficult to look beyond this point. Less streamlined experiences could entrench more negative views.

When making assessments about the trial vehicles themselves, the high exposure audience's considerations typically fell into four categories: **perceptions of safety and security**, **functionality**, **design and aesthetics**, and **accessibility**.

Perceptions of safety and security

The trial experience strengthened participants' feelings of safety and security of SDVs to a greater extent than what was achieved through information provision alone. Participants reported a strong sense of safety during the trial both as users (passengers) and non-users (pedestrians) of the shuttle and pod, and reported feeling safer than they anticipated they would.

The main aspects of the trial experience that contributed to building feelings of safety and security were:

- Evidence of the shuttle navigating roads as expected; including stopping at traffic lights, changing lanes in anticipation of turning or to avoid a bus stop, altering its speed depending on junctions and crowded areas.
- Evidence of safety and security protocols being in place, including experiencing emergency stops when pedestrians got too close to the pod, seeing the pod's screen displaying obstacles around the vehicle based on input from its sensors and cameras, and seeing keypads and locks on the doors of the delivery pod. While experiencing emergency stops was reassuring, they were by nature very sudden and gave passengers a jolt especially when they were not expecting them, which could impact immediate feelings of safety for some.
- Acceptable and non-threatening speed of travel; the pod's slow speed was felt to be appropriate for a crowded pedestrian area, particularly when there were children or elderly people in the vicinity, while the shuttle was faster than expected for some but not to a concerning degree.
- The use of a pre-mapped route and the presence of safety operators in both the shuttle and pod during the trial.

"It didn't feel as weird as I thought I would; it felt safer than I thought." (Deliberative participant, core audience, urban)

"I was impressed with the manoeuvres going around corners, it seemed to cope well." (Deliberative participant, core audience, urban)

"It responded so quickly, immediately to an obstacle – that helped made me feel safe." (Deliberative participant, core audience, urban)

"I thought it was reassuringly boring, I was underwhelmed and that's not a criticism - that's a positive." (Deliberative participant, core audience, rural)

"I was really excited to see where the technology is headed and how innovative the technology is, it's very intuitive and constantly scanning. I felt very safe while riding in the pod and also while walking around the pod." (Deliberative participant, core audience, urban)

"It felt safer to me because you could see the workings on the screen, but he did say they wouldn't normally be there." (Deliberative participant, core audience, rural)

"I liked the technology - the car runs on a map-based system and demonstrated that the technology identifies all likely obstacles. It felt safe and was a comfortable, a smooth ride." (Deliberative participant, core audience, urban)

The trial prompted participants to consider the impact of being able to see where the vehicle was going or not on their overall feelings of safety as a passenger in an SDV, which was something they had not considered prior to the trial. In the pod, participants generally liked being able to see where the vehicle was going. In contrast, when travelling at higher speeds and on the road in the shuttle, feelings about not being able to see out the front window of the vehicle were more mixed. While some felt this reduced feelings of safety as they wanted to be able to assess how the vehicle was navigating the road with their own eyes, others felt it would be more concerning to be able to see what was coming knowing that there was no human driver there to respond. Further, while some likened not being able to see in front of the vehicle to being on a train, others felt this was a false equivalence as trains run on a defined track while SDVs on the road were seen to have to take more decisions during their journey.

"Forward vision would be a welcome addition in order to retain a feeling of control and to see what's ahead." (Deliberative participant, core audience, rural)

"It felt a little like being on the underground because you can't see. But it's not as quick as underground, I was a bit bored." (Deliberative participant, low SEG, urban)

"It was too dark, so it felt unsafe. You couldn't see out the front. There was a wall between the driver [safety operator] and passengers, but we should be able to see them." (Deliberative participant, core audience, rural)

Seeing the delivery pod, participants felt this could be a secure delivery method that would reduce the risk of parcels being lost, damaged or stolen because of being left on the doorstep. However, it was also felt to be at a particularly high risk of vandalism and attempted theft because it could be carrying a high value of goods without in-person supervision. Participants questioned how goods would be kept secure, how the vehicle would react to people attempting to tamper with it, and how people collecting their goods would be kept safe while doing so if there was no delivery driver to step in.

"I can't imagine it working in rural areas as it could easily be sabotaged and broken into. But would be good for busy town areas." (Deliberative participant, 65+, town)

Functionality

Overall, seeing the SDVs in the trial successfully navigating local roads and pathways was impressive and outperformed initial expectations for many in terms of their functionality. The trial really brought home the fact that the technology was 'ready' for real-world use, with some commenting that this surprised them even after the initial discussions and information provision to this effect.

The basic functionality of the shuttle and the pod as modes of transport for getting passengers from A to B was naturally familiar to participants, and they tended to feel comfortable with the self-driving aspect quite quickly. Particularly when riding in the shuttle, some reported that they forgot they were riding in a vehicle that was self-driving or even that they felt relaxed to the point of being bored during the journey.

> *"I wasn't expecting to go out on 'real' roads, I was only expecting a few laps of the car park in a controlled environment, very impressed that the technology is actually ready."*
> (Deliberative participant, ethnic minority, urban)

Seeing the delivery pod helped participants to think beyond only passenger applications of SDVs, which had been the focus of preceding discussions despite being covered in the information provision. For those who already shop online, use locker collection points, and/or do not have mobility concerns, using a delivery pod did not represent a drastic deviation from current behaviours and was positively received as a result.

However, taking part in the trial prompted new questions about the viability of these vehicles as useful alternative transport options compared to what is already available. This was the case for all vehicles included in the trial, although there were often specific concerns for each:

- Some in the urban location felt that the shuttle struggled to match the speed of the surrounding vehicles, prompting concerns about arriving at destinations on time, irritating other road users, and potentially contributing to inner-city traffic.
- Participants without mobility issues felt that walking was likely to take a comparable amount of time to travelling in the pod, and therefore struggled to see any distinct uses for it; this sentiment was more commonly expressed when the pod speed was reduced for safety reasons (e.g. high prevalence of young children in the vicinity of the pod trial in the town location).
- The pod was generally felt to be less impressive than the shuttle due to its slower speed, smaller size, and inability to go on public roads, and was felt to have fewer useful applications as a result.
- Some saw the pod technology as overly sensitive, experiencing 'excessive' emergency stops. This was particularly the case in the urban trial location where heavy rain and large puddles affected the pod's performance, and in the town location where obstacles including pigeons, ducks and squirrels prompted frequent stops and caused the pod to behave in a manner that was perceived as excessively cautious. This prompted concerns about the pod's ability to operate in crowded areas with more obstacles, to adapt to unexpected changes or moving obstacles, and operate in a variety of weather conditions.
- Perceived inability of SDVs to pick up human gesturing, understand unofficial local driving conventions, or know to move off when it does not technically have the right of way (e.g. to navigate around a broken-down vehicle) were considered problematic in the context of these vehicles sharing pedestrian spaces and roads with human drivers.
- While the size of the delivery pod was small enough that rural participants felt confident it could navigate narrow roads and lanes in their area, participants broadly found it difficult to understand how the vehicle could be scaled up to carry larger goods without becoming cumbersome on the road and intimidating for pedestrians.

- With no human driver to provide in-person assistance alongside the delivery pod, there were questions about how any errors, including incorrect collection information or incorrect deliveries, would be resolved. It was felt that a lack of clarity on this could discourage people from using it, especially in the early stages of any rollout.

"It's really good technology, but it [the pod] only goes about walking speed, so what's the point of it?" (Deliberative participant, young people, rural)

"I think that's why I'm struggling to find a use for it [the pod], because it's quite small." (Deliberative participant, core audience, town)

"It [the pod] stopped abruptly when someone walked past us, the technology needs to be improved." (Deliberative participant, core audience, urban)

"We were wondering what would happen if there was a stream of traffic and the vehicle just sat there for hours and hours because it anticipates that it couldn't get out!" (Deliberative participant, core audience, rural)

"It [the delivery pod] would definitely be nimbler than delivery vans." (Deliberative participant, core audience, rural)

Finally, the trial also prompted participants to start thinking about some of the more practical aspects of using SDVs such as how to book the vehicle; ticketing if there are no staff on board; and what, if any, response would be deployed if a passenger needed assistance, including who would take charge if something went wrong and how they would do so.

Design and aesthetics

Both SDVs included in the trial impressed participants with their 'striking' and 'futuristic' appearances, although some also described the designs as 'strange'. The shuttle was noted for having a robust feel to it, while the pod was seen to have an 'unthreatening' or even 'cute' design which participants believed was appropriate as it could be sharing spaces with pedestrians.

"This is what I saw in my head when someone said, 'driverless vehicle'." (Deliberative participant, core audience, urban)

"As I expected, [the shuttle was] more robust and road worthy compared to the pod." (Deliberative participant, core audience, town)

"I don't like the design [of the pod]. It looks like it's meant to clean the floors." (Deliberative participant, core audience, urban)

While discussion of the merits of novel versus traditional vehicle aesthetics for SDVs was not a focus of this research programme, a minority did note that the novel design would be beneficial in alerting other road users to the fact that it is an SDV and therefore may behave differently to a human-driven vehicle (building on views expressed in relation to the

information on real-world applications of SDV technology in section 8). However, others noted that the distinctive look of the shuttle in particular could be confusing or distracting for other road users. Further research into the role of novel features in demarking SDVs is required.

"I was expecting a simpler design, closer to what public transport already looks like." (Deliberative participant, additional audience: ethnic minorities, urban)

"It looks strange... At least it will be easy to distinguish between a normal car and a car like this." (Deliberative participant, additional audience: young people, rural)

"Self-driving vehicles should look different so you know how to hail them, and so you can choose to use them or not." (Deliberative participant, core audience, town)

Accessibility

Participants had already established in discussions prior to the trial that ensuring the accessibility of vehicles was an important priority in the development and design of SDVs, and the trial experience further cemented this view. While there was an acknowledgement that the vehicles were prototypes, seeing the lack of dedicated spaces for bulkier items such as prams, wheelchairs, mobility aids, and luggage, as well as the lack of wheelchair accessibility, fostered strong doubt around the extent to which accessibility was being prioritised.

The spacious interior of the shuttle led participants to believe that it would have the space to accommodate accessibility features, however participants struggled to imagine how the pod could be made more accessible due to its small size. Along with the limited capacity for passengers, this was felt to undermine the pod's potential for aiding those with mobility issues. The quietness of the vehicles when operating was also felt to be a safety concern for pedestrians, particularly for people with visual impairments who would be most reliant on sound and when operating in shared spaces.

"The space inside [the shuttle] didn't seem to be used very efficiently. There was a lot of empty space in the middle." (Deliberative participant, core audience, town)

"You couldn't put luggage inside it. It would have to go in front of you." (Deliberative participant, core audience, rural)

"I think you would need a range of pods, from small ones for getting around the town, to ones for luggage, to ones that are bigger for larger loads." (Deliberative participant, core audience, rural)

When considering the delivery pod, there were concerns that the key benefits of home delivery would be lost if delivery drivers were replaced with SDVs, with the impact disproportionately likely to be felt by the elderly and those with disabilities. While home deliveries currently addressed challenges faced by travelling to a shop and/or shopping in person, customers using a self-driving delivery pod would have to get to the pod's location to pick up items themselves. Regardless of whether this is at a central point in the

neighbourhood or at the top of the driveway, there would also be a lack of driver to help the end customer unload and take goods into their home if this was something they would find difficult to do themselves. There was also a concern that social isolation may increase for these groups if interactions with delivery drivers are lost.

Participants also expressed concerns about the usability of a delivery pod, again due to the lack of a driver or other staff members to provide the customer with assistance if needed. The processes required to access deliveries would need to have clear instructions, and any reliance on apps to operate the vehicle without an offline alternative also being provided should be avoided. These measures would ensure that those less confident with technology or with limited access to it are not prevented from being able to use these services.

"I'm concerned around the lack of human interactions. A lot of people around here are isolated and enjoy speaking with delivery drivers." (Deliberative participant, core audience, rural)

"I can't see the point. I can't see how it would improve current delivery options as it's not door-to-door delivery." (Deliberative participant, core audience, urban)

9.2 Emotional responses to the trial

EEG headsets were used to collect physiological data from the high exposure audience to provide an understanding of the emotional states experienced by participants during the SDV trial. Additionally, pre- and post-ride surveys were completed for each journey undertaken on the shuttle and pod. The combination of this data enabled the research to explore the extent to which participants' physiological and self-reported emotional states were related.

Findings from both the self-reported pre- and post-ride surveys and the physiological data from the EEG readings indicate that the high exposure audience responded in a positive way to the experience of riding both the shuttle and the pod, and that feelings of stress were generally low throughout.

Prior to taking part in the trial, participants reported feeling positive, with very few reporting negative emotions such as feeling scared. Participants' self-reported emotional states were similarly positive after the trial with limited evidence of any increase in negative emotions, indicating that taking part in the trial had a positive impact on participants. There was evidence of increased self-reported feelings of surprise, being pleased, and feeling in control of things following the trial experience.

This was consistent with the physiological data which indicated medium to high levels of Engagement, Excitement and Interest during the trial, suggesting that participants were alert and immersed in the experience, had a degree of affinity with the task, and tended to have positive emotional responses to the technology. Comparatively lower scores for Focus, Stress and Relaxation suggest that participants were not fixing their attention singularly to the experience and were relatively comfortable with the experience despite its novelty. For both the shuttle and the pod, physiological data indicates that Excitement

levels were higher during the trial than they were during the baseline reading prior to riding; this is consistent with an increase in self-reported positive emotions between the pre- and post-ride surveys.

Overall, levels of Engagement and Excitement varied between participants, particularly in relation to socio-economic grade (SEG), age, and gender, as well as the specific vehicle route adopted for the trial. For example, men displayed higher levels of Excitement compared to women when riding in the shuttle, while younger participants and those of higher SEG had lower levels of Excitement compared to those who were older. For the pod ride, women displayed higher levels of Excitement and Interest relative to men, suggesting that the pod ride was more positively received by women. These gender differences could be explained by the characteristics of the vehicles themselves, as well as attitudinal differences that were observed throughout the broader research.

As participants became more familiar with the technology during their shuttle and pod rides, they tended to feel more comfortable and their more immediate emotional reactions (both positive and negative) subsided. For example, Excitement levels were highest during the first five minutes of the trial ride before dropping off for the remainder of time spent riding in the vehicles; this was particularly the case for men. Similarly, women tended to have higher Focus and Stress levels initially, but these decreased after the first five minutes of the ride. These findings are consistent with dual processing theories which indicate that as people trial a new technology for the first time their responses tend to be more spontaneous (emotional), with a move towards more systematic processing as the technology becomes more familiar (Epstein, 1994).

Vehicle kinematics also had an impact on participants' emotional states during the shuttle and pod rides. Excitement levels were generally higher in the first two seconds of turning and acceleration events while the opposite effect was found for deceleration events; this was particularly the case for men. Stress levels tended to be more confined to later stages of turning and acceleration events, particularly for women, though generally remained low. These effects became less pronounced over the duration of the trial experience as the journey progressed, providing further support that as participants became more familiar with the technology, more immediate and emotional reactions tended to subside.

Qualitatively, while the shuttle was felt to give a 'smoother' and more comfortable journey than the pod, participants reported both vehicles feeling 'joltier' than human-driven vehicles. Accelerating, stopping and turning felt pronounced and were aspects of the SDV experience that continued to influence participants' views on the readiness of the technology despite limited evidence of negative physiological responses.

When looking at differences between trial locations, participants in the urban location were significantly more likely than participants in the rural location to report feeling bored after both the shuttle and the pod trial experiences. This aligns with the physiological data, which indicates that those in urban location had the lowest levels of Excitement compared to the other locations during both the shuttle and pod rides. Possible explanations for this include:

- That the vehicle routes used in the urban location had much lower footfall and were less complex than in other locations. This was particularly the case compared to the town location, where the highest excitement levels were recorded for both the shuttle

and pod rides (see 14.4 Research design, SDV trials for more detail on the routes in each location).
- That urban participants have greater exposure to a variety of transport technology types, making the SDV trial experience less novel or exciting overall.

There were no notable differences in participants' self-reported emotional states that would indicate an ordering effect according to whether the shuttle or pod was trialled first or second over the course of the day (see 14.4 Research design, SDV trials for more detail on the trial ordering in each location).

However, the physiological data indicates a potential ordering effect. In the town location, the pod ride took place first with participants displaying relatively high levels of Interest and Excitement, reflective of this being their first experience of self-driving technology. In contrast, those in the urban location displayed comparatively lower levels of Excitement when riding in the pod, likely because they had already trialled the shuttle and were therefore more familiar with the technology (see 14.3 Technical appendix, note 10).

The findings demonstrate that participants respond in a positive way to the experience of riding in a self-driving vehicle and that feelings of anxiousness and/or stress were generally low. There are differences between groups in the emotional state experienced during the journey and how these emotional states develop throughout the ride or under the influence of vehicle kinematics, particularly based on gender. These differences will have implications on both engineering and policy choices to help mitigate certain emotional states if self-driving vehicles become more widespread. The changes in emotional state observed throughout a journey also suggest the value of providing members of the public with the opportunity to trial the technology. This should be done with a diverse representation of the public both to address concerns and normalise the idea of self-driving technology as well as provide opportunities for participants to progress from more automatic, or emotion led reactions, to more deliberated or informed views that can be embedded into the design and development of future self-driving vehicles.

9.3 Reported comfort with SDVs

Pre- and post-ride surveys were completed by the high and medium exposure audiences for each journey undertaken on the shuttle and pod. In addition to questions on emotional states (see 9.2 Emotional responses to the trial), these surveys explored reported levels of comfort using and sharing the road with a variety of SDV types; these measures were also included in other quantitative surveys used in this research to allow for comparison across audiences and timepoints (see 6.3 Perceptions of SDVs and 11.1 Informed views of SDVs: Perceptions of SDVs for more).

High exposure audience

By the time the SDV trials took place, the high exposure audience were already reporting significant increases in reported comfort with SDVs compared to how they felt at the outset of the research. Figure 20 (below) shows how reported comfort with both using and sharing the road with SDVs increased across all SDV types asked between the pre-deliberative research survey (prior to workshop 1) and the pre-ride surveys for both the pod and shuttle (during workshop 2). This demonstrates that information provision and discussion in workshop 1 were already influencing feelings of comfort for this audience; it

is also possible that seeing the vehicles in person prior to undertaking the pre-ride survey also had an effect on comfort levels.

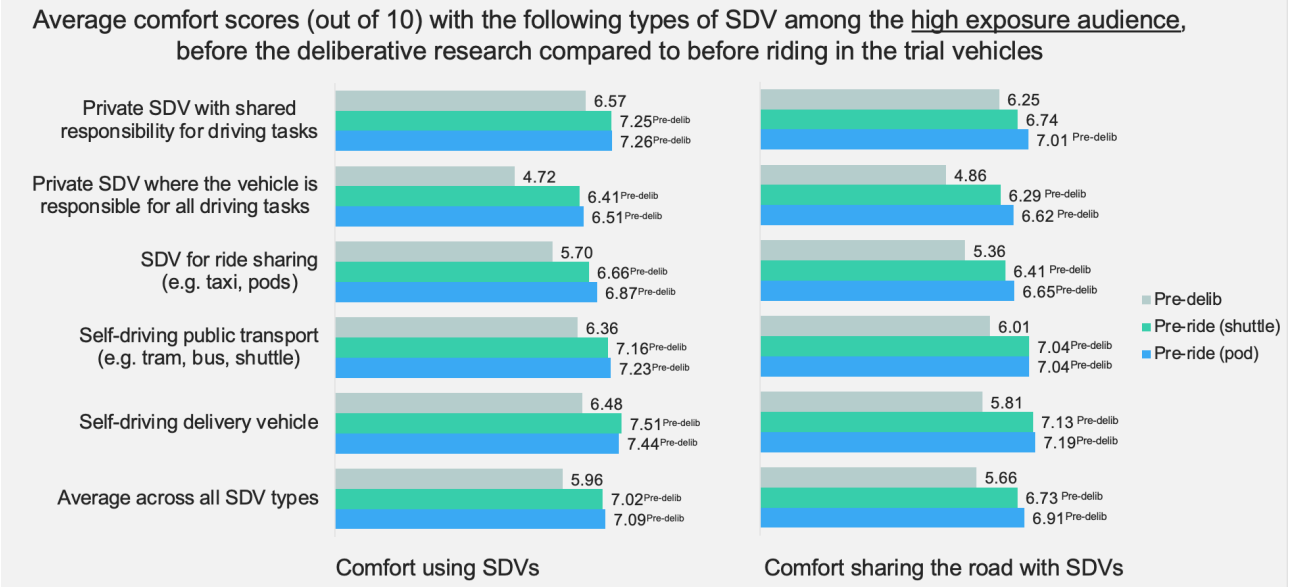

Figure 20 Comfort using and sharing the road with different types of SDV among the high exposure audience pre-deliberative research, pre-shuttle ride and pre-pod ride

C1: On a scale of 0 to 10 where 0 is totally uncomfortable and 10 is totally comfortable, how would you feel (a) using / (b) sharing the road with the following types of self-driving vehicles for any journeys? Base: High exposure audience (all locations): pre-deliberative research n=223, pre-ride (pod) n=230, pre-ride (shuttle) n=216.

For the shuttle ride, average reported comfort using SDVs (averaged across all SDV types asked) increased significantly from 7.02 out of 10 to 7.54 out of 10 immediately afterwards. Similarly, average reported comfort sharing the road with SDVs also increased significantly from 6.73 out of 10 to 7.23 out of 10 after trialling the vehicles. The largest increases in reported comfort using SDVs were for ridesharing and public transport applications, while comfort sharing the road increased most for ridesharing and private vehicles where the vehicle is responsible for all driving tasks.

Before the shuttle ride, the highest comfort scores were for using and sharing the road with self-driving delivery vehicles while the lowest comfort scores were for using and sharing the road with private vehicles where the vehicle is responsible for all driving tasks. Despite increases in reported comfort, these remained the most and least comfortable SDV applications post-shuttle ride.

For the pod ride, similar trends in comfort scores were observed. There was a significant increase in average reported comfort using SDVs (averaged across all SDV types asked) from 7.09 out of 10 to 7.57 out of 10, and an increase in reported comfort sharing the road with SDVs from 6.91 out of 10 to 7.43 out of 10. The largest increases in reported comfort using SDVs were for private vehicles where responsibility is shared, private vehicles where the vehicle is responsible for all driving tasks, and ride sharing. For sharing the road with SDVs, the largest increases in reported comfort were for ridesharing and public transport.

Prior to riding in the pod, the highest comfort scores were for using and sharing the road with self-driving delivery SDVs; while there were increases in these comfort scores, by the

end of the pod trial participants reported being most comfortable using private vehicles with shared responsibility and sharing the road with self-driving public transport (however self-driving delivery vehicles were a close second). In terms of the lowest comfort scores, these were more consistent between pre- and post-pod ride measures, with private SDVs where the vehicle is responsible for all driving tasks consistently scoring the lowest average comfort levels for both using and sharing the road with SDVs.

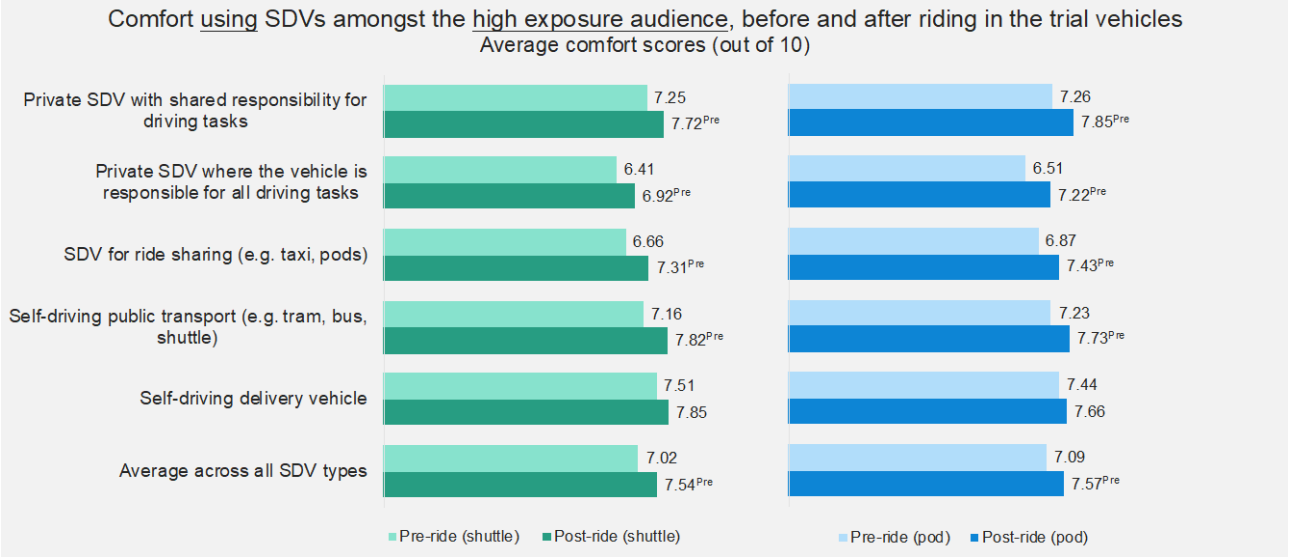

Figure 21 Comfort using different types of SDV among the high exposure audience pre- and post-ride for the shuttle and pod

C1a: On a scale of 0 to 10 where 0 is totally uncomfortable and 10 is totally comfortable, how would you feel using the following types of self-driving vehicles for any journeys? Base: High exposure audience (all locations): pre-ride (shuttle) n=216, post-ride (shuttle) n=230, pre-ride (pod) n=230, post-ride (pod) n=226.

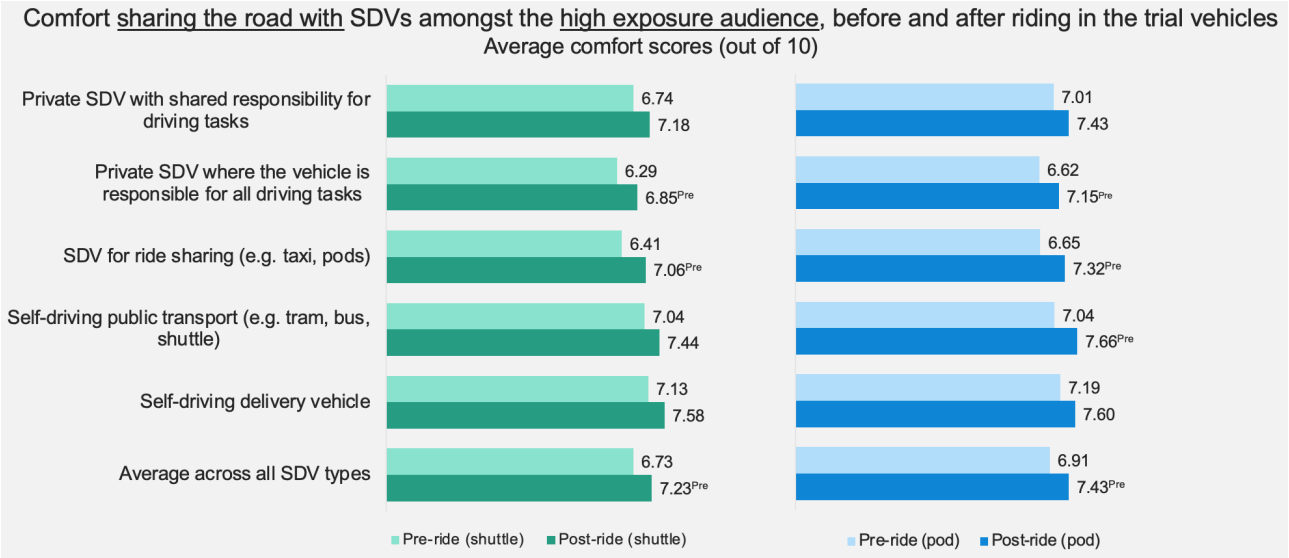

Figure 22 Comfort sharing the road with different types of SDV among the high exposure audience pre- and post-ride for the shuttle and pod

C1b: On a scale of 0 to 10 where 0 is totally uncomfortable and 10 is totally comfortable, how would you feel sharing the road with the following types of self-driving vehicles for any journeys? Base: High exposure audience (all locations): pre-ride (shuttle) n=215, post-ride (shuttle) n=230, pre-ride (pod) n=230, post-ride (pod) n=226.

Medium exposure audience

Pre-ride comfort levels for the medium exposure audience were significantly higher than the comfort levels reported by the high exposure group prior to the research commencing, but lower than their reported comfort levels immediately before trialling the vehicles (which was boosted by exposure to information and discussion for the high exposure audience). This indicates that the medium exposure audience had higher baseline comfort for using and sharing the road with SDVs. This is unsurprising as this audience attended the trial voluntarily and were therefore more likely to have a pre-existing interest in SDVs prior to taking part in the research.

Like the high exposure audience, this group reported indicative increases in comfort using SDVs, and statistically significant increases in sharing the road with SDVs, after taking part in the trial.

For the shuttle ride, average reported comfort using SDVs (averaged across all SDV types asked) increased from 6.57 out of 10 to 7.45 out of 10, while average reported comfort sharing the road with SDVs increased from 6.38 out of 10 to 7.36 out of 10. The highest increase was for using and sharing the road with private SDVs where the vehicle is responsible for all driving tasks.

Prior to riding in the shuttle, the medium exposure audience felt most comfortable using and sharing the road with private SDVs with shared responsibility; this remained the SDV application with the highest comfort ratings after riding. The lowest comfort ratings were for using and sharing the road with private SDVs where the vehicle is responsible for all driving tasks, and again this was consistent between the pre- and post-shuttle ride data.

For the pod ride, average reported comfort using SDVs (averaged across all SDV types asked) was 6.72 out of 10 before riding, significantly increasing to 7.63 out of 10 afterwards. Average reported comfort sharing the road with SDVs increased significantly from 6.46 out of 10 pre-ride to 7.36 out of 10 post. The largest increase in comfort levels were for using and sharing the road with private SDVs where the vehicle is responsible for all driving tasks.

The lowest-rated SDV application in terms of reported comfort was using or sharing the road with a private SDV where the vehicle is responsible for all driving tasks; this was consistent both pre- and post-pod ride. Before riding in the pod, the highest reported comfort scores were for using and sharing the road with private SDVs with shared responsibility and self-driving delivery vehicles. While this remained consistent after the pod ride for comfort using SDVs, the highest comfort scores for sharing the road with SDVs was for self-driving public transport (with self-driving delivery vehicles a close second).

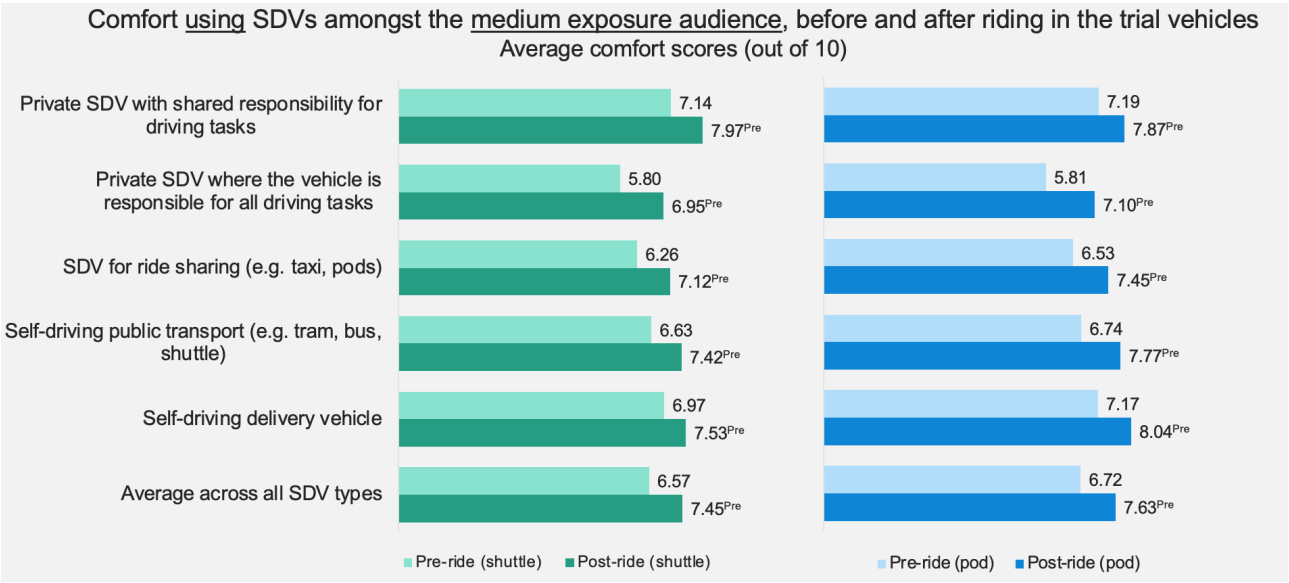

Figure 23 Comfort using different types of SDV among the medium exposure audience pre- and post-ride for the shuttle and pod

C1a: On a scale of 0 to 10 where 0 is totally uncomfortable and 10 is totally comfortable, how would you feel using the following types of self-driving vehicles for any journeys? Base: Medium exposure audience (all locations): pre-ride (shuttle) n=253, post-ride (shuttle) n=199, pre-ride (pod) n=197, post-ride (pod) n=151.

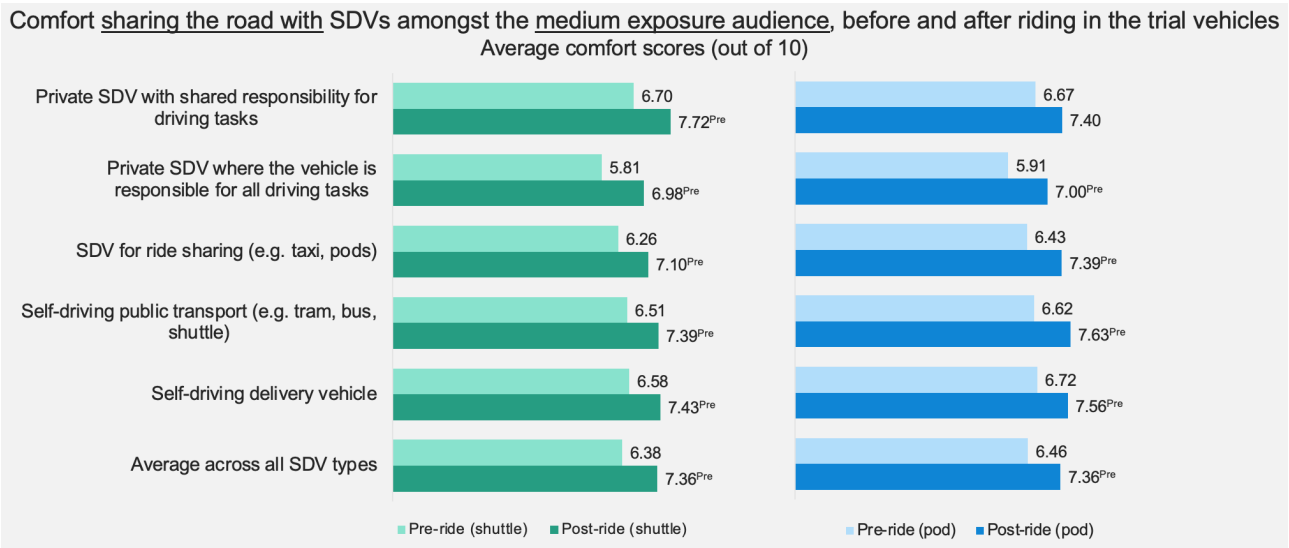

Figure 24 Comfort sharing the road with different types of SDV among the medium exposure audience pre- and post-ride for the shuttle and pod

C1b: On a scale of 0 to 10 where 0 is totally uncomfortable and 10 is totally comfortable, how would you feel sharing the road with the following types of self-driving vehicles for any journeys? Base: Medium exposure audience (all locations): pre-ride (shuttle) n=253, post-ride (shuttle) n=199, pre-ride (pod) n=197, post-ride (pod) n=151.

9.4 Perceived impact of SDVs on local transport systems

Pre- and post-ride surveys completed by the high and medium exposure audiences also explored perceptions of the difference SDVs could have on local transport systems. Like the comfort measures reported on in section 9.3, these measures were also included in other quantitative surveys used in this research to allow for comparison across audiences and timepoints (see 6.4 SDVs in the local transport system and 11.1 Informed views of SDVs: SDVs in the local transport system for more).

High exposure audience

As seen with comfort scores, the high exposure audience were already reporting significant increases in positivity towards the perceived impact of SDVs on local transport systems prior to taking part in the trial. This further demonstrates that information provision and discussion in workshop 1, as well as seeing the vehicles in person prior to completing the pre-ride survey, were likely influencing the high exposure audience's views on this question.

Figure 25 (below) shows that the proportion of participants who reported being unsure in the pre-deliberative research survey (prior to workshop 1) decreased significantly by the time of the pre-ride surveys (during workshop 2). The vast majority of those previously unsure reported that SDVs could make their local transport system better when completing the pre-ride survey, while there were only minor (insignificant) increases in the proportion who felt SDVs could make no difference or could make their local transport system worse.

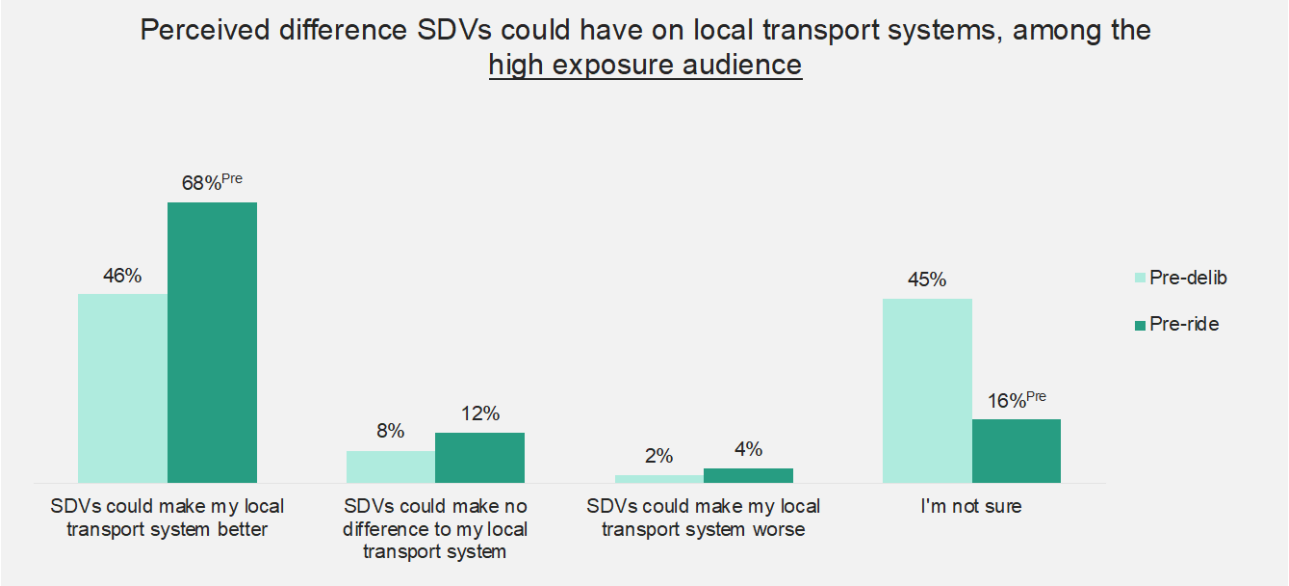

Figure 25 Perceived difference SDVs could have on local transport systems among the high exposure audience pre-deliberative research and pre-ride

E2a: Based on what you know about self-driving vehicles, what difference, if at all, do you think they could have on your local transport system? Base: High exposure audience (all locations): pre-deliberative research n=213, pre-ride n=438.

Taking part in the SDV trial did not greatly challenge the high exposure audience's views on the impact these vehicles could have on their local transport system, with no significant

differences observed between the pre- and post-ride data (Figure 26). This suggests that for those who had already taken part in information provision and discussion but remained unsure about the potential impact of SDVs, having a first-hand experience of SDV technology did not appear to help them move closer to taking a view. This is in contrast to those who were unsure in the medium exposure audience, who had not received information or taken part in discussions prior to riding in the trial, for whom the trial did reduce uncertainty on this measure (see findings on the medium exposure audience below).

Medium exposure audience

Like for comfort scores, the medium exposure audience's pre-ride views on the difference SDVs could have on local transport systems were more positive than the high exposure audience's had been at the outset of the research. However, these remained less positive than the high exposure audience's views pre-ride which had been boosted by exposure to information and discussion.

The trial experience prompted a significant increase in positivity among the medium exposure audience on this measure, with a greater proportion reporting post-trial that they felt SDVs could make their local transport system better. There was a corresponding significant decrease in the proportion who were unsure, however the proportion who felt SDVs could make no difference or could make their local transport system worse remained broadly unchanged between the pre- and post-ride data.

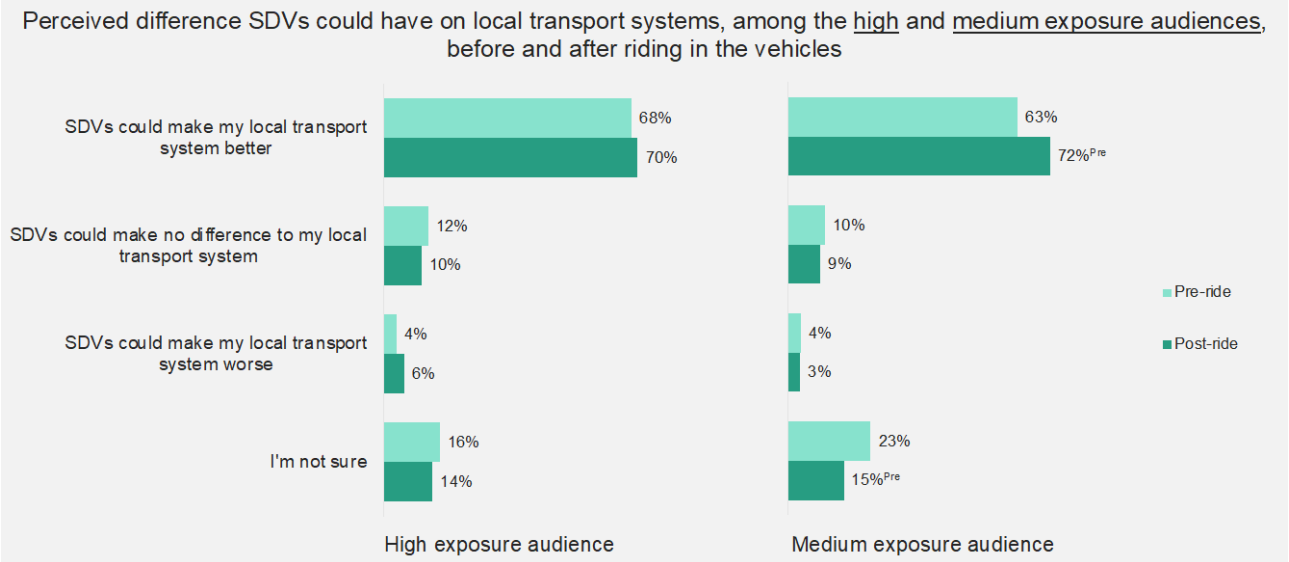

Figure 26 Perceived difference SDVs could have on local transport systems among the high and medium exposure audiences, pre- and post-ride

E2a: Based on what you know about self-driving vehicles, what difference, if at all, do you think they could have on your local transport system? Base: High exposure audience (all locations): pre-ride n=438, post-ride n=449; Medium exposure audience (all locations): pre-ride n=420, post-ride n=345.

9.5 Perceived local applications for trial vehicles

Shuttle

In the **rural and town trial locations**, the shuttle trial reinforced the sense that SDVs could operate much like their existing public transport, particularly for commuting or getting around the town and local villages. Some described the shuttle as operating like a 'simpler version of a bus'.

The trial also reinforced the potential for shuttle-style SDVs to fill current gaps in evening and weekend services, providing a cheaper and more reliable way to travel at all times of day and night than relying on a local human-driver workforce and address the issue of driver shortages.

"I feel positive. The existing public transport system in Alnwick is so appalling, expensive, and hardly ever used - I feel like this technology provides a complete re-think in how people get around on public transport. If you could use it up to the station or to the supermarkets at the edge of town - then it would have a role." (Deliberative participant, core audience, rural)

"Certainly, doing short trips for people who struggle to get into or drive a car, I can see this being convenient for them." (Deliberative participant, core audience, rural)

"This would be great to address driver shortages which end up suspending lots of services. This would be so helpful." (Deliberative participant, core audience, town)

Trialling the shuttle helped participants to think beyond existing public transport options in terms of vehicle size and functionality. The smaller size of the shuttle was felt to be particularly well suited to rural areas, including those surrounding larger towns, as it would allow services to be more tailored if a larger number of minibuses were used instead of a single (or limited number of) larger, conventional bus which must try to cater to everyone.

Despite this there were still concerns that the shuttle would struggle to navigate more rural areas due to its size and speed, for example where there are a lot of tight corners that can be difficult for human drivers, on narrow country lanes, and/or navigating poor road surfaces.

"I think it would be more dangerous in country lanes. In a city, I feel like it will be safer because its more pre-mapped out rather than windy roads." (Deliberative participant, core audience, town)

"I don't see the shuttle being able to do routes from town to town which is what we need in Alnwick. I think speed and size of vehicle would be an issue, but the technology could work." (Deliberative participant, core audience, rural)

Participants in **the urban area** could see some potential for shuttle-style SDVs as an option for short journeys in their local area and improving connectivity between existing

transport options. However, there was no clear gap for SDVs to fill due to extensive transport options already being well-established and advanced in the city centre. The shuttle trial did not serve to prompt any shift in this view.

"I would definitely use the vehicle for short journeys if available in Manchester - for school run, shopping, work…" (Deliberative participant, low SEG, urban)

"It might be good to incorporate into the local area for very short journeys because taxi drivers often won't accept short journeys." (Deliberative participant, core audience, urban)

"I think there's a place for it with city links to buses that go round the centre of Manchester. I can almost see it working in that respect as a free service around the city centre." (Deliberative participant, ethnic minority, urban)

Pod

While the pod trial was broadly seen to be a positive experience, the pod's smaller size, slower speeds, less robust design, and inability to travel on public roads contributed to a sense that it had fewer potential use cases than the shuttle. Furthermore, participants struggled to visualise use cases for the pod beyond the specific setting of the trial - potentially in part due to the less conventional vehicle type and application compared to existing transport options on offer.

"It could turn very easily and in small spaces, would be good for airports or golf courses." (Deliberative participant, core audience, rural)

"I can imagine the vehicles being used at a hospital or stadium, but it doesn't feel like the pod or shuttle are solving a problem." (Deliberative participant, ethnic minority, urban)

While those in the rural location felt the pod's small size could suit their narrow roads and lanes well, in the urban area there were concerns about how the vehicles could have a meaningful impact given their low capacity.

"If it is for taking people around airports and stadiums, but it only takes four people, then how is that going to work? They would need so many of them to make a difference. Should think about the capacity." (Deliberative participant, core audience, urban)

Despite this, the lack of any real restrictions as to where or when the pod could be used was seen as a strength as it offered some flexibility in how it could be used. In general, it was felt that the pod could offer more independence to people with mobility issues, including those with disabilities and the elderly. As an alternative to walking or mobility scooters, pod-style SDVs could be used in airports or hospital settings.

"My next-door neighbour, who is 90 and still wants to be independent, would benefit from that as she wouldn't have to rely on anyone else." (Deliberative participant, core audience, urban)

Additionally, participants in the town trial location saw the potential to restrict human-driven vehicles in the town centre, instead offering pods to help older people or those with mobility issues to move around a more heavily pedestrianised town centre (more on this in 10. Future scenario exploration for SDV deployment). This was also seen to be a potential benefit for those travelling into town and urban centres who felt less comfortable driving themselves.

"Getting around in the city, a lot of people don't want to drive around the city. So, if they had the knowledge that these things were safe, and safer than driving, that would put a lot of people in them. So, automation would give people a lot of accessibility." (Deliberative participant, core audience, rural)

Ultimately, when considering possible applications for SDVs throughout the remainder of the research, participants rarely expressed a desire to see pod-style SDVs deployed in their local area following the trial experience - focusing more on the shuttle as well as self-driving versions of current options (buses, private cars, taxis).

"I suppose in an area like Taunton it could have a role to play in park-and-ride, but you'd need a lot of them. If there was enough of them you could get straight out of your car, get in a pod and not have to wait." (Deliberative participant, core audience, town)

Delivery pod

The delivery pod was seen to offer more flexibility than existing delivery options, especially if being home for a delivery or going to a collection point within specific times is challenging. It was also felt to have the potential to reduce delivery costs by not needing to pay a driver. Further, there was optimism about the potential to improve efficiency and reduce road congestion from multiple delivery vehicles travelling to the same places by having a single delivery pod serve multiple houses or buildings in a small geographical area, and/or by collating orders from different sellers into the same delivery.

Those who were more familiar with using collection lockers tended to live in the urban location. These participants imagined a self-driving delivery pod transporting goods from a supplier to a centralised location and acting as a centralised locker collection point for several nearby homes or buildings. In this way, it was seen to combine the convenience of (near-)home delivery with the security and flexibility of collecting goods at a time that best suits the end customer. It would also eliminate the need for fixed lockers that take up space in public areas and are vulnerable to vandalism.

"I like how it makes parcels more secure and the fact you can pick up whenever. It has more leeway." (Deliberative participant, low SEG, urban)

"Lots of people round here get supermarket deliveries, it's same as that really." (Deliberative participant, core audience, town)

The research found that participants in different trial locations felt the delivery pod would be best suited to a location other than their own. Participants could often identify practical challenges to the pod that it would face in the locations they were more familiar with, therefore suggesting that the pod would be better suited to other areas which in their opinion did not have these limitations.

Those in the **urban location** indicated that delivery pods would best suit towns and rural settings. They imagined the vehicles could struggle to move amongst the heavy foot traffic of a city centre. In contrast, they envisaged the vehicles would have more space and encounter fewer obstacles in lower-density areas. Existing access to delivery options, including static locker collection points, could also have contributed to a sense that this new option was not required.

Those in the **town** felt the delivery pod would benefit those living in rural areas, including those around town centres. They imagined that delivery pods could transport goods to a communal collection point on the fringe of town to eliminate the need for rural residents to drive into the town centre to collect items. They had concerns about the delivery pod operating on pavements in towns which they felt would cause issues for wheelchair and pushchair users, limiting its applicability there.

"I think it's too big to be used on shared pathways. The infrastructure would need to be adjusted for this to work." (Deliberative participant, core audience, urban)

"I'd find it a nuisance as a push chair user because it would take up a lot of pavement." (Deliberative participant, core audience, town)

Meanwhile, those in the **rural location** envisioned delivery pods having the most applicability in an urban setting, where they could efficiently serve a larger number of people within a smaller geographic area - for example, combining deliveries for a block of flats or a defined number of streets in residential areas. Concerns about the unpredictable nature of rural traffic and patchy cellular connectivity were seen to limit the delivery pod's potential in rural locations. Like participants in towns, there were also concerns about them operating on narrow pavements, common in many villages and non-existent in more rural settings.

"As it's a rural area, connectivity and distance need to be considered as sometimes our 4G network doesn't work. Also, road congestion and seasonality of traffic. During the tourist season we have lots of problems with traffic." (Deliberative participant, core audience, rural)

Finally, some participants saw the potential for delivery pods to make small or next-day business-to-business deliveries, such as between store locations or warehouses.

"It would work well in situations where there are definitely people there to receive deliveries, for example delivering newspapers to newsagents." (Deliberative participant, core audience, urban)

9.6 Section summary

- Seeing and experiencing SDVs first-hand was a broadly positive experience that worked to move people towards acceptance. Seeing the technology in action demonstrates, at a basic level, that self-driving technology exists and works, and it allows participants to start imagining how SDVs could be deployed in their local area.
- However, there were still some perceived limitations to the functionality of the technology that prompted new questions about the viability of these vehicles as a useful alternative to what is already available.
- This meant that general excitement about experiencing the technology remained in tension with some participants' pre-existing views on the practical constraints of using the technology, which were not challenged by their experience of the trial. After the trial, participants in the high exposure audience still found it hard to imagine how SDVs would interact with human-driven vehicles during a 'transition phase' and what additional benefits they would bring over and above what could be provided by existing transport options when applied in their local area.
- Those in the high exposure audience reported high levels of comfort using and sharing the road with a variety of different applications of SDV technology (e.g. delivery vehicles, public transport, ride sharing, private vehicles), both before and after taking part in their trial experiences.
- By contrast, the medium exposure audience in the research demonstrated a statistically significant increase in their overall comfort using and sharing the road with a variety of different SDVs as a result of taking part in the trial. This indicates that first-hand experiences have a positive impact on comfort with SDVs when prior exposure to the technology is limited.
- The high exposure audience also reported a positive emotional response to taking part in the trial, and this was supported by the physiological data collected. Excitement and engagement levels were high throughout the trial for both the shuttle and pod, while feelings of anxiousness and stress were generally low throughout.
- Emotional responses to the trial are consistent with dual processing theories, with participants tending to feel more comfortable and their more immediate emotional reactions subsiding as they became more familiar with the technology.
- Participants specific requirements for SDV design was heavily influenced by their experiences of the trial and continued to develop throughout the deliberative engagement. This feedback can be found in 11.3 Vehicle requirements.

10. Future scenario exploration for SDV deployment

The high exposure audience played a role-playing scenario exploration game in the final deliberative workshop. Participants were presented with a future scenario and asked what actions they would take relating to the deployment of SDVs in their local area across a variety of time points (five years ahead in 2027; 20 years ahead in 2042).

The purpose of the game was to test the views that participants had expressed during the preceding discussions. Participants were asked to take on new roles in an imagined world where SDVs are operating widely and make tangible decisions to either promote or restrict the use of SDVs to ensure the diverse needs of different people and situations are met. This section outlines participants' preferred actions for the future deployment of SDVs in their local area, as well as the rationale for these actions.

A full description of the scenario exploration game is included in 14.4 Research Design 'Your self-driving world' scenario exploration game.

10.1 Detailed responses to the scenario exploration

Future scenarios

The scenario exploration game used two different potential future scenarios as the starting point for gameplay. These were a) more self-driving private cars or b) more self-driving public transport**;** each group of participants was allocated one scenario.

While both scenarios were considered credible, **there was tension between which was most likely versus most desirable**. The scenario with **more self-driving public transport was broadly considered most desirable**, in line with views expressed in earlier stages of the deliberative research. Participants were broadly positive about this future scenario when allocated it and proceeded to start building on it with their chosen actions and interventions to develop it further. In contrast, when allocated more self-driving private transport, participants tended to use the first round of the game to promote public and shared applications of SDVs, bringing it in line with the public transport focused scenario.

Despite this, **more self-driving private transport was felt to be the most realistic future scenario**. The scenario exploration game was effective in teasing out underlying feelings that participants were doubtful that public and shared transport would in fact be prioritised in the deployment of SDVs. This was broadly due to budgetary constraints on public money, cynicism and distrust in political institutions, and there not being sufficient regulation in place prior to private SDVs coming onto the market for consumers.

When considering the time frames proposed in the game, **neither scenario was felt likely to have eventuated by 2027**. Five years was not seen as being long enough for SDV technology or the required infrastructure to be developed to a point of being widely in use, and even if it had, then it was predicted to still be expensive and have 'kinks' making it unreliable. Nonetheless, the scenario for more self-driving private transport was felt more realistic in five years' time than more self-driving public transport, and both scenarios were felt to be most realistic in an urban setting. Most did envisage widespread SDV use by 2042 (round two of the game).

"Practically, I can see self-driving vehicles working in towns. But the need is in rural communities." (Deliberative participant, core audience, town)

"Not in five years' time in Alnwick. In the centre of Manchester or Edinburgh would be believable, but for Alnwick it would be 10 years later at least." (Deliberative participant, core audience, rural)

Participant-created scenarios

In line with the focus on self-driving public transport being the most desirable future scenario, participants initially assigned the private SDVs scenario tended to choose or create future scenarios where public and/or shared SDVs are more prevalent when given the option. It was felt that public SDVs would fulfil more of their local transport needs, have more environmental benefits by creating more efficient transport systems, and would help to ease rather than contribute to increasing congestion.

By contrast, those initially assigned the public/shared SDVs scenario tended to go on to develop scenarios which would build on and further enhance the deployment of public/shared SDVs - often pushing for a starting point that went further than what was presented in the initial scenario.

Preferred interventions

Participants were **comfortable with the approach of promoting SDVs and rarely chose or designed interventions to restrict their use when given the opportunity**. As such, the variation in interventions selected was generally based on whether the group wanted to promote shared/public versus private SDVs, and how they thought this could be best achieved.

The choice of interventions was shaped in part by the starting scenarios and trends, as well as participants' assigned roles, however the extent to which participants embraced their role varied from group to group and participant to participant. Despite this, **many of the same underpinning themes and priorities were evident across groups to justify**

specific intervention choices, suggesting that participants' underlying personal views on SDVs developed through the deliberative process and were also influential in their decision making.

There was a strong desire for any rollout of SDVs to be planned and proactive. Ultimately, participants selected interventions to create opportunities for SDV technology to shape and change their local transport system and open it up to those who are most restricted in their transport options today. This suggests that they were more focused on providing opportunities for SDV use and ensuring that people had the capabilities required to use them than developing motivation to use SDVs.

With this in mind, the most popular interventions were (in order of most to least popular):

Environmental and social planning, specifically the creation of new infrastructure in both urban and rural areas to support the rollout of SDVs. Having appropriate infrastructure in place prior to SDV rollout was seen as essential as it would ensure roads were compatible and safe for SDVs, as well as ensuring linkages and connections between SDVs and existing transport options.

"Making it easier for disabled people to use public transport, which would be better for everyone. If public transport is easier to use because of SDVs then that would mean higher use and also higher sales for transport companies, which would help to keep services running." (Deliberative participant, core audience, town)

"National infrastructure will mean that people who like driving can still go on pleasure drives on the B roads, but the boring long journeys on motorways would be self-driving." (Deliberative participant, core audience, urban)

Fiscal measures to further support public transport in rural areas, beyond just the new infrastructure mentioned above, were also a popular intervention and something that participants wanted to see put in place early to ensure a seamless rollout. There were concerns that rural public transport was already lagging behind urban areas and that this would be further exacerbated without early, proactive action. Accordingly, while this intervention was popular across the board, it was chosen particularly often by groups starting with the private SDVs scenario as part of an effort to adjust the scenario back to a focus on the biggest public transport gaps.

"Supporting public transport in rural areas was a big priority for me. I focused on the core principles that I thought should be addressed as the reason [for SDVs] to be developed, not as an afterthought [when making trade-offs in the game]." (Deliberative participant, core audience, town)

Fiscal measures in the form of investing in innovation were also favoured. This could include**:** to ensure the technology is affordable, can solve real world traffic problems at a tailored/local level, and is accessible. Indeed, while participants saw SDVs as an opportunity to open up travel options for a wide array of people, they felt the main priority should be those who are currently most limited by not being able to drive. Participants emphasised that SDVs should be accessible by design from the outset to ensure they

work for everyone, rather than accessibility being something that was only thought about later.

> *"Investing in innovation would help self-driving vehicle manufacturers to exhibit what the technology can do for different groups and hopefully help to speed up adoption too."* (Deliberative participant, core audience, town)

Further to the above, **legislating** to open up self-driving to all, including allowing people without driving licences to operate SDVs, was also seen as fundamental to ensuring access for those seen to be able to benefit most.

> *"Opening up self-driving to all gives everyone the right to use self-driving vehicles and get round. It gives people the freedom to do what they want."* (Deliberative participant, core audience, rural)

Finally, participants rarely questioned that SDVs were safe, in part assuming that they would already be proven safe before planning their deployment. However, introducing **regulations** to increase safety testing criteria for SDVs was felt to be important for building public confidence and persuading them on the concept of SDVs. However, participants did recognise that increased safety testing would need to be balanced against subsequent time and cost barriers for SDVs entering the market.

> *"If I [in the role of a self-driving vehicle manufacturer] increase safety testing criteria now, then by 2042 my safety testing is done, and I can get on with production and meeting new demand."* (Deliberative participant, core audience, rural)

In contrast to the above intervention priorities, there were several interventions that were never or very rarely selected in the game. **The least popular interventions were legislating to restrict SDVs or SDV speeds**, as concerns tended to be focused on SDV decision-making and interactions with human drivers more so than their speed, and **introducing policy to subsidise the purchase of private SDVs**, as shared/public SDVs were prioritised.

Participant-created interventions

When given the chance to create their own interventions, participants continued to seek to promote the use of SDVs rather than restrict them. This indicates that this tendency was not just the result of the specific interventions offered in the initial rounds of the game but rather was aligned with their broader views and priorities for SDVs.

Interventions created by participants were typically refinements of the interventions offered in the game to make them more relevant to local contexts and/or specific problems. However, there were some different intervention ideas that did emerge, including:

- **The creation of SDV 'hubs':** similar to park-and-ride, these hubs could link urban and rural areas with SDVs. This could be an early step in the SDV rollout, whereby more

rural people could travel in their own (human-driven) vehicle to an SDV hub, park up and take an SDV into the town or city centre. Self-driving delivery vehicles could also transport goods from town or city centres for collection at these hubs for those living further out.

- **Pedestrianise town centres with SDVs:** closing town centres to private vehicles and instead prioritising walking, cycling and public transport. These could be used in conjunction with SDV hubs to transport people into the centre. Those with mobility issues could have the option to hire personal SDVs to travel around.
- **Scheme to ensure SDV affordability:** This was primarily created to make travel more affordable and accessible for people with disabilities.

"I want the town centre to be able to cater for all transport users, especially greener ways of travelling like walking and cycling." (Deliberative participant, core audience, town)

Impact of consequences and challenges

For each action chosen by participants, there was a corresponding 'consequence' which was not revealed to participants until after their chosen actions had been played. Furthermore, at the end of each round of gameplay, a 'challenge' was revealed with either positive or negative implications for SDVs to be considered by participants in the following round.

Consequences and challenges rarely negatively impacted participants' views of SDVs, and their support remained resilient. This was the case irrespective of whether the consequences or challenges introduced were positive or negative, including those which could raise potential safety issues.

For negative consequences and challenges, **the focus in participants' subsequent interventions was often on rebuilding public trust and moving past the barrier created by the consequence or challenge introduced**, rather than seeing it as a reason to abandon or restrict the new technology. After consequences and challenges were introduced, **participants continued to choose interventions that would promote SDVs** and continued to prefer shared/public models for SDV use over private ones.

Specifically, on reactions to the challenges:

- The challenge involving a collision was deemed concerning because it could make people afraid of SDVs, subsequently reducing their widespread use. Participants believed this had the potential to negatively impact people with mobility issues because reduced services could limit their independence, as well as businesses who were felt likely to be quite dependent on SDVs (particularly by 2042).
- However, others felt that the impact of a collision was potentially less important because collisions or malfunctions would not be particularly significant in a scenario where SDVs are already commonplace (such as with traditional vehicles today).
- Financial challenges such as recession were seen to be potentially positive for the rollout of SDVs as it would move people away from unaffordable private SDVs and instead towards more shared/public applications.

- The challenge relating to a warning from a disability charity served to further strengthen participants view that SDVs should be accessible. It was felt to be important for government to have policies in place to ensure this.

> *"There should definitely be a policy in place to make self-driving vehicle manufacturers design their vehicles to be disability friendly. Plus, if a disability charity is complaining, then you're cutting out a whole audience of potential customers. So, as a self-driving vehicle manufacturer I'd be asking - how do we figure out what the issue is and who's paying for it?"* (Deliberative participant, core audience, rural)

10.2 Section summary

- When exploring future scenarios for SDVs, participants overwhelmingly chose to take interventions that would promote rather than restrict their use in their local area, further evidencing a general acceptance and positivity towards future use of the technology.
- Scenarios where SDVs are predominantly shared use and/or used for public transport continued to be favoured over private SDVs, in line with earlier discussions. These views were consistent across all locations.
- When presented with potential negative consequences of chosen interventions in the game, as well as challenges likely to have a negative impact on SDVs, participants nonetheless continued to want to promote SDVs and chose subsequent actions to overcome and rectify these developments in the game.
- Specifically, the most popular interventions chosen by participants related to physical environmental planning to develop SDV infrastructure in urban and rural areas and using fiscal measures to further promote and support the use of SDVs particularly in rural public transport.
- The scenario exploration game was a means to challenge the views that participants had articulated towards SDVs by asking them to put these views into practice; yet ultimately, the game revealed that participants rarely held contradictory views or views that they then did not see as the best way forward when playing the game. Instead, the scenario exploration game allowed participants to take the principles and ideas they had already started forming in the discussions and further develop the detail of these.
- The role-playing nature of the game gave participants the opportunity to project their own views onto their allocated roles during the game play, opening up the possibility of potentially less outwardly enthusiastic or positive views coming into play (i.e. if they previously felt, consciously or subconsciously, that they had to be positive about this new technology).
- The scenario exploration game served to strengthen both researchers' and participants' understanding of their attitudes towards SDVs and bring nuances to the fore.

11. Informed 'citizen' conclusions on the use of SDVs in future local transport systems

This section outlines the impact of taking part in the research by comparing data before and after the trial for the low exposure audience, and before and after the deliberative fieldwork for the high exposure audience. For the latter, this section also outlines the longer-term impact on participants' views through data collected six months after the deliberative events took place. This section also summarises the high exposure audience's informed views and conclusions regarding how SDVs should be deployed and communicated about with the public.

Section 14.3 Technical appendix provides more detail about the quantitative approaches used in this research. The full data tables are also provided as a supplement to this report.

11.1 Informed views of SDVs

Overall, participants in the high exposure audience who felt they did not know enough about SDVs at the start of the research went on to **form their own opinions about SDVs, and these opinions tended to be positive**. Meanwhile, **those who had already taken a view on SDVs at the outset tended to retain their views**, regardless of whether these views were positive or negative. Participants who had formed positive opinions of SDVs over the course of the research tended to retain these views after six months, albeit not as strongly.

Views towards technology

Corresponding pre-research findings can be found in 6.1 Views towards technology.

High exposure audience

While originally intended as a profiling measure rather than a research measure, there was evidence that the high exposure audience became more cynical about technology over the course of the research. At the end of the research, the proportion of participants agreeing that 'new technologies are all about making profits rather than making people's lives better' (22%) was significantly higher than at the start of the research (13%).

However, this audience also became less worried about technology over the course of the research with significantly more disagreeing with the statement 'I am worried about where all this technology is leading' at the end of the research (47%) compared to at the start (37%).

Six months on, participants' views had broadly muted and differences in opinion were no longer statistically significant compared to the pre-research data (see 14.3 Technical appendix, note 1).

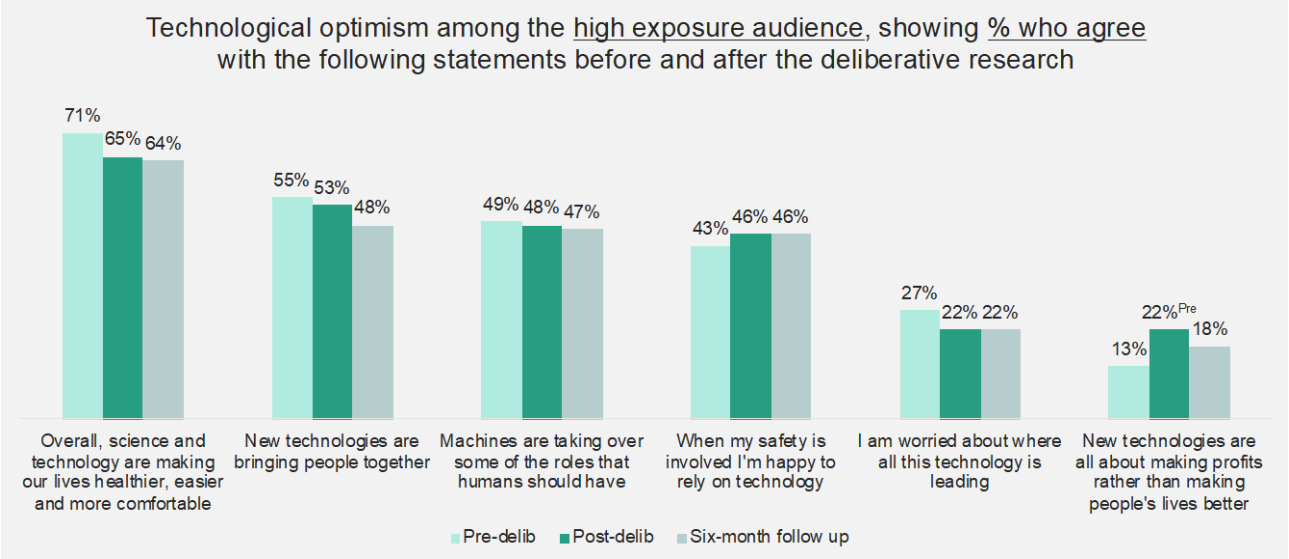

Figure 27 Technological optimism (agreement with statements) among the high exposure audience pre- and post-deliberative research and six months post-research

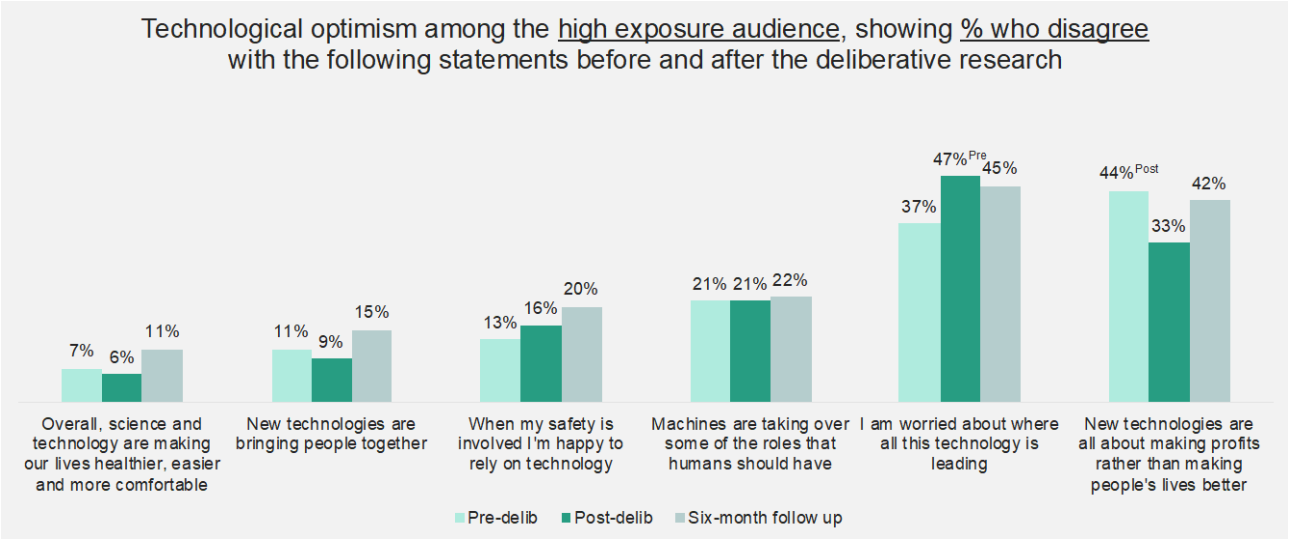

Figure 28 Technological optimism (disagreement with statements) among the high exposure audience pre- and post-deliberative research and six months post-research

P7: For each of the following statements about science and technology please state whether you agree, disagree or neither agree nor disagree? Base: High exposure audience (all locations): pre-deliberative research n=226, post-deliberative research n=212, six-month follow up n=127.

Awareness and knowledge of SDVs

Corresponding pre-research findings can be found in 6.2 Awareness and knowledge of SDVs.

High exposure audience

The research found a large, statistically significant increase in **familiarity** with SDVs as a result of taking part in the research, with more than two thirds of the high exposure audience reporting knowing 'a fair amount' about SDVs by the end of the research (68% compared to just 11% before taking part).

Those with the lowest self-reported knowledge at the outset of the research showed the greatest increase. The proportion of participants indicating that they knew 'a fair amount' or 'a great deal' increased the most for older respondents aged 46-64 years (79% at the end compared to 5% at the start) and 65+ (85% at the end compared to 6% at the start), and women (83% at the end compared to 2% at the start).

Yet by the end of the research there was still only a minority of participants that felt they knew 'a great deal' about SDVs (14% compared to none at the start of the research). This is consistent with the Dunning-Kruger effect which indicates that people often overestimate their knowledge on a topic until they start learning more and become aware of deficiencies in their knowledge (Kruger & Dunning, 1999).

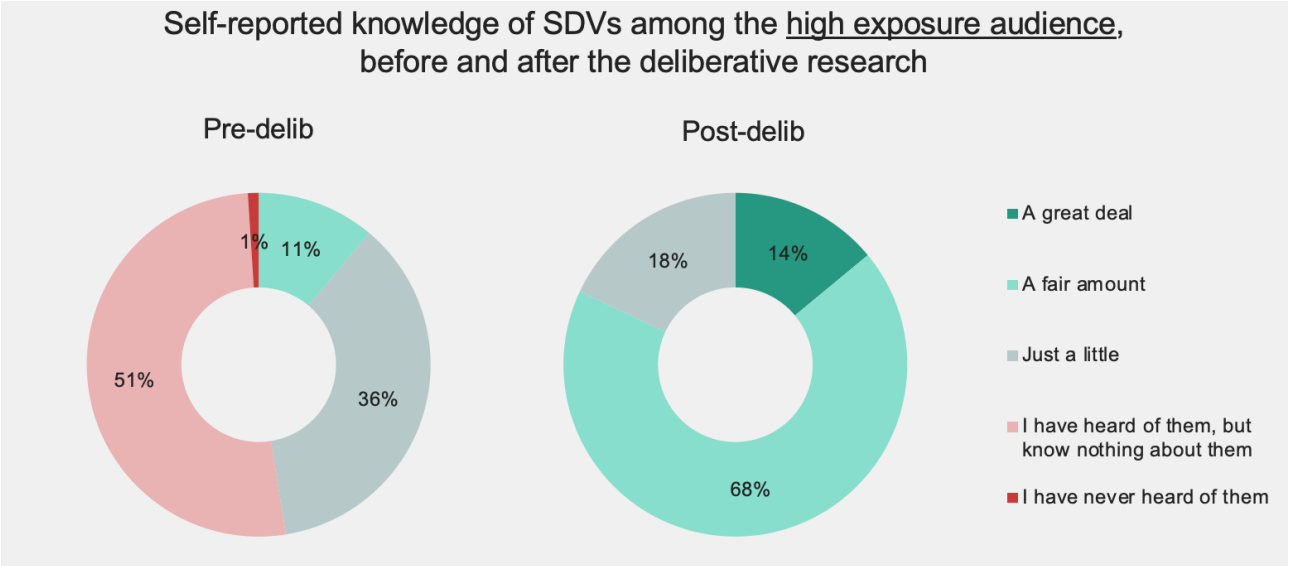

Figure 29 Self-reported knowledge of SDVs among the high exposure audience pre- and post-deliberative research

A1: How much would you say you know about self-driving vehicles? Base: High exposure audience (all locations): pre-deliberative research n=226, post-deliberative research n=212.

Qualitatively, by the end of the research participants in the high exposure audience still had several questions about SDVs but felt these could not be answered until more was known about the technology, how SDVs would be deployed, and what the implications of deployment would be - such as cost, accessibility and how they would interact with human-driven vehicles.

> *"I think that the future for self-driving vehicles remains a little bit unclear and I think that's to do with the fact that we have this transition between there being regular drivers on the road and a scenario where it's all self-driving vehicles, and that middle ground is going to be really hard to navigate."* (Deliberative participant, core audience, urban)

Alongside this increase in familiarity with SDVs, the high exposure audience also demonstrated some improvement in the accuracy of their knowledge of SDVs as a result of taking part in the research. They also demonstrated a reduction in uncertainty about the technology, with a decrease in the proportion who reported feeling unsure about what SDVs can and cannot do by the end of the research; this persisted six months post-fieldwork. However, there was also evidence that some of this confidence was misplaced, demonstrating the challenges associated with communicating the nuances of SDVs (see 14.3 Technical appendix, notes 11 and 12).

When considering the **responsibilities of SDV users**, there was an increase in the proportion correctly identifying that users are not responsible for how an SDV drives as a public transport passenger (61% at the end compared to 39% at the start of the research), and that users of private SDVs are not responsible for the behaviour of the vehicle when the self-driving mode is on and that during this time they are allowed to perform some other activities but cannot use a mobile phone and must be fit to drive throughout the journey if needed (54% at the end compared to 29% at the start). There was also a decrease in the proportion who incorrectly reported that users of private SDVs are always responsible and are not allowed to perform other activities or use their mobile phone and must be fit to drive (24% at the end compared to 53% at the start).

However, there were also increases in the proportion of participants incorrectly indicating that users of private SDVs are not responsible for the behaviour of the vehicle when the self-driving mode is on and that during this time they are not allowed to perform other activities including using a mobile phone and must be fit to drive throughout the journey if needed (30% at the end compared to 12% at the outset), or that users are not responsible but they are allowed to perform other activities including using a mobile phone and do not need to be fit to drive throughout the journey if needed (23% at the end compared to 9% at the outset). Some participants may have answered this question with both user-in-charge and non-user-in-charge vehicles in mind (covered in the workshops) as the question did not distinguish between the two vehicle types. After six months, these incorrect assumptions faded to some extent, with incorrect options not being significantly more likely to be selected compared to at the start of the research.

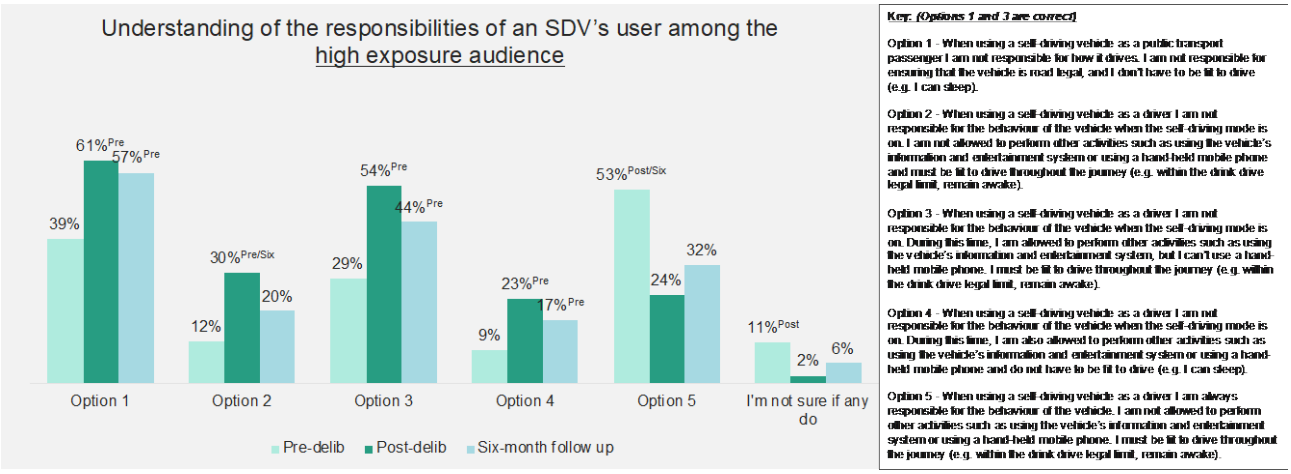

Figure 30 Understanding of the responsibilities of an SDV's user among the high exposure audience pre- and post-deliberative research and six months post-research

A2: For each of the following paragraphs, which do you think accurately describe the responsibility that a driver would have in a self-driving vehicle? Please tell me as many as you think apply. Base: High exposure audience (all locations): pre-deliberative research n=226, post-deliberative research n=216, six-month follow up n=127.

By the end of the research, the high exposure audience were significantly more likely to correctly identify **what vehicles can and cannot legally do in the UK**, with significant increases in correctly identifying that vehicles can support a human driver but they remain in full control of the driving task (88% at the end compared to 73% at the start), and that vehicles cannot currently drive themselves without any input from a human driver (71% at the end compared to 59% at the start). These increases still held six months post-fieldwork.

However, by the end of the research there was also a significant increase in the proportion who incorrectly believed that vehicles can currently legally drive themselves in limited, pre-determined areas with oversight from human drivers (49% at the end compared to 30% at the start of the research), with this change persisting six months post-fieldwork (72%). This could have been the result of participants incorrectly assuming that this question referred to vehicles operating within a controlled trial such as the one they took part in (see 14.3 Technical appendix, note 12).

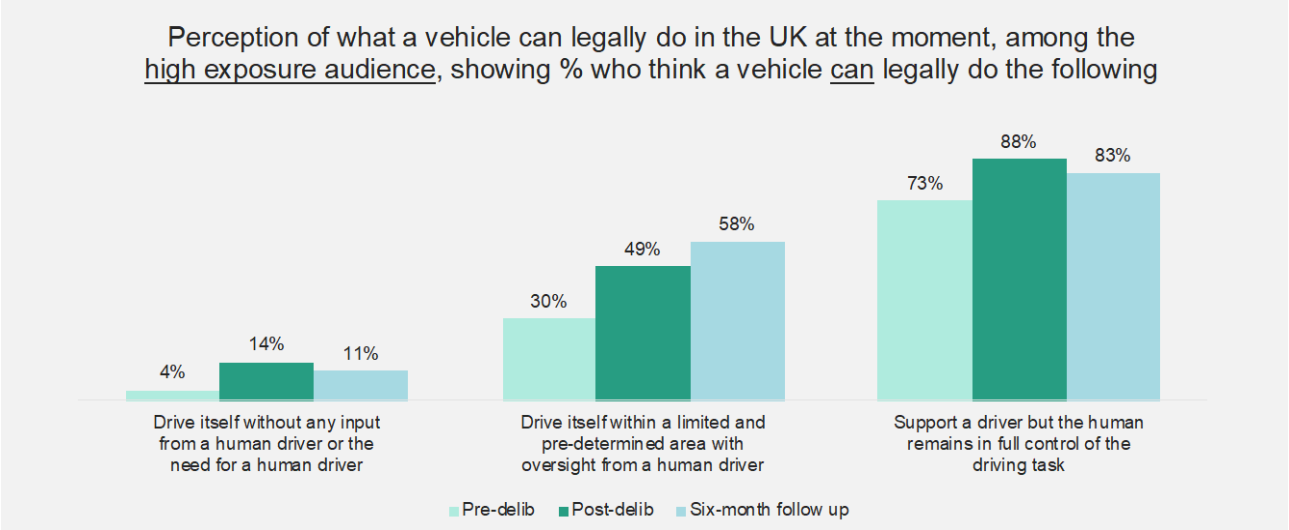

Figure 31 Perceptions of what vehicles can legally do in the UK at the moment among the high exposure audience pre- and post-deliberative research and six months post-research

A3: For each of the following statements, please tell me whether you think a vehicle can legally do this in the UK at the moment. Please just answer to the best of your knowledge. 'Drive itself without any input from a human driver or the need for a human driver', 'Drive itself within a limited and pre-determined area (e.g., on the motorway up to a certain speed) with oversight from a human driver', 'Support a driver by providing steering, braking or acceleration assistance but the human driver remains in full control of the driving task, (e.g., cruise control, automated emergency braking) (AEB).' Base: High exposure audience (all locations): pre-deliberative research n=222, post-deliberative research n=204, six-month follow up n=127.

Low exposure audience

The data does not suggest that the trial delivered a significant change in the low exposure audience's accuracy of understanding of the **responsibilities of SDV users**. There was evidence of the post-trial sample for this audience having marginally more accurate knowledge of **what vehicles can and cannot legally do in the UK** compared to those surveyed pre-trial; as no information was provided to this audience as part of the research, this difference was likely the result of the make-up of the sample rather than an impact of the research (see 14.3 Technical appendix, note 13).

Perceptions of SDVs

Corresponding pre-research findings can be found in 6.3 Perceptions of SDVs.

High exposure audience

Taking part in the deliberative research had a positive impact on this audience's **overall attitudes towards SDVs**. At the end of the research, the majority of participants indicated that taking part had made them feel 'less worried about using SDVs' (71%), 'safer being in or around an SDV' (60%), and 'more confident about SDVs' ability to handle unexpected situations' (50%). While few felt less positive, views towards the accessibility of SDVs were more mixed between those who felt SDVs were more accessible than they had originally thought (45%) and those who felt no different (44%).

In all cases, self-reported increases in positivity either persisted or became stronger still after six months among those who completed the follow up survey, indicating

that the experience of taking part in the research had a persistent and long-lasting positive impact on participants' views of SDVs. This emphasises the positive role for public engagement and trials to support public acceptance of SDVs in the future.

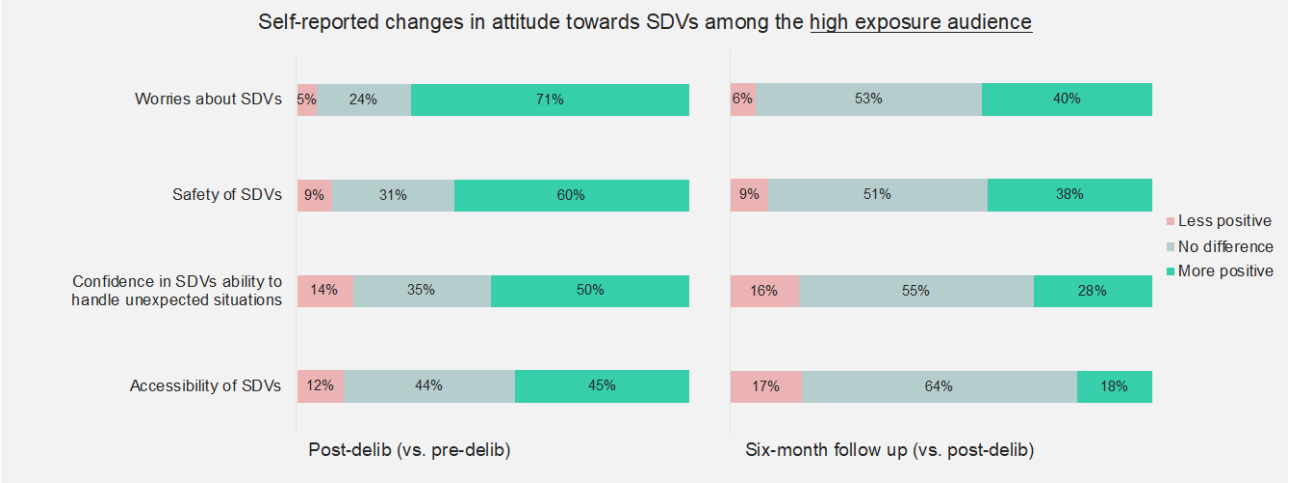

Figure 32 Self-reported changes in attitude towards SDVs among the high exposure audience post-deliberative research and six months post-research

F2a (Post-deliberative research survey): How do your feelings now compare to how you felt before the research event about self-driving vehicles? / F2a (Six-month post-research follow up survey): Having had time to reflect on the research event you participated in roughly six months ago, how do your feelings now compare to how you felt just after the research event about self-driving vehicles in your local area? Base: High exposure audience (all locations): post-deliberative research n=209, six-month follow up n=125.

After taking part in the research, the high exposure audience reported significantly increased **comfort levels** for using and sharing the road with all types of SDV asked. These increases were larger for using SDVs than for sharing the road with them.

Average comfort scores by the end of the research were highest for using and sharing self-driving delivery vehicles and self-driving public transport, both of which saw sizeable increases in comfort scores compared to views at the start of the deliberative research. However, despite being the SDV application that this audience felt least comfortable using or sharing the road with, private SDVs where the vehicle is responsible for all the driving tasks saw the largest increases in average reported comfort levels.

Women were significantly less comfortable using and sharing the road with SDVs than men at the start of the research; however, average comfort levels across both measures saw a larger increase among women than men after taking part in the research. This meant that by the end there were no significant gender differences in level of comfort using or sharing the road with SDVs. Similarly, while there were increases in comfort levels for using and sharing the road with SDVs in all locations, these were greatest for urban participants and brought their average comfort in line with those in other locations by the end of the research.

Six months later, comfort using and sharing the road with SDVs was still significantly higher than it was before the research took place but had dropped compared to what was reported at the end of the research. This suggests that trialling SDVs has a positive long term impact on perceived comfort levels for both using and sharing the road with them.

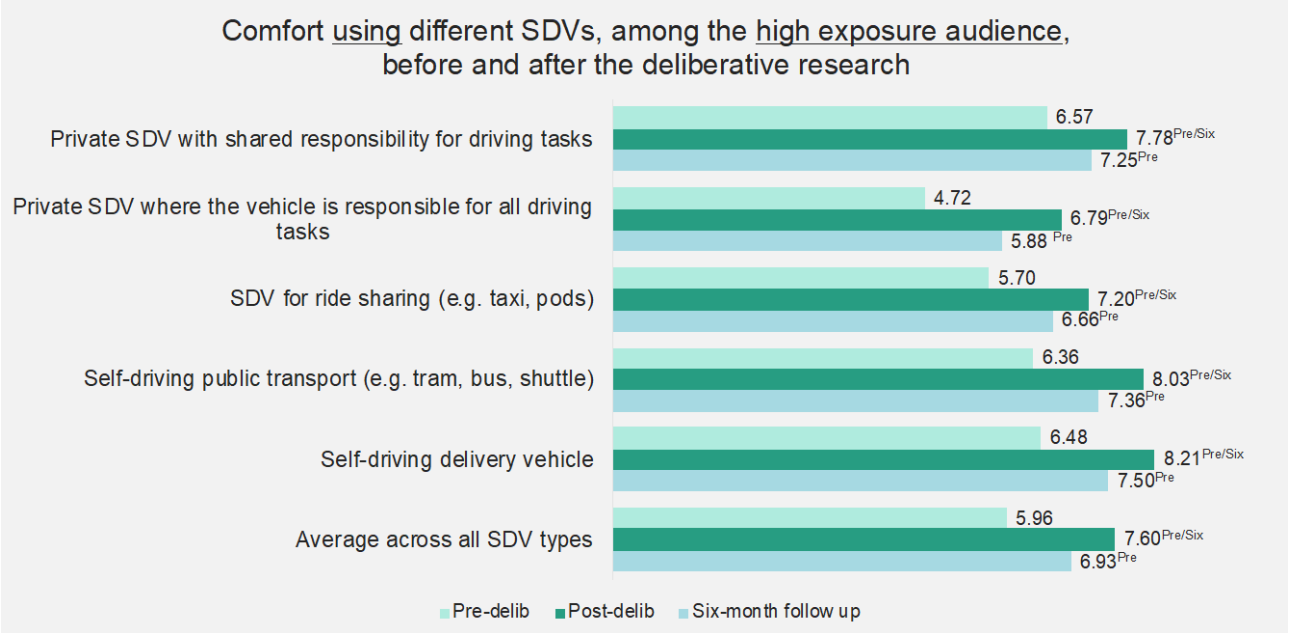

Figure 33 Comfort using different types of SDV among the high exposure audience pre- and post-deliberative research and six months post-research

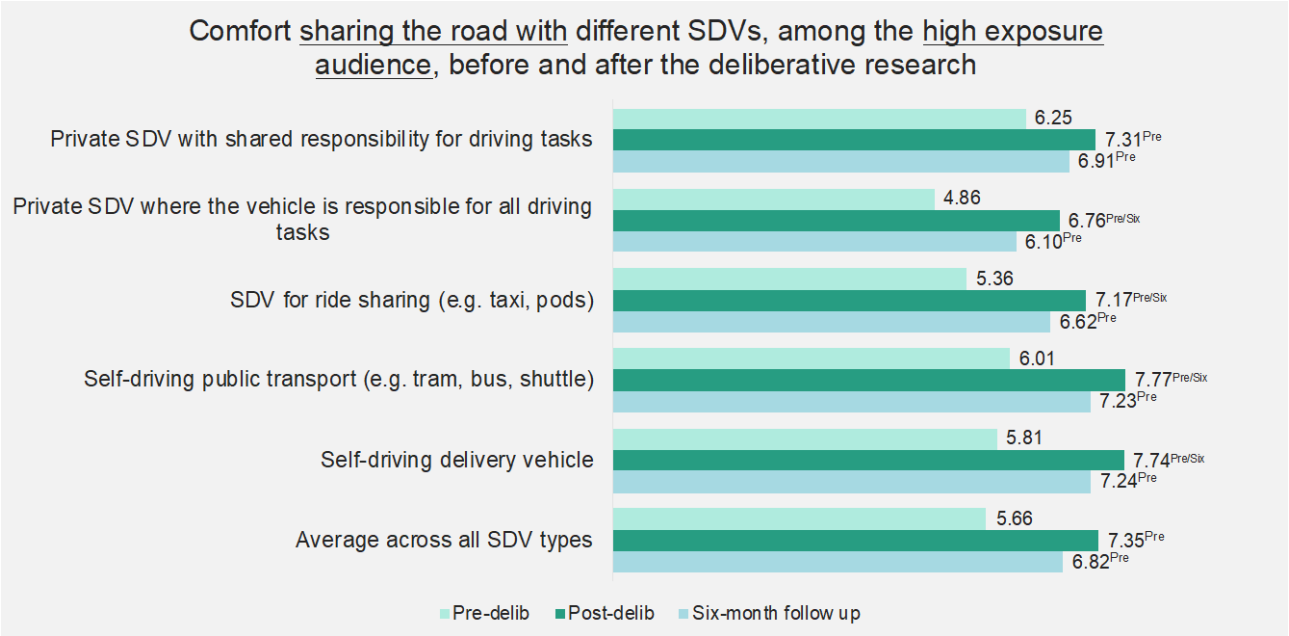

Figure 34 Comfort sharing the road with different types of SDV among the high exposure audience pre- and post-deliberative research and six months post-research

C1: On a scale of 0 to 10 where 0 is totally uncomfortable and 10 is totally comfortable, how would you feel (a) using / (b) sharing the road with the following types of self-driving vehicles for any journeys? Base: High exposure audience (all locations): pre-deliberative research n=223, post-deliberative research n=206, six-month follow up n=125.

Low exposure audience

Following the trial, the low exposure audience continued to report lower average **comfort levels** for both using and sharing the road with SDVs compared to the high exposure audience. While there were some marginal increases in overall comfort levels after the trial

compared to before the trial for this audience, these were limited (see 14.3 Technical appendix, note 13). However, those who took part in both the pre- and post-trial local polling reported significantly higher comfort ratings compared to those who only took part in the post-trial local polling, indicating that being primed to think about SDVs before the trial could have impacted this audience's engagement with it and views of SDVs as a result.

SDVs in the local transport system

Corresponding pre-research findings can be found in 6.4 SDVs in the local transport system.

High exposure audience

There were large increases (+18% on average across vehicle types) in the proportion who would **consider using different types of SDVs** across all journey types asked. Both before and after taking part in the research, participants reported being most likely to consider using a private SDV with shared responsibility for most journey types tested, with using self-driving public transport vehicles the second most likely option considered. The exception was for education where participants were most likely to consider using self-driving public transport vehicles after the research.

The continued high level of consideration for using private SDVs may seem at odds with participants' desire to see the local deployment of shared and public transport SDVs, as discussed throughout the wider deliberative process. However, this is likely because private SDVs were not rejected at any point, they were simply not seen to be the priority for addressing unmet transport needs. Further, participants had higher starting levels of consideration for using private SDVs compared to public transport or shared SDVs; despite this, by the end of the research consideration for using public transport SDVs had increased by 19%.

The fact that using SDVs where the responsibility is shared (user-in-charge) remains ahead of SDVs where there is no need for human input (non-user-in-charge) for all journey types suggests that this audience still have reservations about handing control entirely over to the technology. This could also be reflective of concerns about the extent to which human-driven vehicles and SDVs would be able to interact with each other if there were to be a mixed fleet on roads.

Six months after the research, consideration for using different types of SDVs remained higher than before the research for all types of SDV. While consideration of self-driving public transport, shared SDVs and self-driving delivery vehicles all remained at post-research levels after six months, consideration was lower for private SDVs; this was particularly the case for private SDVs with shared responsibility for which consideration returned to pre-research levels.

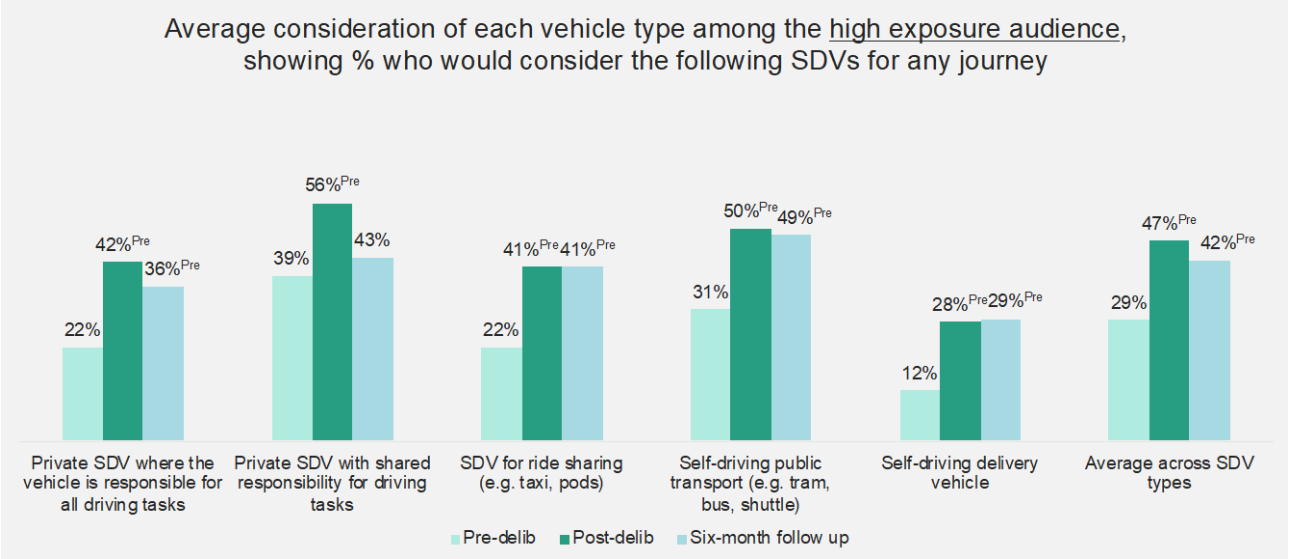

Figure 35 Average consideration of each vehicle type among the high exposure audience pre- and post-deliberative research and six months post-research

D2: Would you consider using any of the following types of self-driving vehicles for [journey type] and why? Please select all that apply. Base: High exposure audience (all locations): pre-deliberative research n=226, post-deliberative research n=216, six-month follow up n=125.

Almost three in 10 in the high exposure audience reported that the research made them feel SDVs are more capable of meeting local transport needs than they had thought at the start (58%). The high exposure audience were also more certain of the **potential impact of SDVs in their local transport system** after taking part in the research. At the start of the research, participants were close to evenly split on whether they felt SDVs could make their local transport system better or were not sure; after taking part in the research, the vast majority took a view, with the proportion of participants indicating they were not sure dropping significantly (12%, down from 45% at the start). Close to three quarters of the high exposure audience felt that SDVs could make their local transport system better by the end of the research, however there was also a small (non-significant) increase in the proportion saying SDVs could make no difference (12%, up from 8% at the start).

Increases in the view that SDVs could make their local transport system better were particularly large among those most uncertain at the start, including older people aged 65+ (77%, up from 28%) and women (75%, up from 36%). By the end of the research there were no significant differences in views between men and women, or older and younger participants, on this measure.

Six months following the research, the proportion who felt SDVs could make their local transport system better remained significantly higher than it had been before the research took place. However, there were indicative (non-significant) increases in the proportion who felt that SDVs could make no difference (14%, up from 12% at the end of the research) or could make their local transport system worse (8%, up from 2% at the end of the research) (see 14.3 Technical appendix, note 1).

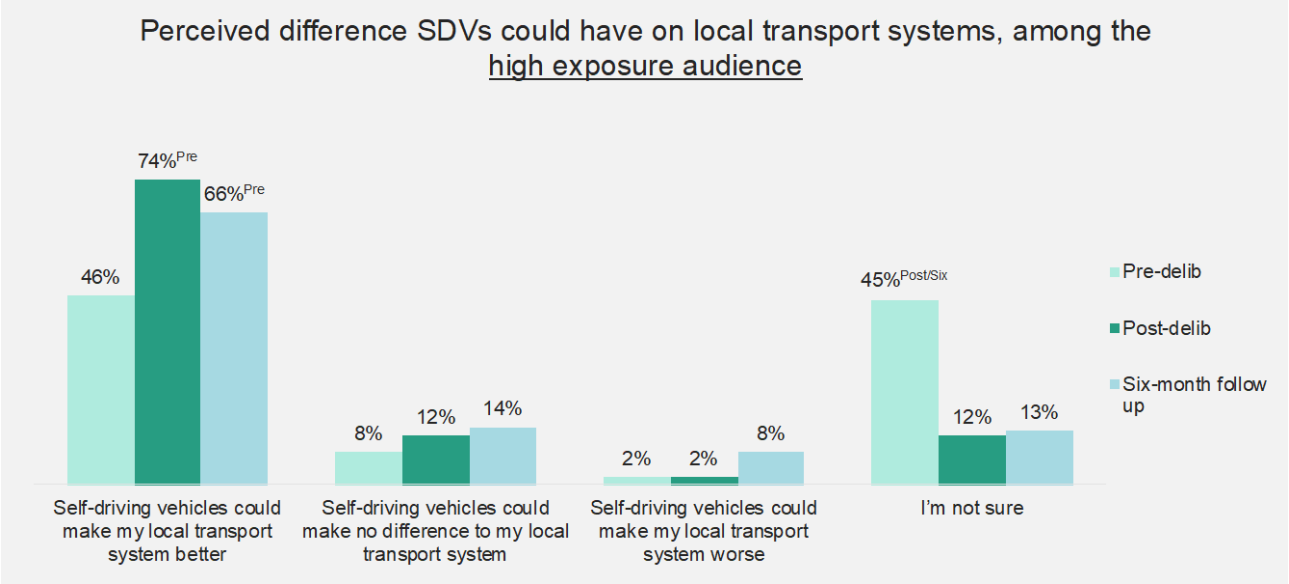

Figure 36 Perceived difference SDVs could have on local transport systems among the high exposure audience pre- and post-deliberative research and six months post-research

E2a: Based on what you know about self-driving vehicles, what difference, if at all, do you think they could have on your local transport system? Base: High exposure audience (all locations): pre-deliberative research n=213, post-deliberative research n=209, six-month follow up n=125.

The research resulted in less uncertainty and more positivity on the **balance of advantages and disadvantages of SDVs** among the high exposure audience. There was a significant increase in the number of participants that believed there were more advantages than disadvantages of SDVs (51%, up from 33%), and a significant decrease in the number of participants who said they were unsure about SDVs or that they needed more information about them (7%, down from 32%). Certainty was seemingly even stronger six months after the research, with an indicative (non-significant) further decrease in the proportion saying they were not sure (2%) and a corresponding indicative increase in the proportion taking a neutral or more negative view (see 14.3 Technical appendix, note 1).

Reflective of the larger increases in comfort with and consideration of using SDVs, increased positivity was larger for women (84% felt there were more or as many advantages as disadvantages, up from 49% at the start), driven by a significant decline in the number of women who felt that they were not sure or needed more information (9% at the end compared to 49% at the start of the research). This brought the proportion of women who said there were more or as many advantages than disadvantages of SDVs in line with men by the end of the research.

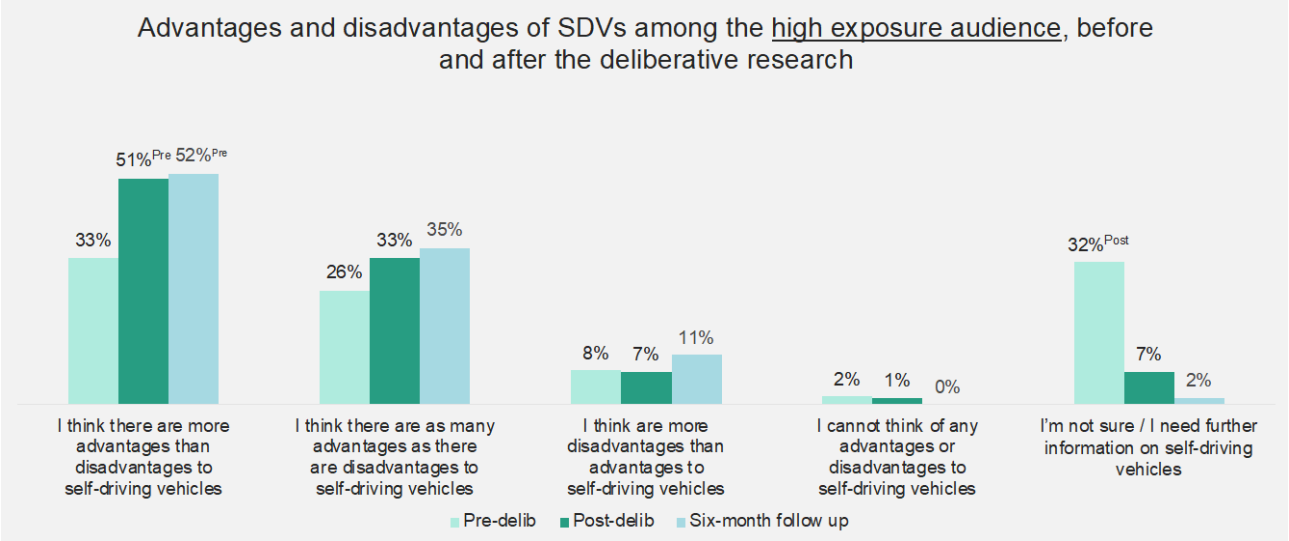

Figure 37 Perceived balance of advantages and disadvantages of SDVs among the high exposure audience pre- and post-deliberative research and six months post-research

C3: Which of the following best describes your view on the advantages or disadvantages of self-driving vehicles? Base: High exposure audience (all locations): pre-deliberative research n=222, post-deliberative research n=206, six-month follow up n=125.

Low exposure audience

For the low exposure audience, there was a significant decrease in belief that SDVs could make their local transport system worse (21%, compared to 27% before the trial). This shift was predominantly driven by an increase in positivity among women, with a significant increase in feeling that SDVs could make their local transport system better (23%, compared to 17% before the trial) and a corresponding significant decrease in feeling that they would make it worse (20%, compared to 30% before the trial) (see 14.3 Technical appendix, note 13).

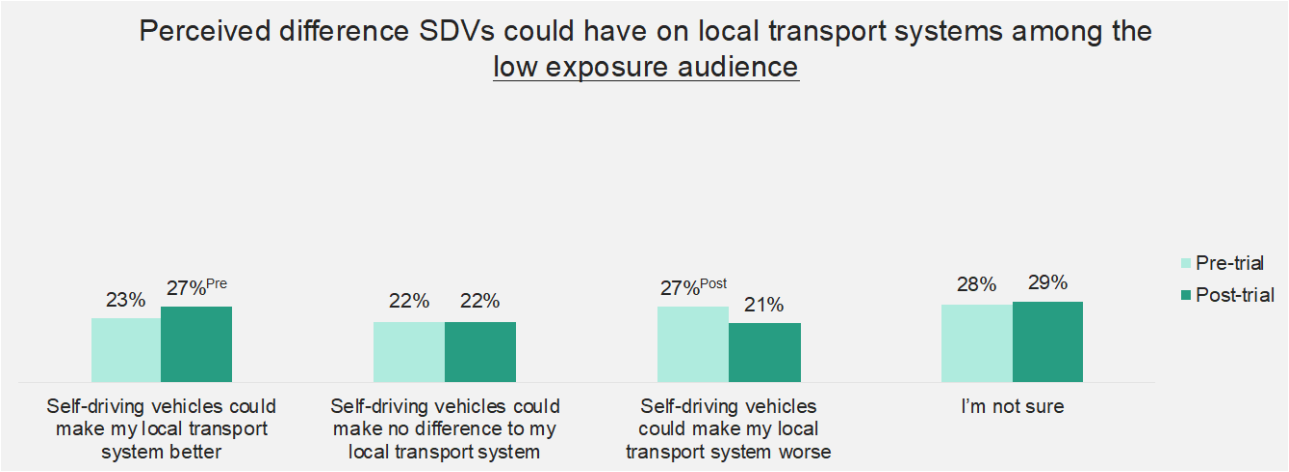

Figure 38 Perceived difference SDVs could have on local transport systems among the low exposure audience pre- and post-trial

E2a: Based on what you know about self-driving vehicles, what difference, if at all, do you think they could have on your local transport system? Base: Low exposure audience (all locations): pre-trial local polling n=750, post-trial local polling n=750.

11.2 Priorities and user requirements for SDV implementation

There is strong support for SDVs playing a role in future local transport systems among the high exposure audience. However, there were several essential priorities that participants felt should be in place prior to any local rollout. It was felt that government should play an active role in addressing each of these priorities including through setting standards and minimum vehicle and service requirements as well as by providing funding for local authorities and SDV manufacturers to adhere to these requirements when developing vehicles and designing local deployments.

These priorities tend to emphasise the need to build the public's opportunity and capability (as per the COM-B model) to drive uptake of SDVs should they be deployed. In order from most to least important, these priorities were:

- **Safety:** A key requirement was for safety to be assured through extensive testing and trials to demonstrate that SDVs are safe to use for everyone (including children and those with physical disabilities), and that they can operate safely across a wide variety of circumstances and scenarios. While this was a top priority for participants in all locations, there was little doubt or concern that sufficient safety testing would happen prior to planning any deployment.
- **Gradual rollout of SDVs:** A slow introduction of SDVs in local transport networks was seen as necessary to ensure time for the technology to be normalised. Participants wanted to be able to choose whether they travelled in a self-driving or human-driven vehicle in the early stages of deployment and while they were building their confidence and comfort with the technology. This would ultimately lead to a lower risk of outright rejection of the technology and higher uptake in the longer term.
- **Prioritising public and shared applications:** The biggest opportunity for SDVs was seen to be in shared and public transport. Participants wanted SDVs to be used to strengthen current public transport systems and address unmet needs. This was felt to deliver the greatest societal benefits by prioritising those who need better public transport options the most (see accessibility below) and ensuring fairness (see affordability below). This would also require lower levels of public buy-in at the outset as the technology would be publicly available as one of a suite of transport options that people can choose from, giving people time to get used to the technology (as users, passengers in other vehicles, pedestrians, cyclists etc) before committing to it for all journeys. Additionally, there was a perception that using SDVs in public transport would mean the vehicles would initially be deployed on set routes, which was seen to be a more predictable environment for the vehicle to operate in.
- **Integration with existing transport system:** Integrating SDVs with the existing transport system, rather than using them to replace existing options, was seen as critical to ensure that SDV deployment strengthens the transport system overall. It was seen to be particularly important that SDVs are used in a way that makes the most of and builds on existing transport options rather than making them redundant.
- **Affordability:** For SDVs to truly have a positive impact on local transport systems it was important that they are not prohibitively expensive at the point of use, ideally reducing, if not maintaining, the current cost of travel in the local area. This was important from a fairness perspective, preventing SDVs from becoming an exclusive, high-cost technology only available to 'the elite', but also to help resolve the issue of high-cost public and private transport. There was a perception that if SDVs were

prohibitively expensive to use people would not use them. This would make them redundant and prevent them from enabling better local transport systems.

- **Accessibility:** Participants wanted services using SDVs to be used by all, from planning and booking a journey, to boarding and riding the vehicles. Participants wanted to see the vehicles used and accessed by those that would benefit the most from them, namely those who do not currently drive (e.g. the elderly, people with disabilities that impact their mobility and young people below the legal driving age) especially in rural areas. It was strongly agreed that people who are currently the most excluded from being able to travel independently should be prioritised when rolling out SDVs.
- **Education and engagement:** Building public trust in SDVs was considered critical to unlocking the potential benefits of SDVs in the local transport system and future-proofing the return on investment of SDVs locally. It was especially important to participants that the public be made aware of the reality of any remaining risks, as an 'unbalanced' portrayal of the technology and vehicles would be met with scepticism and potentially rejection.
- **Consultation:** It was considered critical that there was public engagement prior to the deployment of SDVs to ensure that all needs are represented and catered for, particularly for those with physical accessibility requirements and those who are less confident digitally. There was also a strong desire for communities to be engaged prior to any SDV deployment to ensure the vehicles meet specific local needs. This was particularly important for rural participants to ensure that the technology is adaptable to different types of location. One suggestion was to include 'rural advisors' on each project to ensure this viewpoint was taken into consideration.
- **Sustainability:** Environmental sustainability was an important factor for many of the participants in our sample. There was an assumption that SDVs will inevitably be electric, and therefore better for the environment. While not fundamentally an aspect of self-driving technology itself, a transition to SDVs was seen as an opportunity to make local transport options greener and was a welcome 'side effect' that should not be missed.

"Before I put self-driving buses on the road, I want it proven to me that you've done all the relevant trials under any given scenario." (Deliberative participant, core audience, urban)

"Don't alienate sections of the population by making it inaccessible and exclusive." (Deliberative participant, core audience, urban)

"A big priority is ensuring everyone has access to it, because what's the point of introducing it if lots of people can't use them." (Deliberative participant, core audience, urban)

"Make sure it's actually appealing and worth using, and a good alternative to just jumping in the car." (Deliberative participant, core audience, urban)

"Will it be there in the long term? Because there is no point in investing in it and then it doesn't work because of vandalism, for example the bike system in Manchester was scrapped because all the bikes ended up thrown into the canal." (Deliberative participant, core audience, urban)

11.3 Vehicle requirements

Throughout the research, but particularly after trialling the vehicles, participants shared their ideas on specific requirements for SDV design. Towards the end of the second deliberative workshop, after having trialled the pod and shuttle and explored the delivery pod, participants were asked to design their own SDV. This allowed them to pick out, both explicitly and implicitly through their vehicle design, the features which they would most like an SDV to have in an 'ideal' scenario. Participants undertook this task either individually or in pairs and were encouraged to be creative with their designs.

When designing their own SDVs, participants were most likely to think of shared vehicles, like the pod and shuttle they had trialled, rather than designing futuristic versions of private vehicles. This impacted on the features and requirements they wanted to see, for example prioritising passenger safety over speed.

Accessibility was the most cited vehicle requirement, with commonly featured elements of vehicle design which were thought to make an SDV more accessible including:

- An extendable ramp at the entrance/exit to help wheelchair users and passengers with mobility difficulties get on and off easily.
- Alternatively, a step that could be lowered to be closer to the ground (some found the height and tilt of the step in the shuttle to be difficult to use during the trial itself).
- Designated space inside the vehicle for wheelchairs and/or pushchairs, including 'lock-in' features to fix chairs in place.
- Designated space for bike racks and/or luggage storage.
- Wide doors and handrails.

Additionally, participants wanted to see SDVs include up-to-date technology inside the vehicle. For example, Wi-Fi provision and plug sockets were raised as features which would enable passengers to use devices on board for both work and entertainment. While screens in the shuttle were not in use during the trial, seeing these prompted participants to consider the use of screens in their own designs either for entertainment or providing information. For instance, screens could communicate the necessary procedures to adopt if the vehicle failed and there was no human operator on board.

Furthermore, both when trialling the pod and when watching the video of the Waymo vehicles, participants responded positively to being able to see displays demonstrating the SDVs' cameras and sensors picking up nearby obstacles as this provided reassuring evidence of the technology working. However, there was no clear consensus as to whether this would be desirable for all SDVs. There was a similar lack of consensus about whether passengers should be able to see out of the front of the vehicle (as indicated in relation to perceptions of safety in 9.1 Impressions of the trial). While these views might have been a function of the novelty of the vehicles, they suggest that end users may have different requirements when SDVs are first introduced, requiring more information about how the vehicle is operating to help them get used to the technology.

There was an emphasis on the importance of good functionality, such as ease of use and effective use of internal space, more so than the external appearance of the vehicle itself. Participants saw the removal of a designated driving area as an opportunity to maximise capacity, along with ensuring adequate space for passenger comfort (i.e. seats not being

too close together) and including designated areas for the storage of bikes, prams, or luggage. Comfort was a particular concern for some older adults and people with disabilities, who reported struggling with existing public transport journeys that they found to be particularly tiring.

Participants broadly wanted SDVs to be used as part of a transition to more environmentally friendly transport, as this was felt to be aligned with current commercial and consumer interests. Both this and the emphasis on good functionality meant that participants tended to present novel vehicle designs rather than retrofits of self-driving technology into existing or traditional-looking vehicles.

The below images of participant-created vehicle ideas are typical of many designs that were created and provide clear illustrations of participants' expectations from the vehicles themselves.

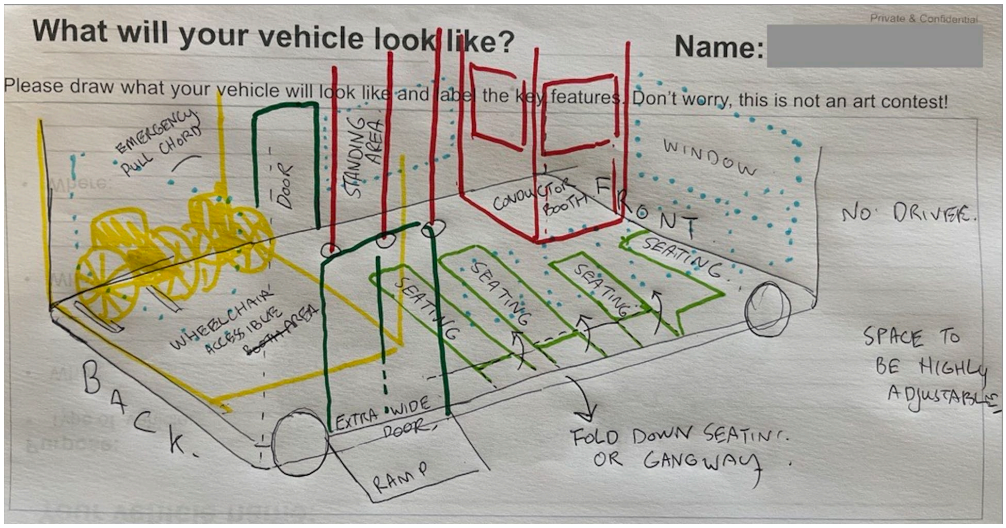

Figure 39 Participant-designed SDV idea (deliberative participant, core audience, town)

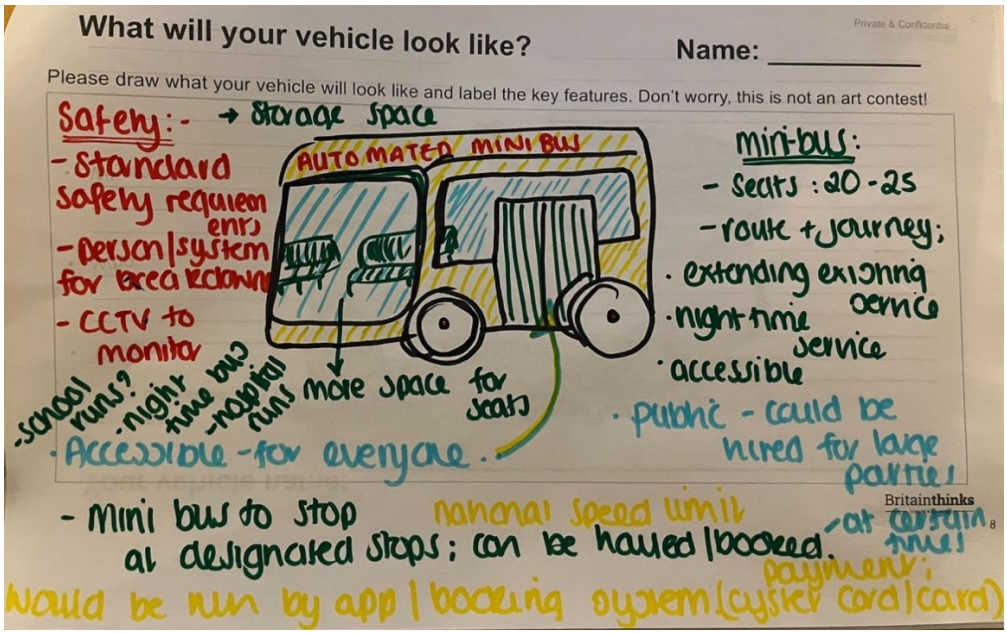

Figure 40 Participant-designed SDV idea (deliberative participant, core audience, town)

11.4 Communication needs

After receiving information about SDVs and taking part in the trial, participants were asked to design an information campaign or advert that would best describe SDVs to the public. Given the generally positive attitude towards SDVs, the information campaigns and adverts designed by participants overwhelmingly focused on communicating the potential benefits of introducing SDVs rather than any of their concerns. Even those who were sceptical responded to the task by focusing on what they would want to see happen rather than giving warnings against SDVs, suggesting they were open to SDVs in the right circumstances and if their concerns had been addressed.

Broadly speaking, to effectively improve awareness of SDVs it was seen as necessary to communicate their advantages over and above traditional human-driven vehicles. Using information campaigns and adverts to normalise the concept of SDVs, either as privately owned vehicles or as part of shared or public transport provision, was considered important, as the public still believed SDVs were a long way from operating on public roads. Communication requirements also reflect the priorities and requirements that participants had for the development and deployment of SDVs. Key aspects to communicate included:

- **Safety:** This was emphasised as a benefit for SDV users and other road users alike. While participants assumed SDVs would be proven to be safe enough by the time they were deployed, they felt that reassurance on safety would be a critical component for building trust with the wider public and to ensure that the technology was positively received. The two key safety features to communicate were SDVs' robust hazard recognition technology, and the fact that a high percentage of collisions are caused by human error. These communicate not only that SDVs are safe, but that they would be safer than human drivers. Participants also wanted to see practical information about how to be safe around SDVs (e.g. their maximum speeds, the distance needed around the vehicle that pedestrians needed to stay clear of to prevent it from stopping) and the certifications and standards that SDVs have met on safety.
- **Reliability and security:** This was often raised as a supporting argument to the safety of SDVs. It was mentioned that SDVs could be more reliable (in a private and public vehicle setting) through being a 'high tech' form of transport. Participants felt that the idea of AI operating SDVs with humans on hand as backup was a powerful message to communicate in a campaign, reassuring the public that technological advancements were leading to progress but not leaving the common sense, human element behind.
- **Accessibility:** Information campaigns and adverts frequently put accessibility front and centre and a key benefit to communicate. Imagery was used in the campaign designs to depict ramps and other forms of assistance for accessing the vehicle, and several participants included vehicles with designated wheelchair space in their campaigns. There was also a focus in the additional audience groups on showing the impact that using an SDV could have on someone's life, for example that it could make travelling less tiring for those with disabilities and/or health conditions.
- **Benefits of public and shared vehicles:** The majority of campaigns described the benefits of shared, rather than private vehicles. Particularly in the rural location, it was important to highlight the potential for improvements in the reliability of the public transport system. In the other locations, focusing on shared vehicles also meant emphasising the ability to cut down on congestion and carbon emissions, both of which were key benefits that appeared frequently in campaign designs.

- **Costs:** Participants felt much more positively towards the idea of SDV's after learning that these vehicles would be cheaper to run and maintain than existing human-driven vehicles. This was felt to be a key benefit to communicate.
- **Ease of use and user comfort:** Some participants incorporated humour into their campaigns, suggesting it might be a good way of catching the public's attention. Suggestions included an advertising campaign aimed at people who are 'bad drivers' but do not want to admit it. For example, advertising that the vehicle does the more difficult parts of driving, such as parking. Another suggestion included replacing the tagline 'ease of use' with 'ease of no use' to communicate the times where the driver does not need to do anything.
- **Evidence and statistics:** While participants said that they considered 'concrete' information to be important for providing reassurance on SDVs throughout other discussions, statistics and specific rules/regulations did not tend to feature in participants' information campaigns. However, this was likely due to participants not having this information to hand at the time of completing this task or not being able to easily recollect (or create, if they had not received them at all) these figures.

By the end of the research, the high exposure audience had some outstanding questions that the research had not addressed. While participants acknowledged that some of these questions would not be possible to answer until more was known about the technology and how it would be deployed, it was felt that the answers to these questions should be included in communications with the public once known. Questions fell into several categories as follows:

- **Safety and security** including what safety testing procedures would be implemented for SDVs in development; what regulations will be put in place for how SDV users' personal data would be collected, stored and used; what safeguards will be put in place to prevent vandals, hackers and/or unruly passengers from damaging the vehicles or preventing them from being used.
- **User requirements and responsibilities** including how processes such as insurance, driving tests and driving licences would be altered to accommodate SDVs, and whether this would result in higher costs for the user of an SDV compared to human-driven vehicles; whether current drivers will need to be upskilled or educated on how to drive alongside SDVs and how this would be done if so.
- **Responsibility for vehicles** including who would own and be responsible for maintaining shared SDVs; who would be liable for SDVs (private or shared) in the event of a malfunction or crash; and what testing processes would be put in place once SDVs were rolled out (e.g. MOTs).
- **Connectivity** including whether SDVs need to be connected to the internet at all times, and if so whether they would struggle in areas lacking satellite connectivity such as rural areas; whether an app would be required to operate SDVs; how SDVs will communicate with one another and with other road users while in operation.
- **Who SDV technology will be used by** including which organisations are currently using or planning to use SDV technology; whether SDVs will be accessible and affordable for all to use or if some parts of the population could be 'unfairly disadvantaged'.
- **Impact of SDV deployment on the local transport network** including whether the addition of SDVs will lead to increased or reduced road congestion; how self-driving public transport would be integrated into areas where public transport provision is currently low (such as rural areas).

- **Features and functionality of SDVs** including what the costs are for retrofitting vehicles with SDV technology; what features are required to make traditional cars fully self-driving; how SDVs will cope with challenging road and weather conditions; how SDVs learn from past experience; how SDVs predict the behaviour of other road users.
- **Infrastructure for deployment** including the overall financial costs of implementing the infrastructure required for SDVs to be rolled out, and who will pay for this; what speeds SDVs will travel at, whether they will have their own lane, and which other road users will it have right of way over; the timeframe for SDV rollout; whether SDVs and the infrastructure required for their rollout will be beneficial or harmful in terms of carbon emissions.

Further, as indicated in the quantitative data earlier in this section, even by the end of the research the high exposure audience did not have a fully accurate knowledge of user responsibilities when using SDVs or what is currently legal on UK roads in relation to self-driving technology. In addition to addressing these knowledge gaps, participants specifically wanted more information on the exact responsibilities of users in a user-in-charge and non-user-in-charge vehicle such as, for user-in-charge, whether users can use their phone, fall asleep, and whether they have to be ready to take over the driving task at all times.

11.5 Section summary

- The high exposure audience reported significant increases in positivity towards numerous aspects of SDVs as a result of taking part in the research, including on perceptions of confidence in, and safety and capability of, SDV technology; comfort with and consideration of using and sharing the road with SDVs; the potential impact of SDVs in the local transport system; and the balance of advantages and disadvantages of SDV use.
- These increases were primarily driven by a shift in the proportion of participants who felt they did not know enough about SDVs at the start of the research to forming their own opinions about SDVs by the end, with these opinions usually being positive. Meanwhile, those who had already taken a view on SDVs at the outset tended to retain their views by the end of the research, regardless of whether these views were positive or negative.
- These increases in positivity towards SDVs tended to remain, albeit often to a lesser degree, six months after the research ended.
- Participants in the high exposure audience had a number of priorities and requirements for the implementation of SDVs in their local area including ensuring safety was prioritised; a gradual rollout of SDVs; prioritising public and shared applications of SDVs; ensuring integration with existing transport systems; having education campaigns as well as programmes of engagement and consultation with local communities in place; ensuring services are affordable, accessible and sustainable. And accessible to all. Participants felt that government should play an active role in addressing each of these, primarily through setting requirements and providing funding.
- Participants in the high exposure audience had outstanding questions about SDVs that they felt were not addressed in the research and potentially could not be answered until more was known about the technology and how it would be deployed. These questions typically related to safety and security; user requirements and responsibilities; responsibility for vehicles; connectivity; who SDV technology will be used by; impact of

SDV deployment on the local transport network; features and functionality of SDVs; and infrastructure for deployment.

- Participants in the high exposure audience felt that the key aspects to communicate with the wider public in any campaign about SDVs included safety, reliability and security, accessibility, the benefits of public and shared vehicles, costs, ease of use and user comfort, and evidence and statistics.

12. Research conclusions and implications

We have structured our conclusions from this programme of work according to two key questions:

- What has the research told us about how best to increase knowledge and understanding of SDV technology, so that citizens can make informed judgments about them?
- How would people like to see SDVs deployed in their local areas to ensure that their introduction and operation is acceptable and based on people's real needs?

To enable the diverse range of actors and stakeholders that will need to be involved in the future development and deployment of SDVs to identify and implement these recommendations, we have structured the conclusions according to the COM-B model of behaviour change (see 4.2 How to read this report).

12.1 How best to increase knowledge and understanding of SDV technology

This section outlines specific **communication** implications for a range of potential stakeholders in the SDV space - from government (national and local) to commercial operators.

Communication and engagement recommendations for improving or enabling capability

We recommend the following:

- Provide information on the **basic facts** about SDV technology, which, coupled with the hands-on experience of prototype vehicles (see later), will considerably improve people's ability to envisage and thus judge how SDVs might be deployed in their local area in the future.
- Ensure education and information provision addresses knowledge gaps including what the technology is or could be capable of; what is currently legally allowed; and, once resolved, **what the responsibilities of different stakeholders are**, all of which will build confidence and understanding.

- Communicating that SDV technology **can promote accessible transport** and mobility, which will be a powerful message both in terms of inclusivity (ensuring all transport users feel a stake in the future deployment of SDVs) but also in demonstrating to the wider public that the technology is 'for all'.
- It would be beneficial to balance the widely held belief that SDV technology is likely to be expensive (for initial purchase and use) by explaining how **SDV technology does not need to be exclusively for those with the highest wealth** or indeed require unacceptably high public investment to make changes to infrastructure.
- The **broader end user benefits** of SDV technology should also be communicated; this could include user-friendly nature of the technology and how users might easily access services in future (e.g. via hailing/summoning services/apps), as well as the benefit of increased convenience of certain trips. Rather than 'selling' the benefits of the technology, this can help to inspire people to imagine how the technology might improve their local transport experiences, providing wider benefits such as social interaction, convenient late night or rural travel and more choice in transport options to meet personal needs/requirements. It can also help to address psychological barriers by improving understanding of the technology's capabilities.
- Communication should be directed at as **diverse a set of audiences as possible**, specifically 'reaching out' to groups such as older people and those less interested or confident in technology. This will ensure that future engagement includes those audiences that the research suggests might benefit most from SDV technology, for example non-drivers, those with impaired mobility and older people.
- The fundamental educational information described here would be best received from **local and national government bodies**, in contrast to those with commercial interests who are less likely to be perceived as having the public's best interest at heart. It should also acknowledge any areas of uncertainty and whether/how these are going to be addressed in future communications or trials; without this transparency, the public are likely to feel that they are not receiving a balanced picture of the technology, which could drive scepticism and distrust.

Communication and engagement recommendations for improving or enabling opportunity

While communicating information was important, the trial experiences proved to be decisive in the research in driving engagement with SDVs and how they might be deployed in local areas. Thus, we recommend:

- Conducting **further public trials** to encourage both the personal involvement and public visibility of trials taking place. This will provide opportunity for people to see the technology, helping to normalise the use of SDV technology and close the gap between the sense that this is a technology for the distant future or for somewhere else and the near future opportunities it could offer the local area.
- We recommend that trials be used to **engage people with potential concerns, limitations or risks** of the technology, thus creating more inclusive debate and engagement in how SDVs can be deployed effectively and acceptably for all. Trials should be co-ordinated by both national and also, importantly, local government.
- Communicating that SDVs can be deployed **in shared and public transport settings** to highlight the potential for wide social benefits to be realised (especially given the poor perception of public transport in the town and rural locations visited in the research). Other potential societal benefits that would come from introducing shared

and public transport (such as reduction in car journeys having positive implications for the environment, local road congestion and air quality) should be highlighted to capture the wider public imagination.

- Communicating how SDVs deal with **situations and environments that human drivers find difficult** will both illustrate the real-world capabilities of the technology and also help answer questions about how SDVs will manage more complex or challenging road situations. The goal of this communication should not be to 'convince' people of the benefits of SDVs per se, but to enable them to consider the possible deployment from a fully informed perspective.
- It is important to **challenge preconceptions** and help people to **think imaginatively about new use cases** and improvements on existing provision, as well as addressing practical concerns around vehicle accessibility, luggage stowage etc. Making it clear that new vehicles might not need to be limited by current vehicle design norms could create productive excitement about the technology - manufacturers have a clear role to play here.
- The way that participants responded to the use of **diverse expert testimony** points to the value of communicating that a wide range of experts from academia, public and private sectors with expertise across transport modes, are actively engaged in the development of the technology. Communicating this can reassure people that proper scrutiny is being applied as well as inspiring them to consider a wide range of uses for the technology, not just self-driving private cars.
- We recommend having **national government as the clear coordinator** of these experts; this will further demonstrate that the deployment of SDVs is being proactively considered while the involvement of **manufacturers and service providers** will help to normalise the technology and reassure people both that significant investment and commercial innovation is being directed at SDVs.
- Communication around the **timescale for deployment** of technology will also help the public to start to imagine SDVs being deployed in a way that meets local transport needs. Currently it is easy for people to imagine that SDVs are unlikely to be deployed soon and thus not worth considering when thinking about their transport systems in the near future.

Communication and engagement recommendations for improving or enabling motivation

When it comes to people's individual **motivations** to engage with SDV technology and how it could benefit them, as well as the reassurances they might need, we recommend the steps below. It is important to note that a number of these considerations also cut across into recommendations for improving the public's opportunity and capability to engage with SDVs.

- Communicating around the **potential for improved road safety and a reduction in collisions** is a key message to focus on. The way that SDVs can improve on human driving (e.g. in relation to the contribution of human error to collisions) will provide a powerful individual and societal benefit to consider. The potential safety benefits and the sometimes surprising 'facts' (such as the role of human error in collisions) should form a key foundation of public dialogue and debate. Evidence is key to effectively communicating the potential for SDVs to improve safety. This should include statistics, explainers and supporting facts relating to vehicle tests and trials. Communication should also include SDV hazard recognition capabilities and how SDV technology

compares with human reactions, attention and decision making. This communication should come from national government but there is also a key role for public safety organisations, experts/academics and manufacturers.

- As well as communicating the benefit of road safety, it will be important to **reassure** people (through the use of explanation and evidence) that SDVs are **safe in a variety of situations**. This should include their use in busy town and city streets to windy rural roads, and when interacting with diverse road users and vehicles. Failing to do so could dampen the motivation to consider SDVs in specific local areas. This is particularly important given the evidence that people felt SDVs would be good for 'other places' and not their areas with all their perceived unique complexities. The most appropriate organisations to communicate these messages would be national government, independent safety organisations, transport watchdogs, experts/academics and manufacturers, plus local government for locally specific applications/concerns.
- Further reassurance could also be needed relating to SDVs' **reliability** in use; alongside this ensuring people are informed and feel comfortable with SDV **security** is key and includes personal security of users, the **security of people's data** (as many people assume that use of SDVs will involve personal data sharing) and the security of vehicles themselves. National regulators and service organisations would be appropriate organisations to communicate on data security.
- As people engage more in imagining the use of SDVs, they also begin to consider the downsides and potential risks more. There was evidence in the research of the 'valley of disappointment' operating which, translated into future industry and government engagement on SDVs, could mean that people's initial enthusiasm (for engagement and/or the technology) wanes as they learn more and begin to consider limitations and risks. This points to a need for communication and engagement which is **continual and takes the public on a longer-term engagement** journey.
- A key concern that is likely to be a motivational barrier is around the question of **who is in charge of SDVs** in different situations. Thus, we recommend national government communication to reassure that the legal framework is currently being developed and will be fully agreed before SDVs are deployed.
- Other potential applications of SDV technology that are not immediately considered but could be personally motivating include the possibility for SDVs to **widen personal choice** for users and this aspect should be included in messaging. Presenting the public with the potential **sustainability** impacts that SDV technology could deliver is of great interest to some segments and therefore a key feature of the technology which could engage them. In addition to national and local government, environmental charities and experts/academics would be appropriate messengers in relation to sustainability.
- Finally, it is worth reiterating that the goal of communication should not be (and is unlikely to be) to convince people of the benefits of SDVs, rather it is to **ensure that they have a rounded view of what the technology is and is not**. As demonstrated in the research, greater knowledge alone does not necessarily lead to a higher level of positive consideration of SDVs with a key tension remaining between people's interest in and acceptance of the theoretical possibilities and the barriers of the practical, real-world deployment in their everyday lives and communities. This gap between abstract possibility and real world 'messy', local applicability remains a key motivational barrier to engage fully.

12.2 How to ensure the acceptable introduction and operation of SDVs

The research project was extremely successful in engaging people to think about how best to deploy SDVs in their area in a way that meets their individual needs and benefits the wider community while addressing local transport challenges. It was notable that the choice of diverse areas (Alnwick in Northumberland, Manchester, and Taunton in Somerset) with their different populations and transport systems, highlighted both shared and divergent requirements, with participants in Manchester seeing fewer overt opportunities for SDVs to benefit their area than their counterparts in the rural and town locations.

This section outlines specific implications for how best to deploy SDVs across a range of areas, in a way that is acceptable to people and meets genuine needs.

Enabling capability in SDV deployment

In order to ensure potential users (and those responsible for local transport systems) have the **capability** to develop and implement SDV technology in a way which benefits local people and meets their underlying transport needs, we recommend the following:

- SDVs should be **deployed with safety front and centre**, both in terms of ensuring that people feel safe using SDVs, are able to use them safely, but also that they benefit from the improved road safety that deployment of SDVs promises. Safe design and deployment includes travelling in vehicles and interacting with them as pedestrians and other road users, as well as their safe deployment in a range of different environments (e.g. town, city, rural and roads vs public spaces).
- Another key tenet of acceptable deployment is **accessibility**. Both those who took part in the research who had physical and mental disabilities, as well as long term health conditions, and 'mainstream' transport users, felt that accessibility was key to fair deployment. SDVs should be deployed in a way that ensures vehicles and services are fully accessible to people with a range of physical abilities or disabilities as well as digital abilities.
- Building on this point, SDV deployment should be designed in a way which **primarily improves on what is often seen as poor accessibility of current public and private transport solutions**. Use cases, such as wheelchair accessible on-demand bus services through to self-driving pods operating in town centres, were readily imagined in the research and demonstrate the public appetite for accessible deployment of SDVs. Therefore, ensuring that end users are physically and digitally able to access and use SDVs should be a core requirement for future deployment; this includes the supporting infrastructure and services required to book or learn about the technology.
- The **design of vehicles** is important in relation to accessibility and also in relation to stimulating the public imagination. This relates to functional design aspects such as adequate space for luggage or cycle storage to support multi-modal journeys or enabling comfort, or factors such as visibility of the road. Further research and development will be necessary to ensure that the design of vehicles meets the needs of diverse users so that they are able to enjoy equal access to the benefits of SDV

technology as well as ensuring that vehicles are fit for purpose for a wide range of use cases.

- As previously mentioned, communication and education are a key and necessary platform for the effective and acceptable introduction of SDVs. People imagined that **government would play a key role** in ensuring that the general public understands what SDVs are, how they operate and how to interact with them in order to feel comfortable with using them and seeing them deployed in their local area. Therefore, education programmes and communication campaigns will be a necessary part of the deployment of SDVs, to ensure that end users, and industry, have the psychological capability (i.e. knowledge, understanding and skills) required to successfully develop and deploy SDVs, this includes ensuring their safe use and interaction with all road users.

Ensuring citizens and local areas have the opportunity to use and deploy SDVs

To ensure the **opportunity** for publicly acceptable use and deployment of SDVs is maximised, we recommend the following:

- Communication and education will build public understanding of the role and potential of SDVs. **Consultation with local communities** will be necessary to make sure that they are being deployed in a way that reflects the specific needs of the area and community.
- In terms of enabling social opportunity, **public trials** will be key to both normalising SDV technology before full deployment and to enabling dialogue with local communities so that SDVs are deployed in a way that fully (and visibly) meets the needs of the local transport system, its users and the local economy.
- Trials will also have the benefit of ensuring appropriate **changes are made to the physical environment** in local areas so that SDVs can be deployed efficiently and effectively, minimising local disruption. Moreover, certain changes to infrastructure will be necessary in order to maximise the potential for trials to fully demonstrate and develop the potential for SDVs to improve people's travel experiences locally.
- An **'infrastructure first'** approach, where the changes required in the physical environment (e.g. ensuring connectivity requirements are in place, upgrading traffic signals or amending road layouts) are funded and implemented prior to the deployment of SDVs would support the longer term deployment of the technology. This would help to address concerns and risks such as poor connectivity impacting the reliability and performance of the vehicles and enable physical opportunity by changing the physical environment.
- This should also include developing and implementing **relevant regulatory and legislative changes** so that SDV technology can operate safely and effectively. This will have additional benefits that people in local areas have confidence that SDV deployment has been thought through and will be effective and safe. This will help to address concerns around safety of the technology and ideally would be accompanied with (national and local) communication that sets out the regulatory changes.
- Linked to this there is a broad consensus that SDVs should be **gradually rolled out** rather than deployed rapidly 'overnight' in an area. This is important to normalise the technology and to ensure that safety (which is a primary driver and barrier to deployment) is fully and publicly evidenced on local roads for all to see. It is possible that a more gradual roll out of SDVs would, over time, lead to a wider range of use cases for a wider range of users thus more effectively addressing the needs of local

communities and providing more opportunities for a diverse range of end users to benefit from the technology.

- In terms of the use cases for SDVs, there was agreement that the general public would like the technology to **improve and plug gaps in public transport and shared mobility** (e.g. enable public transport to extend timetables into the night and link currently poorly connected hubs or areas) before moving to private vehicles. Thus, investment and effort should be directed at these applications before (or at least alongside) focusing on developing systems and infrastructure for private SDVs.
- As mentioned in relation to communication, it is easy for the general public to suspect that SDV technology will be expensive to implement and use. Therefore, every effort should be made to ensure that SDVs, both public and private transport options, **are affordable for all users**, and where relevant financially supporting the development and deployment of public or shared services (e.g. in areas where demand is lower but where the societal impact is greatest).
- This suggests a role for **government to facilitate investment** in areas where there might be lower populations, but a potentially greater level of societal impact for SDVs. Indeed, there is an expectation that (national) government will be an active player in setting out regulation, requirements and potentially providing funding to ensure SDVs are not deployed solely for profit, but realise their potential to increase wider access to affordable and accessible mobility.

Addressing motivation to use/deploy SDVs in local areas

Visibly implementing SDVs in a way that meets local needs and plugs gaps in existing provision will be motivating in itself to transport users who have grown used to working around the challenges that they identified at the start of the research process. Therefore, to increase individual **motivation** to consider SDVs, we recommend the following when it comes to deploying the technology in local areas:

- Many participants did not believe that improvements to their local transport systems were likely to be made, without the overhaul that SDVs could bring. Therefore, using SDVs to **provide solutions to existing transport barriers** and ensuring that the public **are aware of these opportunities** will help increase the motivation for their use.
- In particular, SDVs should be deployed in a way which provides a **comparable, or better alternative,** to the journeys currently undertaken by private car (e.g. increasing rural bus services or late night public transport, providing cheaper alternatives to town centre parking, enabling reliable door to door journeys).
- When it comes to motivating particular audiences, especially those with disabilities or older users, ensuring that vehicles are **fully accessible** will be motivating by removing perceived and actual barriers as well as providing genuine personal benefits (of being able to better access transport and also make journeys that might otherwise not be possible).
- We have discussed the importance of safety in communication (see 12.1 How best to increase knowledge and understanding of SDV technology) and deployment, and this is also key as a motivation. Deployment of SDVs in a way that is both **safe (thus addressing motivational barriers) and offers positive safety benefits**, will provide additional motivation to engage with, deploy and use SDV technology.
- A final expectation for deployment of SDVs is their **sustainability**. Not only is sustainability a key societal concern, it is of significant personal interest to many people who will expect SDVs to be more sustainable than current solutions, either because

they are electric vehicles (EVs) or because they clearly offer a more environmentally friendly way of travelling than, for example, single person private car journeys. Ensuring that SDVs enable the public to engage in more sustainable transport behaviours will help increase the motivation for their use.

13. Location-specific findings

This section of the report focuses on the key differences and local level findings for each of the three research locations: Alnwick, Manchester, and Taunton. Rather than providing a comprehensive analysis of the research findings for each area, this section outlines the most relevant and significant differences observed in local perceptions of SDVs and the local opportunities and potential applications envisaged by participants. This section focusses on the views of the high exposure audience unless stated otherwise.

13.1 Alnwick (rural location)

Local transport landscape

As in other locations, travelling by private vehicle (car) was the most popular option for participants living in Alnwick and the surrounding area. The limited availability of public transport, lack of interconnectedness between different transport modes, and poor cycling and walking infrastructure made driving feel like a necessity more than a choice for those who are able. Local public transport services were primarily used by non-drivers, with limited use by those with the option to drive.

There were several unmet needs in the local public transport system in and around Alnwick. These centred around the infrequency of bus services due to timetabling, as well as workforce shortages, lack of direct bus services, lack of services at night and on weekends, high costs, high reliance on taxis, and overall a lack of connectivity between different modes and services resulting in difficulty travelling between local villages and to nearby cities and towns.

Initial views on potential role of SDVs in local transport systems

Participants in Alnwick began the research with a more reserved view of the potential for SDVs for their own use. The quantitative data indicates that those in Alnwick were significantly less likely than those in Manchester to consider using a private SDV with shared responsibility for the driving tasks for business journeys (23% in Alnwick vs. 38% in Manchester). They were also less likely than those in Taunton to consider a private SDV where the vehicle is responsible for all driving tasks for leisure journeys (21% in Alnwick vs. 36% in Taunton). Finally, participants in Alnwick were less likely than those in

Manchester to consider using an SDV for deliveries (7% in Alnwick vs. 19% in Manchester).

Perceived opportunities

While they expressed broadly similar views to those in other areas regarding the potential **benefits and opportunities** for SDVs, participants in Alnwick identified some that were more specific to their rural context.

- **Providing more independent travel options for non-drivers** was seen as a particularly important benefit that could arise from the use of SDVs in and around Alnwick.
- **By delivering improvements to local public transport,** participants felt that greater independence could be delivered for those with mobility impairments, those in areas poorly served by existing public transport and those who cannot or do not drive their own vehicle. SDVs were seen to support a decreased risk of social isolation for these groups.
- **Increasing a sense of independence, freedom, and flexibility:** SDVs could potentially enable public transport services to operate 24 hours a day, seven days a week, creating benefits for a range of users.
- **Providing health and wellbeing opportunities:** SDVs could support a decreased risk of social isolation for those with disabilities that impact their mobility, the elderly, young people, those living in areas poorly served by public transport and those who cannot afford to purchase and/or run their own vehicle.
- **Creating opportunities for the local economy and employment**: Local tourism places pressure on Alnwick's local transport network during the summer months. The use of SDVs to provide better public transport coverage across the region would reduce the reliance on private cars for tourists. This would result in benefits for local residents by reducing congestion and have regional economic benefits by giving tourists access to a wider array of local destinations and landmarks, including those that are more rural or remote.

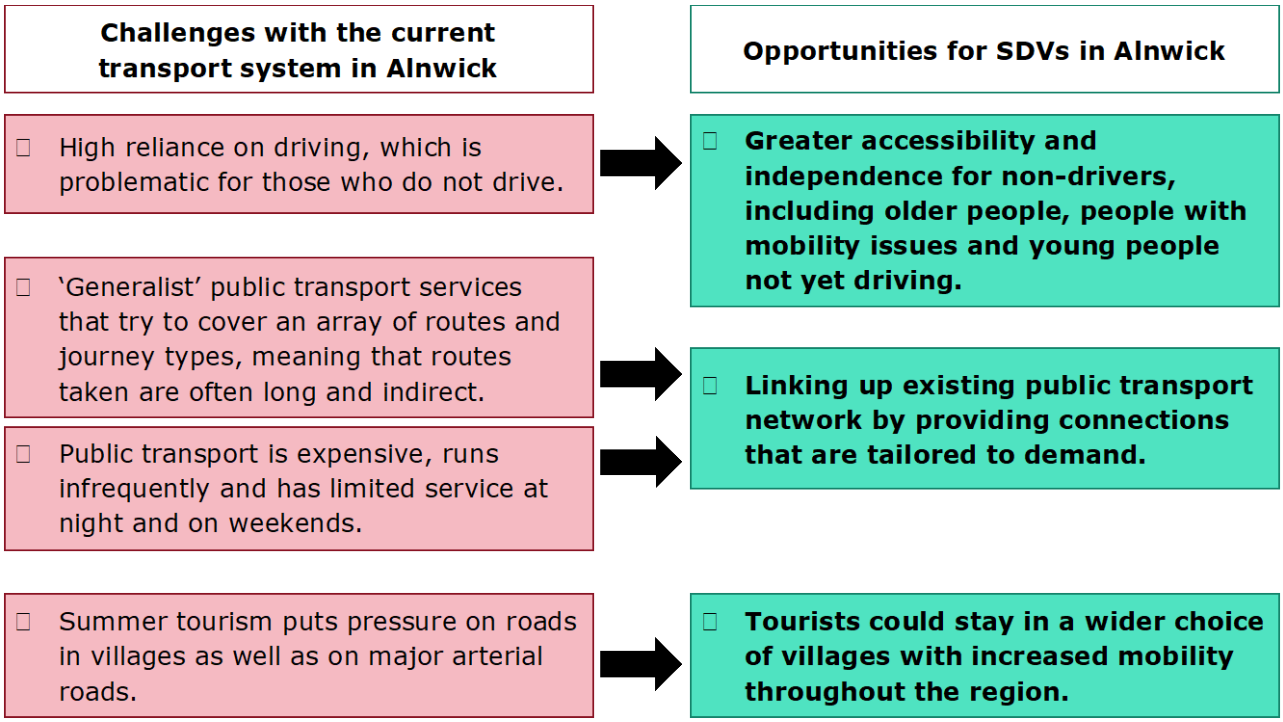

Figure 41 Benefits and opportunities for SDVs in Alnwick

Perceived risks and barriers

Although broadly optimistic about the potential opportunities created by the introduction of SDVs in theory, participants in Alnwick were more sceptical than participants in other locations. This is consistent with previous research that indicates that those in rural areas tend to question the overall viability of SDVs, believing that they will be available in cities sooner than rural locations (Department for Transport, 2019).

Drawbacks and risks perceived by participants in Alnwick primarily centred on concerns that SDVs would **not be effective in their local area in practice**.

- Participants felt there was a **high chance of SDVs malfunctioning on rural roads** due to the often complicated and unpredictable nature of those roads, causing safety risks to those riding in the SDV and to other road users. This stemmed from reservations about the ability of SDVs to operate on rural roads which typically have poorer surfaces, less connectivity or satellite coverage and more obstacles such as animals. Participants expressed concerns that malfunctioning vehicles could leave passengers stranded in remote areas with poor internet and cellular coverage and could create hazards on local roads if abandoned in a dangerous location.
- In practical terms there was a sense that SDV technology was **better suited to urban environments**, controlled and contained areas such as airports or sport venues and motorways where they could have a dedicated lane.

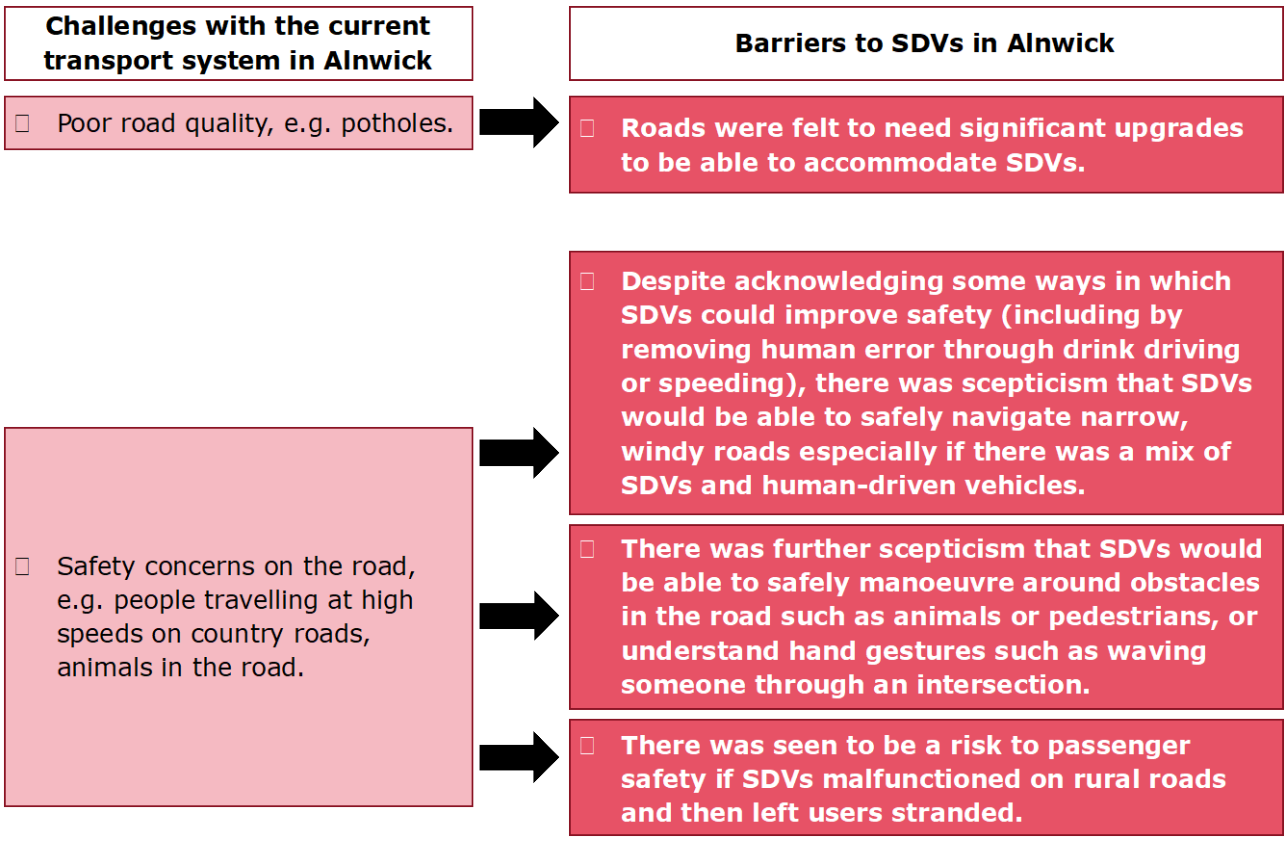

Figure 42 Drawbacks and risks of SDVs in Alnwick

Potential local applications for SDVs

Participants felt that the use of SDVs in and around Alnwick could improve local public transport services by addressing current gaps, supplementing existing transport options without replacing or overhauling the local transport system entirely.

One of the key challenges to address was the connection between homes and existing transport options. Participants reported feeling restricted when the nearest access to public transport was far away and along roads that are perceived as dark and dangerous. The following applications were therefore identified:

- **Taxis or mini-bus services running short or even tailored routes** to connect people to nearby public transport or transport hubs (such as park-and-ride), as well as villages and town centres. Due to the a small and widely spread population, it was difficult for participants to imagine how additional bus services alone could cater to low and inconsistent demand.
- SDVs were seen to be able to provide **more frequent and direct public transport** options as they were not limited by driver availability and the cost of paying drivers, particularly for undesirable shifts such as evenings, nights and on weekends.
- Participants thought **SDVs could enable public transport services to operate 24 hours a day, seven days a week**. They felt that SDVs could make travel more direct and efficient by breaking up a single long route into multiple services covering shorter routes, and adding coverage in areas without existing services as there would not be a restriction in terms of staff availability or cost.

- There was also a hope that SDVs could be used as an alternative to human-driven vehicles in villages helping to ease congestion by reducing the need for cars and parking spaces.

Additional ideas for SDV applications in and around Alnwick included:

- Better delivery coverage to rural areas (e.g. grocery delivery), while also potentially reducing congestion and the number of large delivery vehicles on small/rural roads.
- Long-distance driving using self-driving features on motorways and A roads.
- School services to help reduce the reliance on local taxi services in rural areas.
- Hospital transfers and transfers to medical centres for appointments.
- Options for travelling home at night, including from pubs to reduce the risk of people driving under the influence of drugs or alcohol.
- Support in agriculture (e.g. bringing in the harvest 24/7).

Factors to be addressed prior to SDV rollout

If SDVs were to be used locally, participants felt that infrastructure improvements would be necessary to accommodate this. There was a strong belief that for SDV deployment to work in and around Alnwick, substantial investment in infrastructure would be needed. This included:

- Widened roads and extra lanes, as well as improvements to road surfaces (e.g. fixing potholes) and road markings.
- Improved charging infrastructure for electric vehicles across the local area, as SDVs were assumed to be electric.
- Incorporation of SDV deployment into wider transport planning, ensuring SDVs can fill current gaps in transport provision and provide connections between other modes of transport where this doesn't already exist (e.g. between bus and rail stations/services).

Ultimately though, participants in Alnwick were sceptical about their local authority being able to afford or justify the expense of the new technology and the perceived infrastructure requirements, which made the prospect of SDV introduction in the local area feel unlikely.

Impact of information provision on views towards SDVs

Participants in Alnwick tended to grow more positive about SDVs as they learnt more about them, consistent with those in other research locations. However, they had ongoing questions which were not fully addressed by the information provided. These included how SDVs would manage rural road conditions, and whether poor internet and cellular connectivity in rural locations would cause problems for SDV functionality. Upon learning about retrofitted vehicles such as the buses demonstrated in the Stagecoach video, participants questioned the impact and effectiveness in rural areas where public transport provision is already very low.

Digitally disengaged participants, who were one of the additional audiences engaged with in Alnwick (alongside young people), worried that users would have to be technologically savvy to operate SDVs, for example by using apps to hail the vehicles. This raised

concerns that SDVs might further reduce accessibility for certain groups such as older people, who it was felt could gain the most benefits from these technologies.

Impact of trial experience on views towards SDVs

In Alnwick, the shuttle trial broadly reinforced the perception of the potential for minibus-style SDVs to fill current gaps in existing services by providing a cheaper and more reliable way to travel at all times of day and night. However, there were concerns that the shuttle used in the trial would struggle to navigate more remote roads (outside the village centre), which tend to be narrow and have tight or blind corners, due to its size and speed. The sizes of the pod and delivery pod were small enough that rural participants felt confident that they could navigate narrow roads and lanes in their area. This should be taken into consideration when designing vehicles for use in rural locations.

In all research locations, participants' views towards SDVs were largely impacted by how smoothly their individual experience went. Particularly in Alnwick, the right-turn out of the local bus station halfway through the route prompted participants to question how an SDV would make decisions about giving way, and whether it was capable of deciding to pull out when it does not technically have right of way but it would be beneficial for other road users for it to do so. This prompted some concerns about the ability for SDVs and human-driven vehicles to share the road if SDVs were to stick strictly to the highway code where human drivers might make different decisions.

Future scenario exploration for SDV deployment

Fiscal measures to support public transport in rural areas was a popular intervention for participants in Alnwick when deciding how SDVs could be deployed locally in future. In particular, participants wanted to see new or upgraded infrastructure put in place early to ensure a seamless rollout of SDVs. Further, this intervention was chosen particularly often by groups starting with the private SDVs scenario as part of an effort to adjust the scenario back to a focus on the biggest public transport gaps.

Informed 'citizen' conclusions on the use of SDVs in future local transport systems

By the end of the research, participants in Alnwick reported being more comfortable using and sharing the road with SDVs (Figure 43) and felt SDVs were safer (Figure 44). There was also an increase in the proportion who thought there were more advantages than disadvantages to using SDVs (54% post vs. 29% pre). In addition, 71% of Alnwick participants felt that SDVs could make their local transport system better, compared to 44% at the outset. Six months on this sentiment was maintained, with 67% still feeling that SDVs could make their local transport systems better.

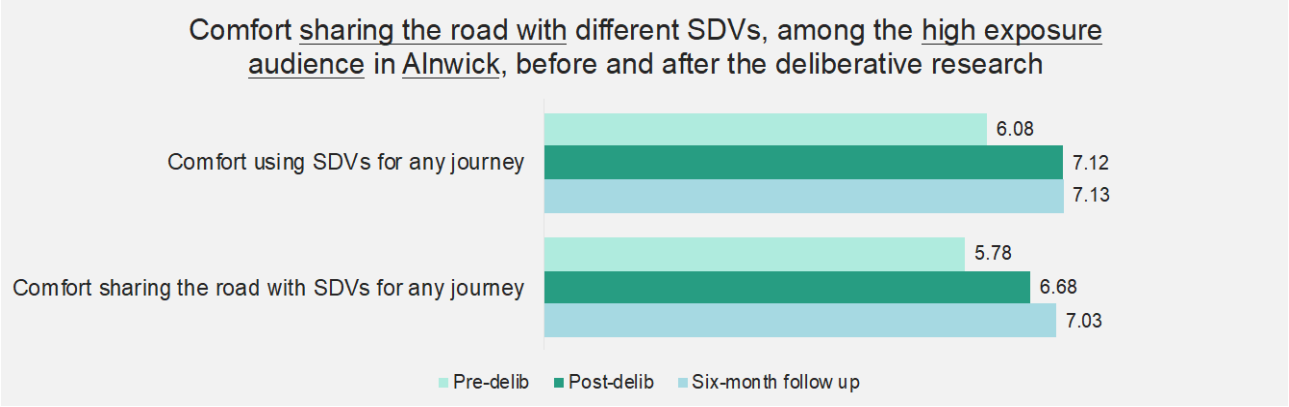

Figure 43 Comfort using and sharing the road with different types of SDV among the high exposure audience in Alnwick pre- and post-deliberative research and six months post-research

C1: On a scale of 0 to 10 where 0 is totally uncomfortable and 10 is totally comfortable, how would you feel (a) using / (b) sharing the road with the following types of self-driving vehicles for any journeys? Base: High exposure (Alnwick): pre-deliberative research n=69, post-deliberative research n=57, six-month follow up, n=36.

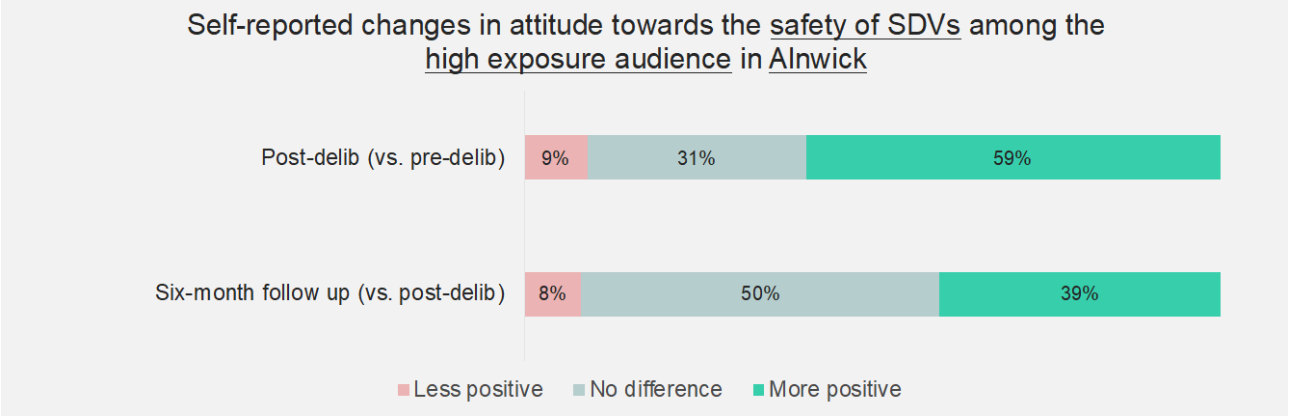

Figure 44 Self-reported changes in attitude towards the safety of SDVs among the high exposure audience in Alnwick post-deliberative research and six months post-research

F2a (Post-deliberative research): How do your feelings now compare to how you felt before the research event about self-driving vehicles? / F2a: Having had time to reflect on the research event you participated in roughly six months ago, how do your feelings now compare to how you felt just after the research event about self-driving vehicles in your local area? Base: High exposure audience (Alnwick): post-deliberative research n=51, six-month follow up n=36.

By the end of the research, participants in Alnwick continued to believe that SDVs provided a good opportunity to address gaps and unmet needs specifically in their local public transport services. They felt that the design and deployment of SDVs should prioritise groups who currently face the biggest challenges travelling independently due to the remote nature of the area, and therefore have the most to gain from SDVs. This included those with mobility impairments, those in areas poorly served by existing public transport and those who cannot or do not drive their own vehicle.

Despite positivity, participants still broadly saw SDVs being implemented in urban areas first for practical reasons, believing that cities and towns have better pre-existing infrastructure to enable the technology to operate effectively. There was also scepticism towards the level of funding for rural parts of the country compared to more urban areas.

Claimed experience of transport improvements being promised but not delivered in their area (such as dualling the A1) or the lack of investment into existing issues (such as potholes) drove scepticism amongst a significant minority of rural participants. To combat this, rural audiences wanted to see evidence of planned, tangible actions with measurable outcomes to be convinced. Some rural participants also wanted to see 'rural advisors' on SDV projects to ensure specific local needs were taken into consideration.

13.2 Manchester (urban)

Local transport landscape

While participants in Manchester shared a preference for driving with those in other research locations, their attitudes towards public transport were generally more positive. Use of and satisfaction with local public transport were typically high, with it often chosen over driving when travelling into the city centre due to congestion as well as the high cost and limited capacity of parking. Participants in Manchester generally felt that they had few barriers to mobility due to the large variety of transport options available to them.

Despite this, there were some areas in which it was felt local public transport could be improved including better integration and 'joining up' of services from different operators, increasing lateral links between suburban areas, increasing service provision in evenings and at night, improving personal safety and security, and allowing cycles on board public transport to enable multi-modal journeys. However, these were seen to be minor tweaks and adjustments to improve on an already strong local transport network.

Initial views on potential role of SDVs in local transport system

Overall, those living in Manchester tended to view SDVs more positively than other areas. The quantitative data suggests that they are more likely to feel comfortable with the idea of using SDVs across a range of journey types, believe that SDVs could make their local transport system better and believe there are more advantages than disadvantages to SDVs.

Participants in Manchester reported being more likely to consider using a 'self-driving delivery vehicle, delivering goods and services ordered remotely' (19% compared to 7% in both Alnwick (rural) and Taunton (town)) at the start of the research. Equally, they were also significantly more likely than those in Alnwick (rural) to consider a 'private SDV where the responsibility for driving is shared between the human driver and the vehicle' for business journeys (38% in Manchester vs. 23% in Alnwick).

Perceived opportunities

Despite feeling quite positive towards the technology generally, participants in Manchester saw limited **benefits and opportunities** for SDV use in their local transport system. This was likely due to the existing strength of Manchester's local transport network and limited perceived requirements for improvement, with participants struggling to see what SDVs could offer that could not be addressed with improvements to existing transport options.

Participants felt, however, that SDVs had the potential:

- To improve **transport frequency and reduce costs**, as driver availability and pay would no longer be relevant to the operation of these vehicles.
- To be introduced in taxis and public transport services, which could improve the provision of **evening, night, and weekend services**.
- Further, SDVs could help to **better link up existing transport options,** particularly with the addition of lateral links across the city (without having to go into the centre and back out), improving efficiency of travel for users.

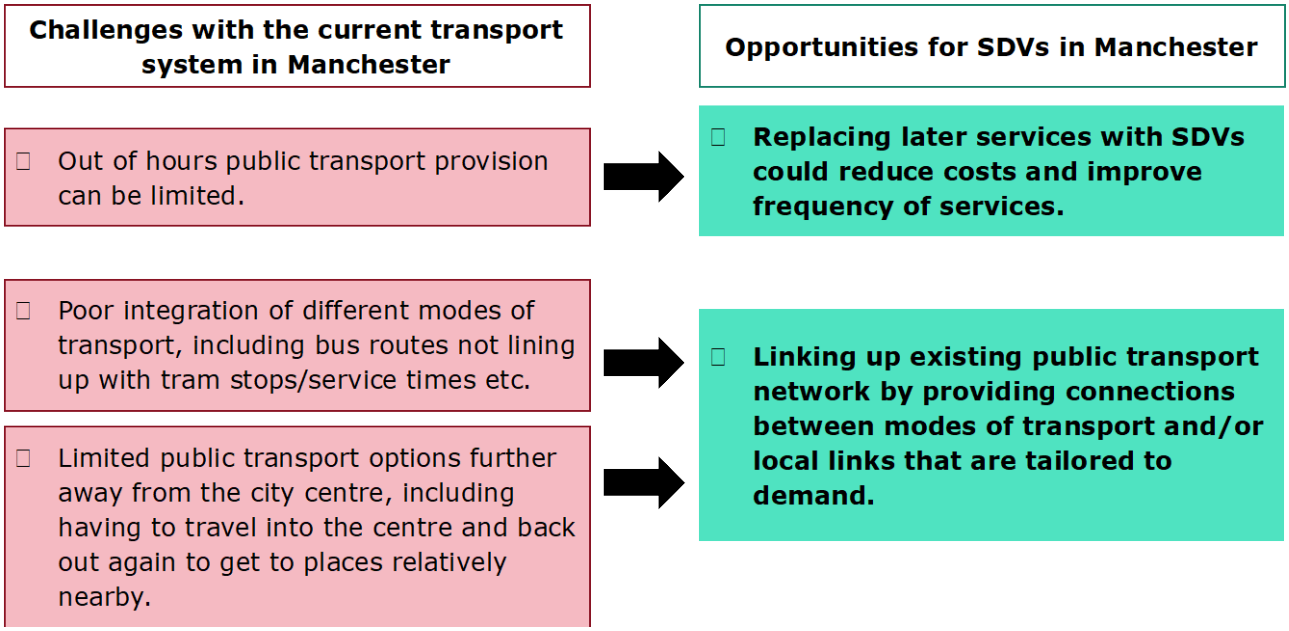

Figure 45 Benefits and opportunities for SDVs in Manchester

Perceived risks and barriers

Despite not being able to identify many potential use cases or applications for SDVs or feeling strongly that SDVs could improve the local transport network beyond what could be achieved with existing options, participants in Manchester also had limited reservations about their use. Perceived **drawbacks and risks** included:

- **Potentially higher costs** for local authorities and public transport users to fund the purchase and operation of SDVs as well as any new or upgraded infrastructure required for their use. Participants worried that these costs would come back to them either directly or indirectly through the deprioritisation of funding for other local initiatives.
- Participants also felt that SDVs could **worsen personal safety and security** through the lack of staff (seen as a neutral third party) on board, particularly when travelling alone or at night.

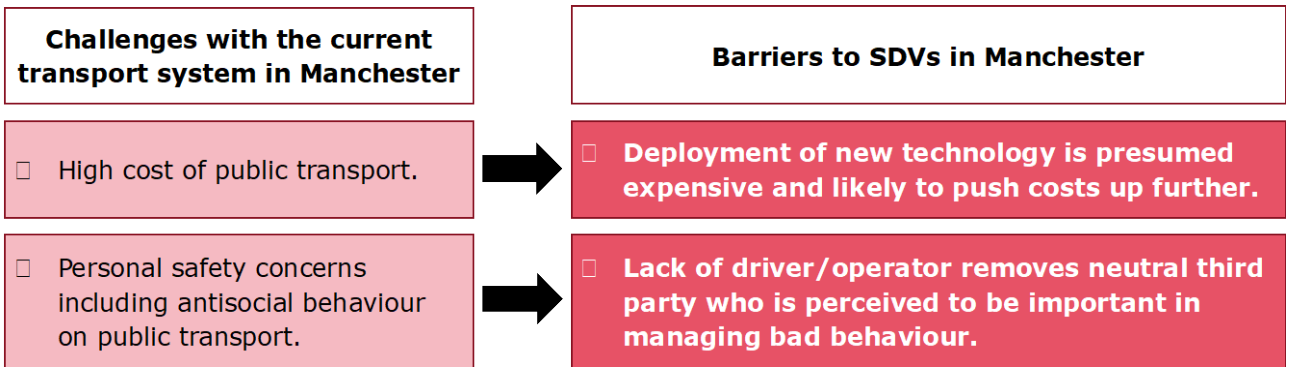

Figure 46 Drawbacks and risks of SDVs in Manchester

Potential local applications for SDVs

In addition to the potential benefits that SDV technology could offer, and notwithstanding the belief that Manchester already has an effective local transport system, participants noted the potential to use SDVs to provide new services in Manchester, including the provision of shuttle services at airports, festivals and large campuses where they can connect large, but often self-contained, areas.

In terms of goods delivery, participants also saw the potential for SDVs to improve service coverage and offer more, as well as more convenient, delivery times.

Factors to be addressed prior to SDV rollout

The main issue that participants in Manchester felt needed to be addressed to make SDV rollout as effective as possible was ensuring their integration with the existing, and comprehensive, transport system. This included joining up timetables and adjusting the infrastructure to accommodate SDVs in terms of road space.

Impact of information provision on views towards SDVs

As in other locations, participants in Manchester tended to become more positive about SDVs as they received more information about them. These participants broadly felt comfortable sharing the road with SDVs; this was particularly the case for journeys such as frequently travelled routes where participants felt that SDVs would operate predictably and consistently. For these routes, participants assumed that the SDV would be able to learn a set route to follow, minimising the perceived likelihood of the vehicle having to make decisions during the journey. Furthermore, if used regularly along the same route, it was also felt that other road users would know how to behave in its vicinity as the SDV would be a familiar sight. For many, but not all, this also meant SDVs being clearly distinguishable from other non-SDVs.

Concerns voiced earlier in the discussions about potential risks to personal safety if the driver, seen as a neutral third party, was removed, were somewhat alleviated upon hearing about the potential role of on-board staff in the Stagecoach video. The presence of a human operator, for example in the form of a bus conductor, was also seen to mitigate

some concerns relating to job losses and a lack of in-person customer service and support.

However, after receiving the information provided in the research, participants were still left wondering how humans and SDVs would interact if sharing the road as well as the extent to which humans would retain any control over the driving task (e.g. through an override button in the case of an emergency). Participants found hearing about having a choice to easily switch between self-driving and human driven modes reassuring.

Impact of trial experience on views towards SDVs

After the trial, participants could see some potential for shuttle-style SDVs as an option for short journeys in Manchester, including to improve connectivity between existing transport options. However, their view that there was no clear gap for SDVs to fill due to the extensive and well-established transport options already available, was not significantly impacted by the trial experience. This was particularly the case for the pod trial, which participants struggled to see a clear need for in Manchester.

The shuttle was often perceived by participants as 'offputtingly slow', with the trial route taking the vehicle on a dual carriageway where participants could easily compare its speed to that of other road users. This led to concerns about SDVs arriving at destinations on time, irritating other road users, and potentially contributing to inner-city traffic. Further, the low capacity of the trial SDVs in comparison to existing public transport options also led to questions about the extent to which the vehicles could have a meaningful impact. These factors should be taken into consideration when designing services for such locations.

Participants in Manchester were warmer towards the concept of a self-driving delivery pod than those in other research locations, possibly because delivery services and collection lockers are more prevalent in urban areas. However, participants also expressed some scepticism about the practicality of deploying self-driving delivery pods in busy urban areas, imagining that vehicles would struggle to move amongst the heavy foot traffic of the city centre. Combined with their broader satisfaction with existing delivery and collection services, this dampened their overall impression of the usefulness of this SDV application in Manchester.

Future scenario exploration for SDV deployment

Public transport was highly valued and seen as critical to SDV deployment. Therefore, like in other locations, participants in Manchester focused on interventions that prioritised SDVs in public transport. Furthermore, earlier concerns about self-driving and human-driven vehicles interacting with each other led to participants wanting the necessary infrastructure put in place to manage SDVs integration into the current transport system prior to any of the vehicles being deployed. Finally, participants wanted strong regulation of SDVs to be established prior to their use. They referred to issues around the introduction of electric scooters, with policy perceived to have followed rather than led deployment, and the need to learn from this and ensure the same does not happen in relation to SDVs.

Informed 'citizen' view of SDVs and their use in future local transport systems

Over the course of the research, participants became more positive towards SDVs. By the end of the research, participants in Manchester reported being more comfortable using and sharing the road with SDVs (Figure 47) and felt SDVs were safer (Figure 48). They also reported an increase in confidence in SDVs being able to handle unexpected situations (64% reporting the research made them feel more confident). The proportion who felt that there were at least as many, if not more, advantages than disadvantages to SDV use also increased (86% post vs. 61% pre). Six months on, this sentiment was maintained with 64% still feeling that SDVs could make their local transport systems better and 68% saying they felt more positive about SDVs being in their local area than prior to the research.

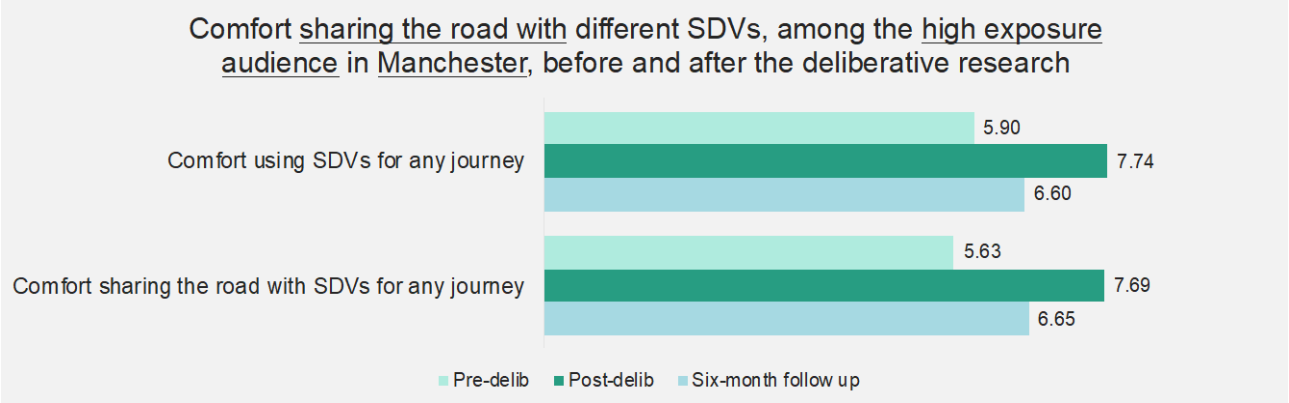

Figure 47 Comfort using and sharing the road with different types of SDV among the high exposure audience in Manchester pre- and post-deliberative research and six months post-research

C1: On a scale of 0 to 10 where 0 is totally uncomfortable and 10 is totally comfortable, how would you feel (a) using / (b) sharing the road with the following types of self-driving vehicles for any journeys? Base: High exposure (Manchester): pre-deliberative research n=79, post-deliberative research n=74, six-month follow up n=44.

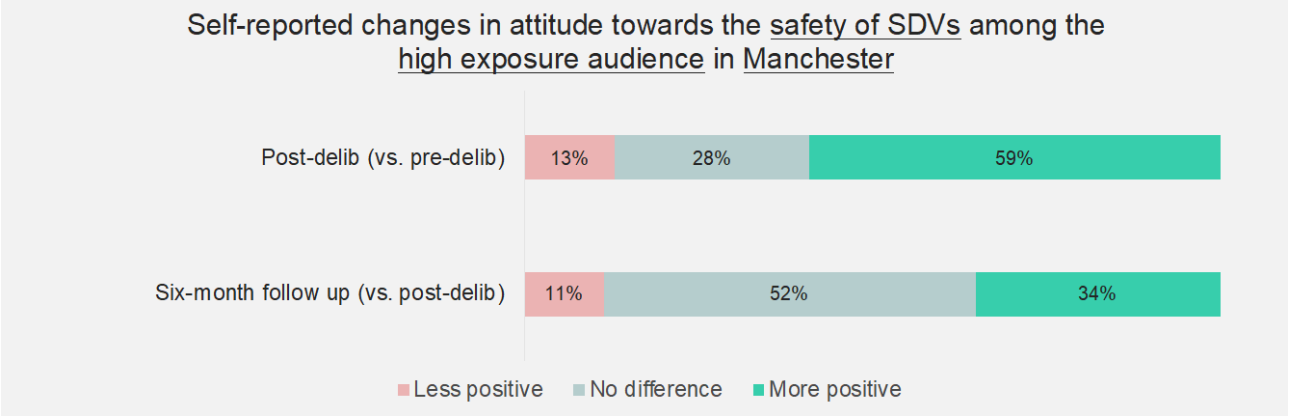

Figure 48 Self-reported changes in attitude towards the safety of SDVs among the high exposure audience in Manchester post-deliberative research and six months post-research

F2a (Post-deliberative research): How do your feelings now compare to how you felt before the research event about self-driving vehicles? / F2a: Having had time to reflect on the research event you participated in roughly six months ago, how do your feelings now compare to how you felt just after the research event about self-driving vehicles in your local area? Base: High exposure audience (Manchester): post-deliberative research n=70, six-month follow up n=44.

Despite these increases in positivity towards the technology in theory, participants in Manchester still expressed limited appetite for the use of SDVs in their local transport network. If SDVs were to be used, participants wanted them to support the integration of existing transport options, tightening up the local transport network while limiting the risk of high costs and negative impacts on the local workforce.

By the end of the research, participants broadly recognised the potential safety benefits of SDVs in an SDV-only transport landscape but felt there were safety risks and ethical challenges in any hybrid approach (where self-driving and human driven vehicles share the road). In the likely event of a hybrid approach, there was a desire for policies to be put in place to manage SDV integration into the current transport landscape prior to SDVs being deployed, and for these to be communicated about to raise awareness.

13.3 Taunton (town)

Local transport landscape

Participants in Taunton were generally comfortable with their ability to travel around their local area, especially if they were a driver - with driving generally being the preferred mode of travel in Taunton. However, congestion and limited availability of parking in the town centre could make driving an inconvenient option at times.

Participants reported that declining public transport services meant that this was not always a viable alternative to driving despite the above difficulties. Infrequent, unreliable services as well as the removal of services in some areas were seen to be limiting mobility, particularly for those in the rural fringe and surrounding satellite villages. Furthermore, the lack of interconnectedness between different modes of public transport was reported to make some journeys inefficient. As a result, the experience of those in the town location reflects a hybrid of the rural and urban experiences in relation to transport systems.

In terms of improving the local transport system, participants in Taunton suggested reintroducing bus services that have recently been lost, continuing to expand park-and-ride options to reduce traffic in town centres, and considering pedestrianising the town centre to ease congestion and make it a more enjoyable environment to be in.

Initial views on the potential role of SDVs in local transport system

At the start of the research there were few measures on which the views of participants in Taunton deviated significantly from those in the other research locations. Instead, participants in Taunton tended to sit between the other two locations, reflective of its combination of both urban (town centre) and rural (surrounding fringe) characteristics.

That said, those in Taunton were significantly more likely than those in Alnwick to consider a private SDV where the vehicle is responsible for all driving tasks for leisure journeys (36% in Taunton vs. 21% in Alnwick). Equally, they were significantly less likely than those in Manchester to report that they would consider using an SDV for deliveries (7% in Taunton vs. 19% in Manchester).

Perceived opportunities

Participants in Taunton were the most optimistic about the use of SDVs as a potential solution to some of the existing gaps and unmet needs in their local transport system. SDVs were seen to offer **benefits and opportunities** particularly in relation to reversing the recent decline in public transport services, and thus could offer the following benefits:

- **Overcome issues of driver shortages** and lack of availability of staff, leading to anticipated improvements in frequency and reliability of services on existing routes as well as being able to add lost routes back into service. This could also include the provision of evening, night, and weekend services, all of which are currently limited.
- **Reduce reliance on private vehicles**, improve accessibility for non-drivers, and make the roads safer at night.

SDVs could be used to connect park-and-ride facilities to the town centre, potentially even supplementing existing transport services to the point that the town centre could be closed to private vehicles.

- Participants felt that this would help to **reduce traffic and congestion**, as well as removing the need for parking provision, positively impacting the streetscape.
- This was also felt to **create a safer and more appealing environment for pedestrians** and cyclists, which would come with environmental and health benefits for the local community.

Like in Alnwick, participants in Taunton saw particular benefits of SDVs for those currently least mobile, including those with mobility impairments, those in areas poorly served by existing public transport and those who cannot or do not drive their own vehicle. SDVs were seen to support a decreased risk of social isolation for these groups by delivering greater accessibility and travel independence.

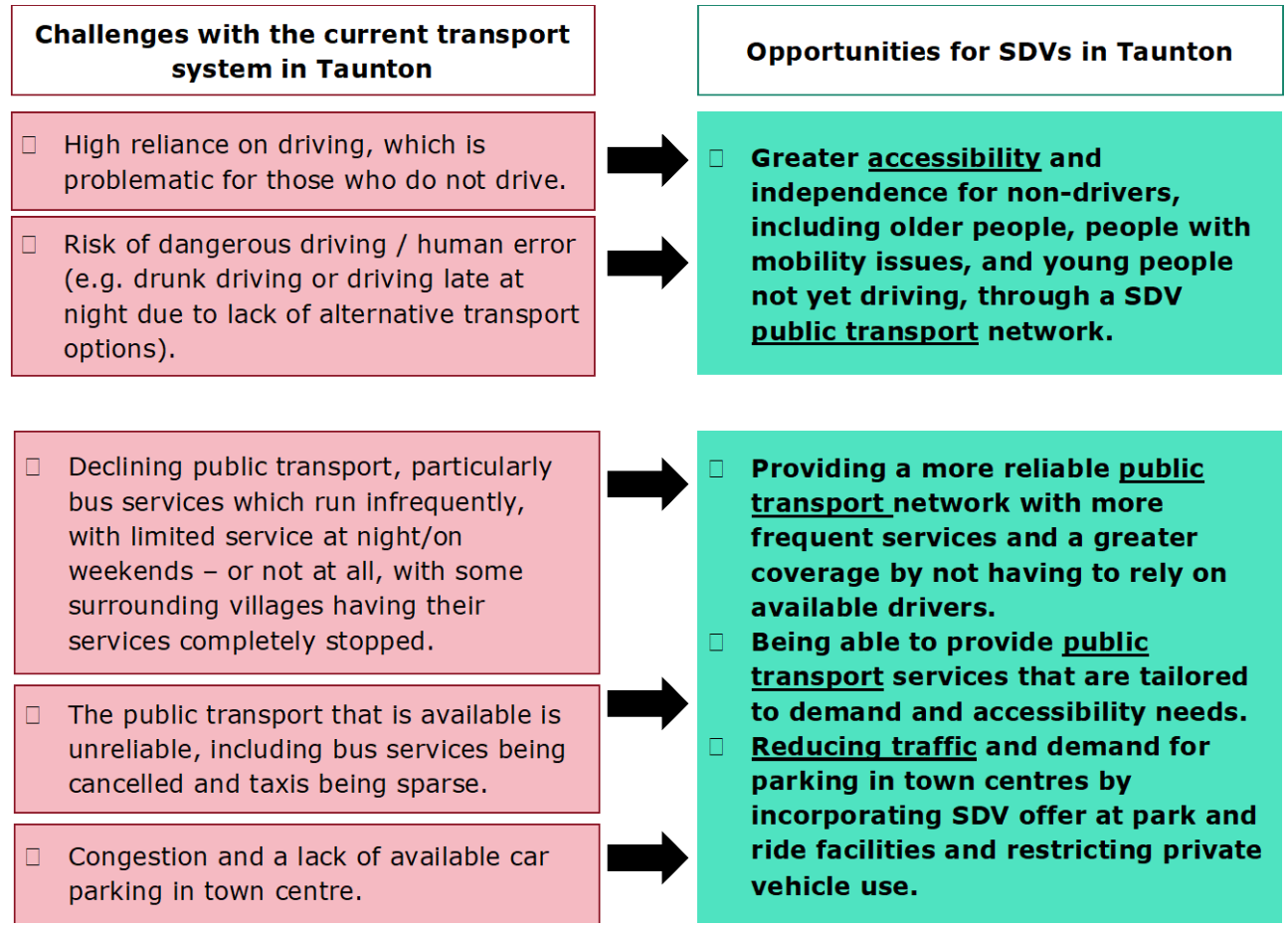

Figure 49 Benefits and opportunities for SDVs in Taunton

Perceived risks and barriers

Despite seeing opportunities for SDV applications to improve their local transport offer, some participants in Taunton felt that:

- SDV technology could be **better suited to urban areas** and controlled environments such as airports, sport venues or motorways (perhaps with a dedicated lane).
- There was also scepticism about the **local authority being able to afford** or justify the expense of new technology, which made the prospect of local SDV introduction feel less likely.

There were also several **limiting beliefs** about SDVs that impacted perceptions of their potential use and uptake in Taunton. These included:

- Concerns that **SDVs would struggle to imitate human behaviours** which was felt to be necessary to successfully navigate unpredictable rural roads around the town.
- Being **expensive** at the point of use.
- The lack of a human driver resulting in **safety and personal security concerns**.

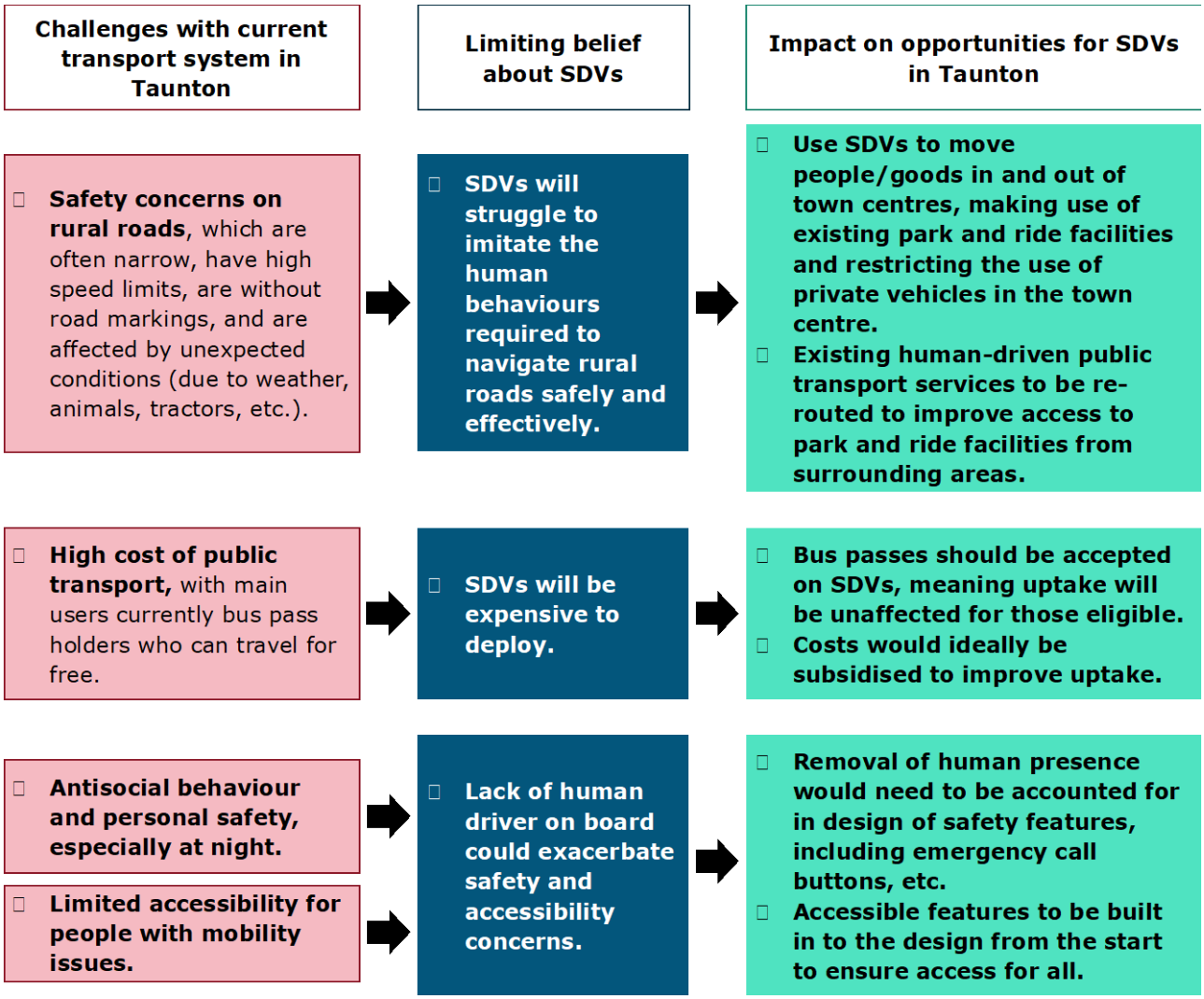

Figure 50 Limiting beliefs and impact on opportunities for SDVs in Taunton

Potential local applications for SDVs

In addition to generally improving public transport, Taunton participants saw potential for SDVs to support better connectivity to existing transport services by providing taxis or minibus services running short routes to connect people to local transport hubs such as park-and-ride facilities. This would benefit the local area by driving uptake of public transport services, in turn reducing traffic and congestion in built up areas and making roads safer by reducing reliance on private vehicles.

Additional ideas for SDV applications in and around Taunton included:

- Long-distance driving using self-driving features on motorways and A roads.
- Hospital transfers and transfers to medical centres for appointments.
- Options for travelling home at night, including from pubs to reduce the risk of people driving under the influence of drugs or alcohol.

Factors to be addressed prior to SDV rollout

A key consideration for participants in Taunton related to their feeling that the current local transport and infrastructure is struggling with underinvestment. Some participants therefore felt that to enable SDVs to have a positive impact within the existing transport network investment in SDVs should be built into the investment in the town centre and transport infrastructure more generally (including surrounding rural areas).

Impact of information provision on views towards SDVs

While participants in Taunton were impacted in a similar way to other areas by the information shared during the research sessions, certain elements stood out. This included the potential for SDVs to offer greater safety, improvements to congestion and pollution in and around towns, and the promise of improved mobility and independence for people with disabilities (NB. the additional audience in this location comprised older people and those with LTHCs).

Congestion was a key focus in Taunton, and the information prompted discussion of the risk of unintended consequences such as SDVs increasing instead of decreasing congestion, as well as the risk of SDVs in freight increasing congestion on roads. Some participants also expressed concerns and questions around responsibility, regulation, liability and insurance.

Impact of trial experience on views towards SDVs

The trial in Taunton reinforced the sense that SDVs could operate much like their existing public transport, particularly for commuting, getting around town and providing links between towns and satellite villages. Some described the shuttle as operating like a ‘simpler version of a bus’.

Taunton participants had some concerns about the technology being overly sensitive as obstacles including pigeons, ducks and squirrels prompted frequent stops during the pod trial. These disruptions undermined perceptions of the technology more broadly being ready for real-world application in the near future. Despite this, participants in Taunton could still see potential applications for pods such as to help older people or those with mobility issues to move around a pedestrianised town centre.

Participants in Taunton liked the concept of the self-driving delivery pod and felt that it could benefit those living in surrounding rural areas and villages. They imagined that these vehicles could transport goods to a communal collection point on the fringe of town to eliminate the need for rural residents to drive into the town centre to collect items, while also getting around their limiting beliefs about the ability of SDVs to successfully navigate complex rural roads. However, they did have concerns about the self-driving delivery pod operating on pavements in the town centre as this was felt to risk causing issues for wheelchair and pushchair users.

Future scenario exploration for SDV deployment

When considering the future potential deployment of SDVs in the local area, participants in Taunton prioritised fiscal measures focusing on new rural infrastructure for public transport. Further, they were keen to make sure that rural and town locations were not left behind larger urban areas in being able to access and benefit from this technology; therefore, participants in Taunton also wanted to implement new national infrastructure as this was felt to provide even more investment in areas such as theirs.

Participants in Taunton were consistent with those in other locations in their choice of interventions. However, when it came to creating their own interventions, the idea of pedestrianising town centres with SDVs was again raised; this was not raised in other locations. The game prompted the further development of this idea, including the use of this intervention in conjunction with SDV hubs (similar to park-and-ride) to transport people in and out of the centre and personal SDVs for those with mobility issues to use when travelling around the town centre.

Informed 'citizen' view of SDVs and their use in future local transport systems

Over the course of the research, the high exposure audience in the town location became more positive towards SDVs. By the end of the research, participants reported being more comfortable using and sharing the road with SDVs (Figure 51) and felt that SDVs were safer (Figure 52). The proportion who felt that there were at least as many, if not more, advantages than disadvantages to SDV use also increased (86% post vs. 63% pre). Six months on this sentiment was maintained with 67% still feeling that SDVs could make their local transport systems better and 62% saying they feel more positive about SDVs being in their local area than prior to the research.

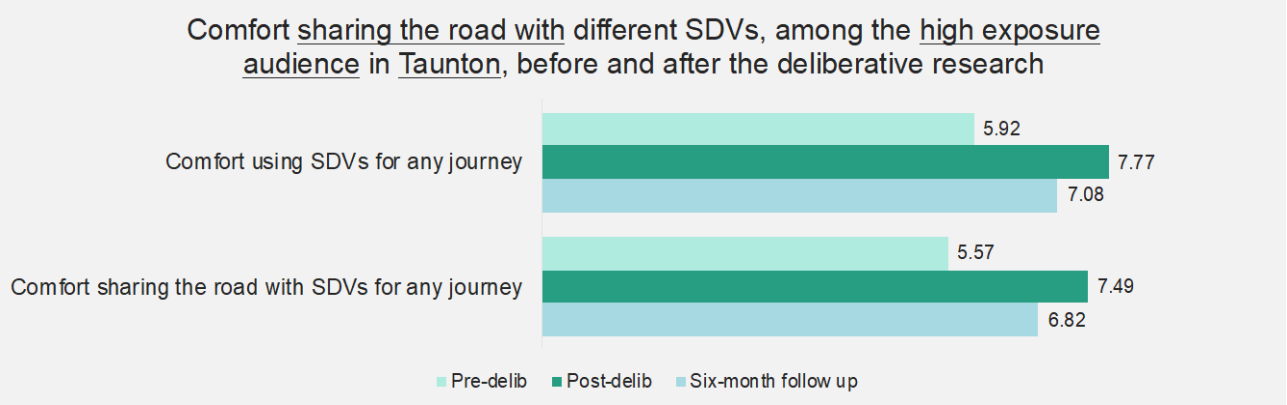

Figure 51 Comfort using and sharing the road with different types of SDV among the high exposure audience in Taunton pre- and post-deliberative research and six months post-research

C1: On a scale of 0 to 10 where 0 is totally uncomfortable and 10 is totally comfortable, how would you feel (a) using / (b) sharing the road with the following types of self-driving vehicles for any journeys? Base: High exposure (Taunton): pre-deliberative research n=71, post-deliberative research n=74, six-month follow up n=45.

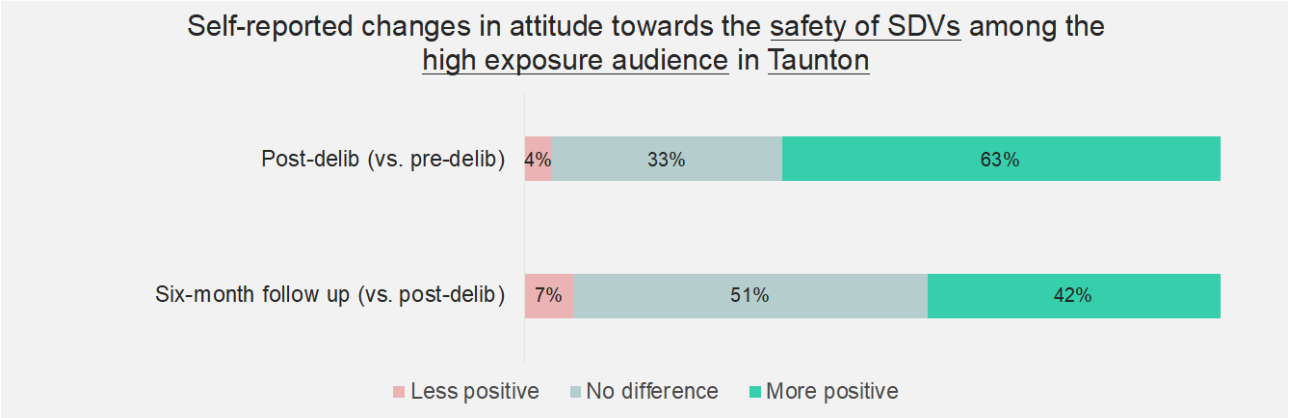

Figure 52 Self-reported changes in attitude towards the safety of SDVs among the high exposure audience in Taunton post-deliberative research and six months post-research

F2a (Post-deliberative research): How do your feelings now compare to how you felt before the research event about self-driving vehicles? / F2a: Having had time to reflect on the research event you participated in roughly six months ago, how do your feelings now compare to how you felt just after the research event about self-driving vehicles in your local area? Base: High exposure audience (Taunton): post-deliberative research n=73, six-month follow up n=45.

Participants in Taunton really saw the potential for SDVs to redesign how transport works in their local area, and did so to a greater extent than those in the other research locations. With a proactive and planned approach to design and deployment, it was felt that there were strong benefits to SDVs for the public and, in particular, those least able to travel independently today.

After considering the information on regulation, participants in Taunton were reassured that SDVs would not be deployed without consideration for the changes in responsibility for vehicles, including maintenance. They took a pragmatic approach to the potential local use of SDVs, including the possibility of restricting the use of SDVs to specific areas (such as initially prioritising them in town centres but not using them on more rural roads until later) and the need for communication to inform people in certain areas that SDVs might be active and how to behave around them.

14. Appendices

14.1 Specialist Group

With many thanks to all members of the Specialist Group for their valuable contributions to this research. The Specialist Group included:

- Elisabetta Cherchi, Professor of Transport, Newcastle University
- Dr Tom Cohen, Senior Lecturer in Transport, University of Westminster
- Camilla Fowler, Head of Safety Assurance at Oxbotica
- Steve Gooding, Director of the RAC Foundation
- Brian Matthews, Head of Transport Innovation, Milton Keynes Council
- Dr Lamprini Papafoti, Senior Future Mobility Developer - Behaviour Change, Transport for West Midlands
- Dr Nick Reed, independent consultant and Chief Road Safety Advisor for National Highways
- Steven Russell, Innovation Manager, Stagecoach
- Jessica Uguccioni, Lead Lawyer of Automated Vehicle Review at the Law Commission

14.2 Sample breakdown

Core deliberative sample

Table 1 Core deliberative sample breakdown

Demographic	Criteria	Alnwick	Manchester	Taunton
Age	18-25	10	11	5
Age	26-45	21	19	25
Age	46-64	18	13	19
Age	65+	12	13	11
Gender	Male	27	26	29
Gender	Female	34	29	31
Gender	Other	0	1	0
Ethnicity	White	59	37	53
Ethnicity	Mixed	2	3	1

Ethnicity	Asian / Asian British	0	7	0
Ethnicity	Black / African / Caribbean / Black British	0	4	5
Ethnicity	Other	0	1	0
Socio-economic group	AB	14	18	12
Socio-economic group	C1/C2	37	22	38
Socio-economic group	DE	10	16	10
Type of location	Rural	36	5	26
Type of location	Suburban	25	27	17
Type of location	Urban	0	24	16
Housing composition	I live alone	6	8	13
Housing composition	With friends / in a house share	0	3	3
Housing composition	With partner / spouse	25	13	29
Housing composition	With children under 12	11	12	16
Housing composition	With children aged 13-18	8	12	10
Housing composition	With children 18 or over	2	2	2
Housing composition	With parents or other family members	11	10	5
Health	Long-term health condition/disability	10	12	15
Travel to workplace	Public transport (any type)	5	16	9
Travel to workplace	Private Car	24	18	20
Travel to workplace	Active travel (walking or cycling)	8	9	10
Travel to workplace	Work from home	5	4	6
Travel to workplace	Not currently employed so no workplace	16	19	8
Travel to workplace	Other	3	0	3
Attitude to technology	More of an opportunity than a threat	37	32	38
Attitude to technology	Equally and opportunity and a threat	22	22	11
Attitude to technology	More of a threat than an opportunity	2	2	8
Attitude to technology	Neither	0	0	1
Technology statement	Early adopters	11	12	19
Technology statement	Mainstream Consumers	43	36	33
Technology statement	Traditionalists	7	8	6

Additional audiences sample

Table 2 Additional audiences sample breakdown

Demo-graphic	Criteria	Digitally disengaged (Alnwick)	Young people (Alnwick)	Ethnic minority (Manc)	Low SEG (DE) (Manc)	Older people (Taunton)	Long-term health conditions (LTHCs) (Taunton)
Age	Under 18	0	11	0	0	0	0
Age	18-25	0	0	2	3	0	1
Age	26-45	0	0	4	4	0	4
Age	46-64	3	0	4	4	0	5
Age	65+	6	0	0	0	12	1
Gender	Male	4	7	4	8	5	2

Gender	Female	5	4	6	4	7	9
Gender	Other	0	0	0	0	0	0
Ethnicity	White	9	9	0	5	12	11
Ethnicity	Mixed	0	1	0	1	0	0
Ethnicity	Asian / Asian British	0	0	3	5	0	0
Ethnicity	Black / African / Caribbean / Black British	0	0	7	0	0	0
Ethnicity	Other	0	0	0	0	0	0
Socio-economic group	AB	3	6	2	0	3	1
Socio-economic group	C1/C2	3	2	6	0	9	6
Socio-economic group	DE	2	2	2	12	0	4
Type of location (self-reported)	Rural	1	5	0	0	3	3
Type of location (self-reported)	Suburban	8	5	6	4	2	1
Type of location (self-reported)	Urban	0	0	4	8	7	6
LTHC / disability	Mobility	N/A	N/A	N/A	N/A	N/A	6
LTHC / disability	Dexterity	N/A	N/A	N/A	N/A	N/A	3
LTHC / disability	Visual	N/A	N/A	N/A	N/A	N/A	1
LTHC / disability	Hearing	N/A	N/A	N/A	N/A	N/A	1
LTHC / disability	Mental health condition	N/A	N/A	N/A	N/A	N/A	3
LTHC / disability	Social or behavioural difficulty	N/A	N/A	N/A	N/A	N/A	0
LTHC / disability	Learning disability	N/A	N/A	N/A	N/A	N/A	0
LTHC / disability	Learning difficulty	N/A	N/A	N/A	N/A	N/A	1
LTHC / disability	Difficulty with memory / periods of confusion	N/A	N/A	N/A	N/A	N/A	1
LTHC / disability	Physical impairment	N/A	N/A	N/A	N/A	N/A	3
LTHC / disability	Stamina or breathing or fatigue	N/A	N/A	N/A	N/A	N/A	1
LTHC / disability	Other	N/A	N/A	N/A	N/A	N/A	0

14.3 Technical appendix

Quantitative approach

This research endeavoured to account for and build on what was already known about attitudes towards SDVs. A series of quantitative surveys were used to measure baseline views of the UK public (national control survey) as well as the views of the low, medium, and high exposure audiences who took part in this research. For a full breakdown of quantitative measures and which measures were comparable please see the quantitative measures matrix later in this section.

Statistical testing

Where the term ‘significant’ is used throughout this report in reference to quantitative data, statistical significance is meant. When interpreting sub-group differences in this report, only statistically significant differences (at a 95% confidence level) are reported, unless otherwise indicated.

Two methodologies are used to calculate statistical significance, two-tailed independent z-tests to compare percentages and Welch's unequal variances two-tailed independent t-tests to compare mean scores.

Statistically significant differences are noted using superscript lettering in the charts; the superscript letter next to a score or percentage denotes the initial of the sample that it is statistically more significant than. For example, a score which is significantly greater than the corresponding score from the low exposure audience will be marked with a superscript 'L'. Where multiple waves of data are shown for the same audience over time a superscript 'pre' indicates where the post-read data is significantly greater than the pre-read data, and vice versa.

Sub-group analysis

Where quantitative questions were asked of multiple audiences, sub-group differences are primarily reported for the national control survey as it has the largest base size and is therefore best able to pick up statistically significant differences. Sub-group differences are then reported for other audiences only where there is a statistically significant finding that differed from the control.

The following were identified as sub-groups potentially of interest to the research process:

- Attitudes by technological optimism
- Gender
- Age
- Urban / Rural comparison
- Income
- Education
- House tenure
- Ethnicity

- Social grade
- Households with children

For some of these variables, identifying quantitative associations between these sub-groups and their attitudes towards SDVs was difficult. This is because some of these sub-group attributes have confounders (additional factors) that may also be having an influence on any apparent associations. In the national control survey, the sample was quoted and weighted to be representative by age, gender, region, social grade, and ethnicity. However, analysis showed that among the following sub-groups, there were likely cofounding factors:

- House tenure: people owning their homes outright (no mortgage) tended to be older.
- Ethnicity: amongst the survey respondents a majority of the older respondents are white, while other ethnicity respondents are predominantly younger.
- Social grade: a majority of AB social grades are men.

In the deliberative research, quotas were set to ensure representation across these variables, with additional audiences recruited specifically for some groups. However, due to this targeting other attributes are not evenly spread across these attributes.

Once these disparities are taken into account, sub-group differences in starting point become more challenging to see quantitatively. These variables are also not prominent in the most cited literature reviews (Becker & Axhausen, 2017; Gartzonikas & Gkritza, 2019). This research has therefore not generally reported these sub-group differences in the quantitative analysis. Full details for these groups are available in the data tables included alongside this report.

Technical notes

1. For the six-month post-research follow up survey, not all deliberative research participants responded to the request to complete the survey. In total, n=140 respondents completed the survey, evenly distributed across the three fieldwork locations. Differences between pre-/post-deliberative research survey data and the follow up survey data could be due to differences in the make-up of the sample completing the follow up survey. Further, it is possible that those with more polarised views were more likely to complete the follow up survey, which could be impacting reported sentiment towards SDVs in this sample.

2. Data was rebased to remove those who do not undertake each journey type, to allow for the indication of clear proportions of mode type used amongst those who do undertake each journey. Results for those travelling to education are not included for the high exposure audience as the base size is too small for findings to meaningful.

3. The lower proportion of traditionalists in Manchester compared to Alnwick and Taunton suggests that lower urbanity might play some role in attitudes towards new technology. However, there are likely to be a range of other factors that were not specifically explored that may have also contributed to these differences and therefore this should be treated with caution.

4. To ensure a range of viewpoints were represented in the deliberative research, a minimum of eight respondents were recruited to each attitudinal segment (early adopter, mainstream consumer, traditionalist) in each location, with the remainder being allowed to fall out naturally. Final proportions in the deliberative research were 24% early adopters and 12% traditionalists; the full sample breakdown can be found in section 14.2.

5. A 'mode effect' may have impacted the results for the low exposure audience, who were polled using a computer assisted telephone interviewing (CATI) approach in which questions and answer codes were read out to them by an interviewer, compared to all other audiences who self-completed the survey (either online or on paper). The low exposure audience were consistently less likely to answer that they were 'unsure' and additionally may have found it difficult to distinguish between different options given when read aloud.

6. Among the national control group there was a strong correlation (+0.386) observed between technological optimism and comfort with using SDVs. This indicates that comfort with SDVs is considerably higher amongst the most technologically optimistic - by a whole standard deviation compared to the least optimistic.

7. The 'most technologically optimistic' is defined as respondents who fell in the top quartile of the sample on the technological optimism measure, while the 'least technologically optimistic' are respondents in the bottom quartile of the same measure.

8. In the national control survey, respondents were asked what journeys they regularly undertake and were then only asked about their willingness to use SDVs for these journeys. In contrast, the survey for the low exposure audience asked respondents if they would consider SDVs for all journey types with 'I never take this journey' as an additional answer code. Therefore, caution should be used in comparing the two datasets.

9. Sub-group differences by location are indicative (not significant) for the high exposure audience on questions E2a and C3, however further research with a larger base size could demonstrate that these are significant shifts.

10. For the pod trial in Alnwick (rural location), there was no video data to accompany the EEG recordings due to a technical issue. As the video data included the timings, the research was unable to compare post-ride survey findings with EEG readings for this element of the research.

11. Some participants may have answered the question on responsibilities of SDV users (A2) with both user-in-charge and non-user-in-charge vehicles in mind (covered in the workshops) as the question wording did not distinguish between the two vehicle types.

12. Participants may have understood the statement 'drive itself without any input from a human driver' (in question A3) to reflect the shuttle and pod trial experiences that they took part in in the research, and the question text did not explicitly distinguish between an SDV trial and a non-trial environment.

13. For the low exposure audience, both pre- and post-reads had a base size of n=750. The number of participants who completed both surveys was n=225 (30%). Small differences between pre- and post-trial data for this audience could be due to differences in the make-up of the sample rather than an impact of the research.

14. Within the high exposure audience surveys, base sizes for some questions show minor variation. This is due to some participants not completing all questions. We do not believe this was systematic or has caused bias to the results.

Quantitative measures matrix

Table 3 below maps question areas with question numbers used across different quantitative surveys to enable comparison of results.

Table 3 Overview of quantitative questions asked according to audience and survey instrument

	National control survey (online omnibus)	Low exposure audience: Pre- and post-trial local polling (CATI)	Medium/high exposure audience: Pre- and post-ride survey (online/paper)	High exposure audience: Pre- and post-deliberative research survey (online/paper)	High exposure audience: six-month post-research follow up survey (online)
Views towards science and technology	P6 and P7	P6 and P7		P6 and P7	P7
Awareness of SDVs				A1	
Engagement with SDVs	B2			B2	B2
Accurate understanding of SDVs	A2, A3	A2, A3		A2, A3	A2, A3
Comfort using SDVs	C1a	C1a	C1a	C1a	C1a
Comfort sharing the road with SDVs	C1b	C1b	C1b	C1b	C1b
Advantages/disadvantages of SDVs	C3			C3	C3
Journeys regularly undertaken + mode used	D1			D1	
Journeys considered for using SDVs	D2	D2		D2	
Priorities for improving local transport system				E1 and E1_1	
Difference that SDVs could have on local transport system	E2a	E2a	E2a	E2a, E2b	E2a
Incidence of seeing/hearing about events		F1 (Post-event only)			
Reported differences in feelings toward SDVs		F2b (Post-event only)			F2a
Emotions	EM1		EM1		

14.4 Research design

Information provided in the deliberative research

See Section 8 for the impact of this information provision on views towards SDVs.

Video Summaries

In the first and second deliberative workshops, participants were shown videos introducing them to different aspects of SDVs' deployment. A summary of the information covered in each video was included in participants' workbooks for them to refer back to; these summaries are included here.

Workshop 1

Video 1: Introduction to SDVs

Speaker: Rebecca Posner, CCAV, UK Government:

- Self-driving vehicles are vehicles that are capable of safely and legally driving themselves.
- A vehicle is driving itself if it is operating in a mode where it is not being controlled and does not need to be monitored by an individual.
- Self-driving vehicles are able to communicate with the world around them to collect information about road and weather conditions, as well as the behaviour of other vehicles, so they can adapt their own behaviours.
- Self-driving vehicles are different to vehicles that have features that assist drivers (such as cruise control or adaptive lane keeping), as they only support the driver and don't perform the driving.
- "Self-driving vehicles" doesn't just mean private vehicles like the vehicles that you might own now, it also includes a wide range of vehicles such as buses, shuttles, delivery vehicle, trams etc.
- Self-driving vehicles have the potential to help contribute to a number of key governmental priorities, including improving connectivity across the UK by enhancing the transport network, while also tackling climate change by decarbonising transport.
- However, all of these are only possible if self-driving vehicles and services are well designed and well-regulated to make sure that everyone can benefit from them, and that they go through robust and rigorous safety processes and can work with other modes of transport happening around them.

Video 2: Top-level introduction to SDV use cases

Speaker: Camilla Fowler, Head of Safety Assurance, Oxbotica

- Introducing SDVs is not about using new technology for the sake of it, it is about improving our quality of life. The 'right' self-driving vehicles will help to improve road safety, reduce traffic, congestion and emissions, and improve mobility and accessibility for communities.

- There are lots of possible vehicles: small pods and shuttles have already been introduced in some locations and could be used to help carry people short distances between existing public transport routes, or in an ‘off road environment’ such as airports or stadiums.
- Self-driving vehicles could replace privately owned cars; one day perhaps we will all have one sat on our drive or near our home. However, it is more likely these vehicles will be shared, potentially by hailing them with an app on our smart phones.
- It could be that current public transport services are replaced by self-driving vehicles, as has already been trialled in Fife and Edinburgh. These services could reduce congestion and improve safety for road users.
- Another potential use for self-driving vehicles would be for the movement of goods and groceries. Self-driving HGVs could be used to deliver to the outskirts of cities, while smaller vehicles could assist with local deliveries.
- Self-driving vehicles could help to make our lives easier, with services such as automated valet parking, but also make our lives safer by reducing road deaths and improving safety for those working in construction, mining, agriculture and defence.

Video 3: Introduction to SDV safety

Speaker: Siddartha Khastgir, Head of Verification and Validation, University of Warwick

- Globally over 1.35 million people die due to road accidents every year; over 1,700 people in the UK. 88% of these accidents are caused by user error. This begs the question, with all the technology at our disposal are we doing enough to improve road safety and save people's lives?
- One potential solution to this problem could be introducing self-driving vehicles, which would reduce accidents by removing the driver from the task of driving. Introducing self-driving vehicles may not prevent all road accidents, but it would improve those that are caused by driver error.
- There are however a range of challenges that limit the introduction and use of self-driving technology. Safety is a key consideration in their development. But in order to prove that test self-driving vehicles are 20% safer we need to drive them for 11 billion miles. The road variety of road conditions an SDV may encounter also adds complexity to test driving and safety estimations.
- However, it is important to note that by introducing self-driving vehicles that are even 10% safer than the way you and I drive, we could save over 100,000 lives in the next thirty years.

Video 4: How self-driving are they? Part 1

Speaker: Jessica Uguccioni, Lead Lawyer of Automated Vehicle Review, Law Commission

- Currently there is no clear definition of ‘self-driving’.
- Whether something is self-driving or not has important legal consequences. If the human isn’t driving, who is?
- To help define this the Law Commission has proposed that technologies designed to enable a vehicle to drive itself can fall into two different categories: user-in-charge features and non-user-in-charge features.
- Vehicles with user-in-charge features are designed to drive themselves for only part of a journey, for example they may function on motorways but not in more complicated

road environments. When the self-driving feature is engaged the person in the car is no longer responsible for how the vehicle drives, but they do need to be ready to take over.

- Safety experts disagree if these features should be classified as self-driving. A big question is what happens if the user-in-charge doesn't take over driving when the technology asks them to?
- Vehicles with non-user-in-charge features do not rely on human driving at all. Such vehicles may travel carrying only goods or empty in-between pick-ups. Any people carried are purely passengers. These vehicles present the most opportunity for improving accessibility. These vehicles may not be able to drive everywhere and might be restricted to only some locations.
- Trials with safety drivers (like the one you'll take part in) are a key part of developing self-driving technology. Vehicles designed to drive themselves may still have a safety driver in them that can intervene if the technology does not behave as expected. This can help make sure that other road users are not put at risk.
- In 2018 the Automated and Electric Vehicles Act was introduced; this ensures anyone who suffers injury or damage from a self-driving vehicle compensation from an insurer without having to prove fault.

Video 5: How self-driving are they? Part 2

Speaker: Dr Nick Reed, independent consultant and Chief Road Safety Advisor for National Highways

- Where a human driver would use their eyes, memory and knowledge to drive a car, a self-driving vehicle has its own range of senses. But unlike a human driver, self-driving technology doesn't get tired or distracted.
- Self-driving vehicles are constantly gathering information about their environment and some have detailed 3D maps to help them figure out the best route. All of this is used to make judgements about the best course of action, such as slowing down for a pedestrian.
- Because computers are in control, all of this happens dozens of times per second so that the self-driving vehicle can react quickly to any change in circumstances.
- Self-driving vehicles may become a common sight on our roads. Hopefully this will mean fewer road accidents, as we know many crashes are caused by human error. However, we need to be careful as new types of crash may emerge as we learn how self-driving cars work.
- Another benefit of self-driving cars would be to improve independence and mobility for those unable to drive, such as the elderly or the disabled.
- However, again we must be careful, as these technologies are being developed by private companies at huge cost which may exclude some from their use.
- A particular area of focus for self-driving vehicles is for deliveries. But while this might be one route to tackling the shortage of human drivers, we must remember there are many tasks a human driver can perform that a machine cannot.
- Another hope is that self-driving vehicles will help to improve congestion. However, if self-driving vehicles make travel cheaper and more accessible, they may end up making congestion worse.
- As self-driving cars become more prevalent, governments and local authorities may need to take steps to limit their use to reduce congestion and promote public transport or active travel modes.

Video 6: Shared self-driving vehicles

Speaker: Brian Matthews, Head of Transport Innovation, Milton Keynes Council

- Regarding self-driving vehicles and their shared use, we first need to think about how they will impact our urban areas. Cities face a number of challenges with transport, and anything that can help with the efficiency of transport has to be considered.
- Self-driving vehicles have the potential to change how we travel together in the future – but one of the concerns around shared self-driving vehicles is the cost, so using them in as many ways as possible is a good way to get value for money.
- We need to think about how we use our vehicles now. Many of us only use our vehicles for a small amount of time each day or week, but if we found a way where vehicles were always in use, this would provide that value we're looking for.
- Shared self-driving vehicles can help tackle congestion, particularly around car parking. If more people were to use these shared vehicles, the need for largescale car parks would reduce, and these areas could be used for more parks and leisure facilities.
- Shared self-driving vehicles can also benefit the community in other ways, such as increasing the mobility for older people, as well as being used as delivery vehicles during off-peak times when people tend to travel less.
- Society is also changing – as we tend not to own things ourselves as much anymore, such as streaming music and films. As we continue to get used to this new mode of ownership, shared self-driving vehicles could be more valuable than owning an expensive piece of machinery.
- Finally, shared self-driving vehicles has the potential to support rural areas and as the technology continues to grow, it can ensure that more communities are connected with one another.

Video 7: Private self-driving vehicles

Speaker: Steve Gooding, Director, RAC Foundation

- When thinking about self-driving vehicles and their private use, we need to distinguish two different types: those that were designed from the outset to be purely self-driving and those where the self-driving is something the human driver can turn on.
- Based on the pace that self-driving technology is evolving, it is unlikely we will see self-driving vehicles available for purchase anytime soon. So, let's consider those vehicles that have a component of self-driving functionality.
- There are four use cases where this technology may be seen: motorway driving, self-parking, summoning and end-to-end trips.
- Motorway driving, this could eliminate the need for a human driver to control the car while on the motorway section of a journey. Although this might cause some confusion at first, it is my belief that it could be safer to remove the human driver and let the car make the decision.
- Self-parking - how many of us wouldn't vote for a world in which we never have to park our car again? However, this task is more difficult that it might first seem to be.
- Summoning - this functionality would allow you to summon the car to you from a short or potentially a longer distance. This may be convenient for you, but how would this potentially affect others?

- End-to-end trips - although fully self-driving technology may be further away, I do envision a time when vehicles will be able to make certain end-to-end trips, on particular types of roads.
- The final functionality we might see from self-driving vehicles is to improve accessibility for those unable to drive such as the elderly or disabled. But what happens if that person can't make it into the vehicle unassisted? How does that improve accessibility then.

Video 8: Passenger self-driving vehicles

Speaker: Tom Cohen, Senior Lecturer in Transport, University of Westminster

- Self-driving vehicles aren't replacements for cars, anything on wheels could become self-driving, and new types of vehicle might be created.
- One of the main arguments for self-driving vehicles is freeing up time spent driving.
- Another is safety, with most crashes caused by human error, technology could make a big difference unless it causes new types of crash.
- A big question is who has access to a self-driving vehicle? If it's only the wealthy this could cause problems, especially if self-driving vehicles have priority over other road users.
- But governments could act to avoid this, for example insisting that self-driving vehicles give way to pedestrians and cyclists.
- Other concerns with self-driving passenger vehicles are that they could cause more congestion, and more climate change.
- Replacing freight vehicles would make a big difference in the freight industry, but might have less of a wider impact.

Video 9: Freight self-driving vehicles

Speaker: David Sharp, Head of Autonomous Mobility, Ocado

- Ocado is an online grocery delivery service that has always used innovation to develop its service. Ocado uses automated robots to sort groceries that are then delivered to customers' houses. The next step for Ocado is to start using self-driving technology.
- For example – one of the current trucks that uses self-driving technology, which is an early prototype, has LIDAR (Light Detection and Ranging) sensors on the side of the vehicle that uses lasers to detect if there any obstacles in front of the vehicle.
- In the back of the self-driving truck, there are eight cargo bays that are able to store grocery boxes due to be delivered to people's homes. Here, people would be able to go to their respective cargo bay to retrieve their groceries.
- The next step for Ocado is to start fitting cameras, LIDAR and RADAR (Radio Detection and Ranging) to current delivery vans and trucks. This can help gather data and aid the development of self-driving vehicles in the future.
- Ocado will collaborate with Oxbotica to create new self-driving, fully electric vehicles with the aim of being ready in a few years' time.
- Ocado believe this will be the safest, most economical and greenest way to deliver groceries in the future.

Workshop 2

Video 10: Stagecoach

- **Martin Griffiths, Chief Executive, Stagecoach Group:** We're demonstrating a pilot with an autonomous single-decker bus, which is looking at parking, fuelling and washing.
- There is a need to embrace new technology, we need to understand what it can offer, whether that's safety benefits, efficiency benefits – what will that mean for our passengers in the long term?
- **Colin Robertson, Chief Executive, Alexander Dennis:** Really, autonomous bus technology is a huge enabler for the future, particularly around safety. This is a technology trial, and I think from that standpoint it's going to teach all of us lots of things.
- **Jim Hutchinson, Chief Executive, Fusion Processing Ltd:** CAV Star comprises sensors and a controller; it is a fully encompassing autonomous driving system which can be fitted to most vehicles.
- CAV Star uses its sensors to build up a picture of its course, so it can a) determine exactly where it is and b) what hazards there are around it that it might take evasive action or stop for.
- The main advantages are safety and efficiency. They work well with a safety driver, looking after the safety and comfort of their passengers.
- **Martin Griffiths:** We need to take staff, employees and customers with us, and so far the drivers are supportive of the learning. It won't be for everywhere but it will be more suitable to certain parts of operations that we do going forward.
- **Michael Matheson, Scottish Transport Secretary:** I'm very excited to see the scale of how this is all progressing here in Scotland and right across the world – just last year we were talking about the concept of operating autonomous buses across the Forth Road Bridge, we're now at the point where we have the first edition of those buses and by this time next year, we expect to see them operating from Fife into Edinburgh.

Video 11: Waymo

- As it drives, Waymo uses LiDAR, which sends out millions of laser beams per second to build up a detailed picture of the world. It also uses RADAR to detect how far away objects are and their speed, and high-resolution cameras detect visual information like whether a traffic signal is red or green. It then combines all that data to understand the world around it.
- The car can identify objects around it in full 360 degrees and predict what those things might do next. And it doesn't just do that for the objects you can see, it can do that for things up to three football fields away.
- What makes this possible is the car's experience. Waymo has self-driven millions of miles on complicated city streets and it learns from every mile it drives.
- When it comes to making decisions, this is a good example of how Waymo doesn't just take into account your safety, it also makes sure that you, and the people around you, feel secure and at ease.
- In terms of user experience, there's no one in the driver's seat, no one turning the wheel. There are screens which show you what the car is seeing and the route it's taking. But the goal is to create a normal journey that simply gets you from A to B safe and sound.

Written information

In the second deliberative workshop, participants' handbooks also included the following information on the Aurrigo AUTO-SHUTTLE, AUTO-POD and AUTO-DELIVER vehicles, the Stagecoach buses and Waymo cars, and the rules and regulations around SDVs.

AUTO-SHUTTLE

Purpose:

- Road-worthy M1 Category vehicle (same as a regular car)
- Shuttle bus designed to transport people around town and city centres, shopping and care facilities, airports, and heritage sites

Design features:

- Currently has a safety operator present at all times – in future will not require an operator, once infrastructure and connectivity (e.g. 5G) is in place
- Height: 2.4 metres (about the same as the average UK ceiling height)
- Width: 2.2 metres (about the same as a luxury executive desk)
- Length: 5.8 metres (about the same as a large crocodile)
- Typical operation speed: <9.3mph
- Fully pre-mapped route used at all times
- Up to seven passengers (trial) and 10 (operation)
- Electric

AUTO-POD

Purpose:

- Designed to carry people around airports, pedestrianised town and city centres, sporting stadiums, and other similar shared spaces with pedestrians (not roads)

Design features:

- Currently has a safety operator – in future will not require an operator, once infrastructure and connectivity (e.g. 5G) is in place
- Height: 2.3 metres (about the same as an average artificial Christmas tree)
- Width: 1.5 metres (about the same as the length of a full size bed)
- Length: 2.5 metres (about the same as Andre the Giant was tall)
- Typical operation speed: <4.3mph
- Fully pre-mapped route used at all times
- Up to three passengers (trial) and four (in operation)
- Electric

AUTO-DELIVER

Purpose:

- Operates on authorised shared user pathways

- Pod vehicle designed to deliver items such as groceries and other goods to buyers on shared user pathways (not roads)

Design features:

- Height: 2 metres (about the same height as Michael Jordan)
- Width: 1.6 metres (about the same as the length of a full size bed)
- Length: 3.2 metres (about the same as a VW Beetle)
- Typical operation speed: <4.3mph
- Fully pre-mapped route used at all times
- Electric

Stagecoach buses

Purpose:

- Operates on public roads
- Enviro200 single deck bus trials that carried passengers between Fife and Edinburgh across the Forth Bridge in the CAV Forth project
- To be launched this year

Design features:

- Height: 2.9 metres (about the same as a VW Beetle is long)
- Width: 2.4 metres (about the same as an average artificial Christmas tree is tall)
- Length: 11.8 metres (about the same as the height of two giraffes)
- Trained safety driver on board at all times
- Top speed: 50mph when self-driving to 36 passengers
- Diesel engine

Waymo car

Purpose:

- Operates on public roads. Variety of car models
- Private vehicle that is currently being trialled in the US. Fully self-driving ride hailing service available in Phoenix and tests in San Francisco
- Formerly the Google self-driving car project

Design features:

- Height: 1.8 metres (about the same as a refrigerator)
- Width: 2 metres (about the same as a queen size bed is long)
- Length: 5.2 metres (about the same as a giraffe is tall)
- Fully autonomous
- Top speed: 65mph when self-driving
- No. of passengers varies depending on car model
- Electric and hybrid designs depending on car model

Rules and regulations

At the moment

- There are no self-driving vehicles operating on the UK's roads except in trials like the one you'll take part in this weekend.
- Some vehicles have assistive features that can help and advise a driver, but the driver is still fully in charge and responsible at all times.
- But in preparation for the launch of the first vehicles the Highway Code was updated in April 2022. To ensure the first wave of self-driving technology will be used safely, it explains clearly that while travelling in self-driving mode, motorists must be ready to resume control in a timely way if they are prompted to.

Coming soon

- Automated Lane Keeping System technology (ALKS), which can take full control of speed and steering without the need for a human monitoring the road, will be the first self-driving technology to be introduced on UK roads.
- The first version of ALKS technology (due to be released later this year) can only be used on motorways, at low speeds, in heavy traffic. Drivers must always be able and ready to take back control of the driving task when prompted.
- ALKS has been rigorously and comprehensively tested and regulated by the UN and UK Government.
- ALKS technology is not designed for and can't be used for end-to-end journeys (i.e. from the very start of your journey to the very end) – it only controls the speed and steering without the need for human monitoring in certain conditions.

Next steps: user-in-charge

- When using self-driving technology (for example when ALKS is activated), the person in the driving seat would no longer be a driver but a "user-in-charge".
- A user-in-charge cannot be prosecuted for offences which arise directly from the driving task.
- They would have immunity from a wide range of offences – from dangerous driving to exceeding the speed limit or running a red light.
- However, the user-in-charge would retain other driver duties, such as carrying insurance, ensuring the vehicle has a valid MOT and ensuring that children wear seat belts.

Looking ahead: no user-in-charge

- Some self-driving vehicles do not rely on any element of human driving at all. These vehicles may be designed without a steering wheel and with no driving seat at all.
- Such vehicles may travel carrying only goods or empty in-between pick-ups. Any people carried are purely passengers.
- These vehicles may not be able to drive everywhere and might be restricted to only some locations for example. But they do not rely on a human taking over driving at any point.

What won't change

- Some of the standards and rules that already apply to manually driven cars will continue to apply to self-driving cars.
- Manufacturing standards will continue to be carefully managed and:
- Adhere to British Standards Institution criteria
- Adhere to the Highway Code
- Must have a valid MOT certificate
- Must be roadworthy
- Must be taxed and insured.
- Anyone who is in charge of a vehicle will still need to have appropriate training, even though that training might look different than it does now.

What's not decided yet

- Are there other aspects of driving that you think need to be considered?

SDV trials

Three Aurrigo vehicles were used for the trials:

- AUTO-SHUTTLE: road-worthy M1 Category vehicle with a typical operation speed of up to 15km/hr; always runs to a fully pre-mapped route and has an automated vehicle (AV) operator present at all times; carries six passengers for trial purposes (with space for up to 10 passengers in future); dimensions: height 2400mm / width 2180mm / length 5800mm.
- AUTO-POD: operates on authorised shared pathways with a typical operation speed of up to 7km/hr; always runs to a fully pre-mapped route and has an AV operator present at all times; carries two passengers for trial purposes (with space for up to four passengers in future); dimensions: height 2285mm / width 1460mm / length 2490mm.
- AUTO-DELIVER: used as part of a static display only during the trial (not operational); dimensions: height 2000mm / width 1560mm / length 3200mm.

All passengers taking part in the SDV trials had to sign a waiver prior to travel and were not required to pay to travel. Passengers had to meet the following criteria to ride in the shuttle:

- Aged over 16
- Aged 12-16 and accompanied by a responsible adult
- Aged 3-12, be over 135 cm tall and accompanied by a responsible adult.

Passengers had to meet the following criteria to ride in the pod:

- Aged over 16
- Aged 3-16, be able to sit unsupported, wear a seatbelt, and accompanied by a responsible adult.

As the delivery pod is not a passenger-carrying vehicle, it was demonstrated as a non-operational (static) display only, maximising participants' exposure to the technology by keeping it in one place.

Outlined below is an overview of the vehicle order, trial use cases, and routes used in each research location.

Alnwick

AUTO-SHUTTLE (morning)

- Trial use case: Linking a large estate open to the public with nearby transport links and shops.
- Route: Alnwick Castle, route started in the car park at the front entrance and turned onto Bailiffgate, left onto Northumberland Street, which becomes Dispensary Street and then Lagny Street, left into the bus station to turn around before returning the way it had come to the carpark at the Alnwick Castle front entrance.

AUTO-POD (afternoon)

- Trial use case: Linking parts of a large park or estate.
- Route: Alnwick Castle and Alnwick Garden, route started at the Alnwick Garden end of Alnwick Castle Drive, travelling towards the Castle before turning around and returning back to the starting point.

Figure 53 Alnwick shuttle route (red line)

Figure 54 Alnwick pod route (red line)

Manchester

AUTO-SHUTTLE (morning)

- Trial use case: Linking a sports stadium to other nearby sporting facilities, alternative car parking, shops and other transport links.
- Route: Etihad Campus, route started in the Blue Car Park and turned left onto Forge Lane, right onto Alan Turing Way (A6010), left onto Gibbon Street, straight through the roundabout, turned around in the National Cycling Centre car park before returning the way it had come to the Blue Car Park.

AUTO-POD (afternoon)

- Trial use case: Linking a sports stadium to visitor car parking (in line with an existing shuttle service).
- Route: Etihad Campus, route started at the Blue Moon Café and ran down Joe Mercer Way to the Blue Car Park before turning around and coming back up Joe Mercer Way, around the Manchester City Shop and returning to the Blue Moon Café.

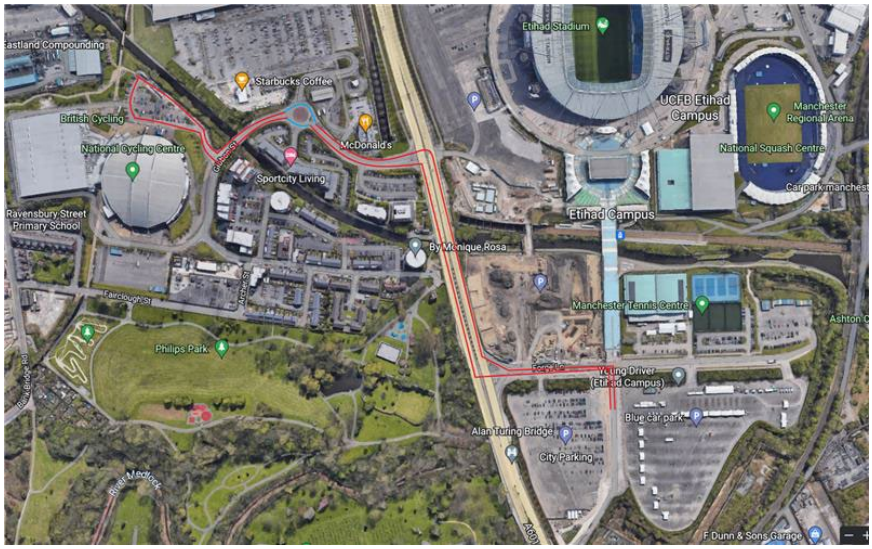

Figure 55 Manchester shuttle route (red line)

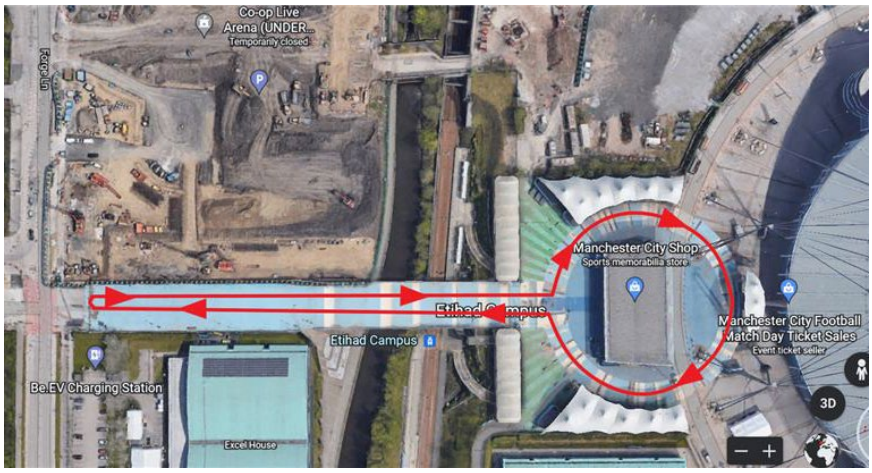

Figure 56 Manchester pod route (red line)

Taunton

AUTO-POD (morning)

- Trial use case: Linking parts of a large park or estate.
- Route: Vivary Park, route started at the bandstand and ran anti-clockwise past Vivary Park Fountain, Vivary Park Gates and back to the bandstand.

AUTO-SHUTTLE (afternoon)

- Trial use case: Linking a sports stadium to nearby shops and other transport links.
- Route: Somerset County Cricket Club (SCCC), route started in the car park before turning right onto Priory Avenue, left at the roundabout onto Canon Street, right onto Magdalene Street, left onto Hammet Street, then left at the roundabout onto Fore Street (A3027), left onto Tancred Street, left onto Duke Street, right onto Canon Street, right at the roundabout onto Priory Ave before turning left back into the car park of the SCCC.

Figure 57 Taunton pod route (red line)

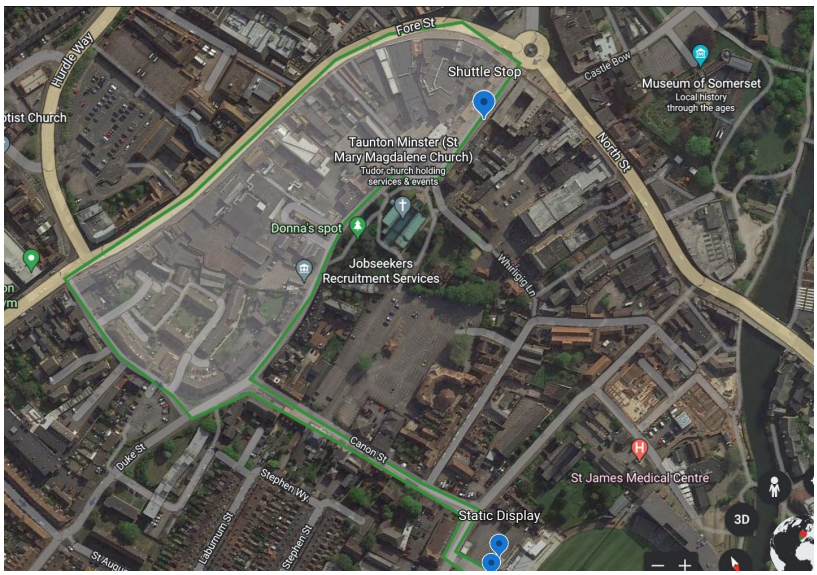

Figure 58 Taunton shuttle route (green line); NB. indicated shuttle stop not used in the final trial route

'Your self-driving world' scenario exploration game

Participants played in groups of up to eight with one moderator to guide them through the game. The game was played in multiple rounds, with the first taking place in 2027 (five years ahead) and the second in 2042 (20 years ahead).

There were multiple variables built into the game. To set up the game, groups were allocated of one of two **future scenarios that their game play would be based around:**

- **Increasing private SDVs:** *It's [2027 / 2042] and there's been some big progress on self-driving vehicles. Many more people now own private self-driving vehicles after a couple of manufacturers released new models. Most common are those that are able to do most of the journey in self-driving mode, but still require a human driver for part of the journey. By contrast, fewer public transport operators have made the shift, and the self-driving shared vehicles (like taxi pods) haven't really taken off. This means the people who have access to self-driving vehicles are mostly people who can afford a new-ish car. And of course, it hasn't done anything to reduce the amount of traffic on the roads, in fact congestion has continued to get worse.*
- **Increasing public and shared SDVs:** *It's [2027 / 2042] and there's been some big progress on self-driving vehicles. Bus and taxi companies were quick to see the potential of self-driving vehicles when they became available to purchase a few years ago. Now whole fleets have been switched over and in areas like yours more than half of shared vehicles are self-driving. That includes public bus services that connect up with trains or long distance self-driving coach services. There are also self-driving taxis, which operate a bit like a shuttle bus – you order using an app and can choose whether you want to ride alone (higher prices and wait for a vehicle to be available) or tag along with other passenger journeys and share. And if you need a car for a particular journey, you can hire a self-driving one from a car club, which are widely available.*

Groups were also allocated up to three **trends** impacting society and the economy that did not directly reference SDVs but could potentially impact their use. Trends included:

- Virtualisation: everybody online
- Electrification: everything's electric
- Decarbonisation: a greener world
- Changing high streets: social spaces, specialist shops
- Mobility as a service: Alexa, take me home
- Population change: longer, healthier lives
- Rising cost of living: less money for luxuries

The final aspect of game set up was assignment of individual **roles**, with participants asked to play the game from the perspective of this role. They were provided with a description of the job role, its priorities and its concerns to help. Roles included:

- National Government: a senior civil servant in the Department for Transport
- Local Government: a senior officer in the local council
- Large business: transport manager for a supermarket chain
- Small business: general manager of an independent shop
- Disability charity: head of transport for an organisation that champions the needs of people with a range of disabilities

- Drivers' charity: head of a charity that represents the interests of drivers, including new drivers
- Transport charity: head of a charity that represents public transport passengers, pedestrians, cyclists, and horse-riders
- Self-driving vehicle manufacturer: head of new technology at a company that develops, builds and markets SDVs

Once the set up was complete, participants moved on to playing the game in rounds. Each round started with participants deciding collectively on **actions** to take to improve the scenario or remedy any issues they perceived with the scenario they had been assigned.

Participants put forward one desired action in each round, including their rationale for choosing their action from the perspective of their own role as well as an argument for why it might be desirable for those in other roles as well. Once all participants had put forward their chosen action, they were given a chance to vote for the two actions that would be played for that round.

There were 18 actions provided for participants to choose from, and these broadly fell into the following intervention categories:

- Environmental restructuring
- Incentivisation
- Restriction
- Training/education
- Enablement

For each action there was a corresponding consequence which was not revealed to participants until after their chosen actions had been played. Actions and consequences remained in play when moving onto the next round.

Finally, before moving onto the next round, one of eight allocated **challenges** were revealed with either positive or negative implications for SDVs to be considered by participants in the next round. These were designed to emulate one-off events that could impact SDV deployment and/or uptake. Challenges included:

- Self-driving collision
- Recession
- Technological advances cuts price of SDVs
- Economic boom
- Tech advance increases speeds
- Self-driving safety evidence
- Strong local opposition
- Warning from disability charity

The game was reset and repeated in the afternoon. In the afternoon session participants were given a design role; they were allowed to choose to play with the scenarios, trends, roles, actions, consequences, and/or challenges already designed (including options they were not allocated to in the morning session), modify these, or create their own. This allowed participants the space to explore the future of SDV deployment and use without any limitations on what was possible.

Participants in the additional audiences played a modified version of the game due to having shorter workshops.

The full list of actions used in the scenario exploration game are outlined below according to the intervention in which they fell:

Environmental / Social planning

- NEW NATIONAL INFRASTRUCTURE: Start building self-driving lanes on motorways and A-roads.
- NEW URBAN INFRASTRUCTURE FOR PRIVATE VEHICLES: Invest in infrastructure to make private self-driving vehicles easier to use. Improve road markings, widen lanes/introduce new lanes to improve access, add new smart signs to guide vehicles and set up shuttle points for public transport.
- NEW URBAN INFRASTRUCTURE FOR PUBLIC TRANSPORT: Remove on-street parking to enable easier pick up and drop off of self-driving taxis, add self-driving bus lanes and smart signs to help self-driving vehicles navigate cities efficiently.
- NEW RURAL INFRASTRUCTURE FOR PRIVATE VEHICLES: Invest in infrastructure to make private self-driving vehicles easier to use. Improve road markings, widen lanes/introduce new lanes to improve access, add new smart signs to guide vehicles and set up shuttle points for public transport.
- INVEST IN SELF-DRIVING DELIVERY INFRASTRUCTURE: Set up a fund aimed at growing the self-driving freight and delivery infrastructure. Businesses can apply for funding to develop or buy their first self-driving delivery vehicle.

Legislation

- CHANGE LEGISLATION – SDVs allowed on all roads. Make it possible to operate self-driving vehicles on all public roads.
- LEGISLATE TO RESTRICT SELF-DRIVING VEHICLES: Restrict self-driving vehicles to specific lanes or environments (e.g. not in mixed traffic with human-driven vehicles).
- RESTRICT MANUAL VEHICLE SPEEDS: Speed limits are reduced for manual vehicles so they can't travel as fast as self-driving ones.
- RESTRICT SELF-DRIVING SPEED: Restrict self-driving vehicles to certain speeds (e.g. 10mph less than manual cars in all areas). For example, a self-driving vehicle can only travel at 20mph in a 30mph urban zone, 50mph on a single carriageway or 60mph on a dual carriageway.
- OPEN UP SELF-DRIVING TO ALL: Allow people without driving licences to operate self-driving cars, including those with disabilities, so new drivers no longer have to pass a test.
- POLICY – SHARED VEHICLES - Subsidise purchase of shared SDVs. A policy has been put forward that subsidises the purchase of shared self-driving vehicles.
- POLICY – PRIVATE VEHICLES - Subsidise private SDVs. A policy has been put forward that subsidises private self-driving vehicles.

Service provisions

- SELF-DRIVING VEHICLE TRAINING FOR OLDER DRIVERS: Launch a new heavily subsidised training initiative, aimed at drivers aged 40 and over, to help manual drivers become more comfortable with self-driving vehicles.

Regulation

- EDUCATION: Add self-driving vehicles to the driving test and require everyone to take it before using one. Self-driving vehicle lessons are readily available and inexpensive.
- INCREASED SAFETY TESTING CRITERIA FOR SELF-DRIVING VEHICLES: Launch an initiative that demands self-driving vehicle manufacturers increase the safety testing criteria of the vehicles.

Fiscal measures

- INVEST IN INNOVATION: Set up a self-driving vehicle innovation fund, investing tax revenue in grants for developers to rapidly improve self-driving technology.
- SUPPORT PUBLIC TRANSPORT IN RURAL AREAS: Decide to set up a fund using tax revenue to support the introduction of self-driving bus routes to areas that have poor public transport links.

Guidelines

- IMPROVE SCHOOL TRANSPORT ROUTES: Decide to ensure that self-driving public transport targets schools in order to supplement one the largest public transport demands in the UK.

14.5 Resources

Source list

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Supplementary reports

Full datasets for all quantitative elements of the research have been published alongside this report.

The Great Self-Driving Exploration: EEG Strand, produced by UCL MaaS Lab Team, covers the research findings from the EEG element of this research programme in full. Some EEG findings are covered in this report where relevant in Section 9.

ALKS Cognitive Testing Research Report, produced by Thinks Insight & Strategy (then called BritainThinks) for DfT in June 2022. The purpose of this research was to understand reactions to a set of messages and technological explainers communicating what ALKS technology is to the public, to inform DfT's communications around ALKS ahead of the technology being introduced later in 2022. While part of the wider research programme covered by this report, this cognitive testing was conducted as a standalone piece due to the specificity of the insight required.