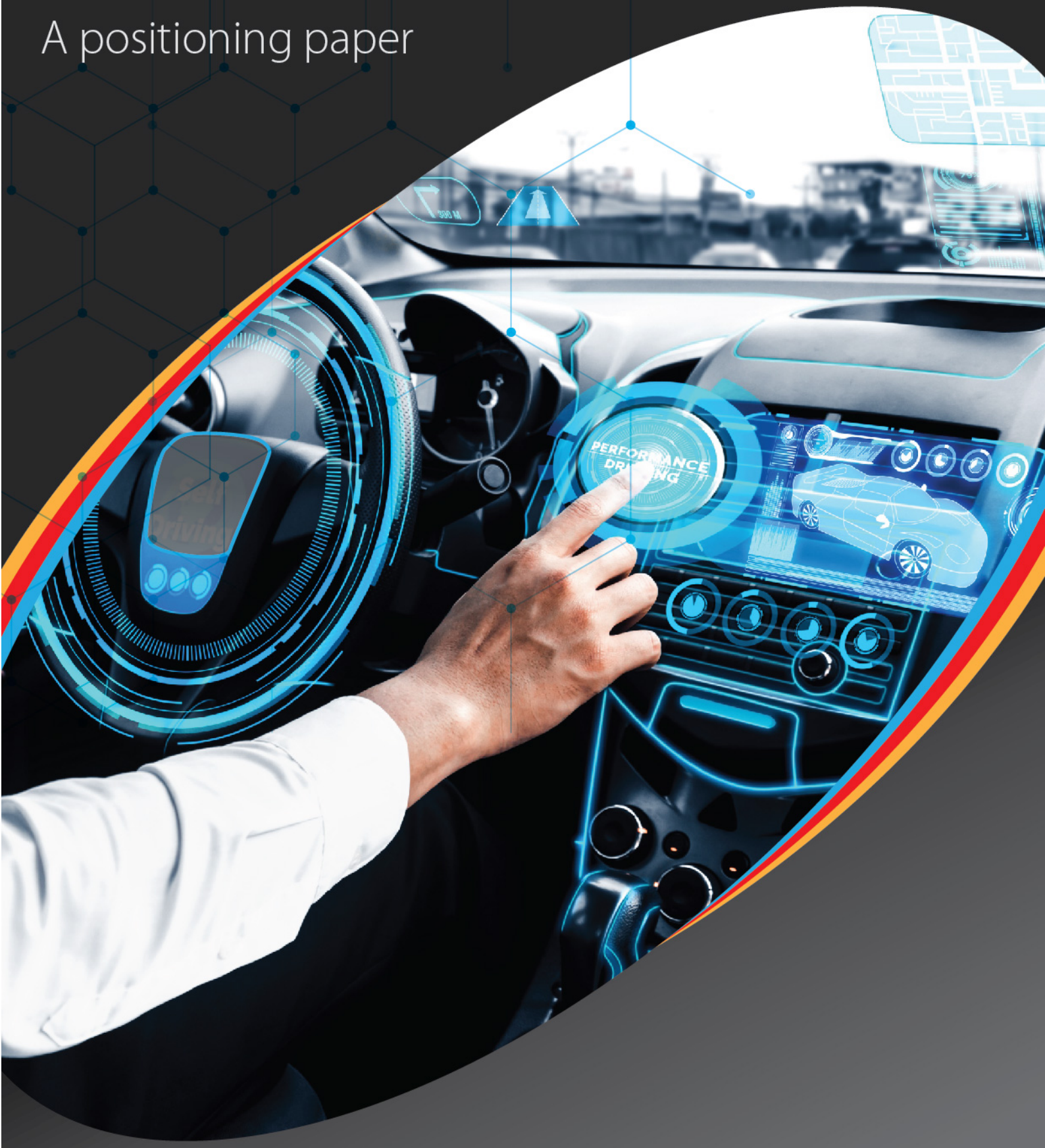
COMMUNICATIONS TECHNOLOGIES & ROAD SAFETY IN THE 2020s

A positioning paper



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Communications Technologies and Road Safety in the 2020s

A Positioning Paper

BACKGROUND

In the 20th century, road safety performance was the result of interactions between:

- driver behaviour (training, impairment, distractions etc.);
- vehicles (type, primary and secondary safety features etc.);
- physical infrastructure (road type, junction design, barriers, signs etc.).

The growth of mobile and vehicle-based computing technologies and telecommunications networks in the 21st century has seen the emergence of a fourth contributor – that of **communications technologies**.

RoadSafe has convened an expert group on this topic involving representatives from Agilysis, Bosch, Geotab, Highways England, Reed Mobility, the Road Safety Foundation and TRL with a focus on how the exchange of data between drivers, vehicles and infrastructure enables new ways to support safe, efficient and sustainable driving over the coming decade.

Our shared view is that technology and connectivity could help turn the tide on stagnated safety performance, capitalising on the UK's position as a global leader in road safety, connected and automated vehicles and associated technologies.

TERMINOLOGY

- 3G, 4G, 5G – third, fourth, fifth generation mobile communications networks
- ADAS – advanced driver assistance systems
- CAM – connected and automated mobility
- CAV – connected and automated vehicle
- CCAV – UK government Centre for Connected and Autonomous Vehicles
- V2V, V2I, V2X – vehicle-to-vehicle, -to-infrastructure, -to-everything communication
- Zenzic – organisation created by UK government and industry to champion CAM

ISSUES

NETWORK FORMAT AND COVERAGE

Connectivity depends fundamentally on network coverage and, while mobile network operators have tended to focus coverage on areas of population density, roads often travel between areas of population density. This means that network coverage on roads can be poor or even non-existent (UK roads coverage (all operators) – voice: 77%; 4G: 57%; 'Not-spots': 2%[1]).

A key challenge to the rollout of connectivity is therefore where responsibility for implementing network coverage rests. Mobile network operators may not see the value in enabling coverage for low density environments while roads operators and public sector bodies may struggle to justify paying for dedicated communications infrastructure if the benefits are only (initially) available to a few road users who have suitably equipped vehicles.

The A2-M2 Connected Corridor project (involving Highways England, the Department for Transport, Kent County Council and Transport for London) has showcased a range of connected vehicle services, demonstrating the value of connectivity and providing network operators with evidence on which to base future coverage plans.

DATA

If connectivity is established, the next challenge is determining what information will be communicated. Sensors fitted to vehicles and to infrastructure can collect and share data about a wide variety of relevant aspects, including:

- The environment (temperature, precipitation, visibility, air quality etc.);
- The vehicle (location, speed charge state, windscreen wiper operation etc.);
- The road (potholes, surface temperature, flooding etc.)
- Traffic (congestion, broken down vehicles, emergency vehicles etc.);
- Hazards (pedestrians, cyclists, motorcyclists, black ice etc.)

Aggregation and analysis of such data can enable safer, more efficient, more reliable journeys. However, it needs to be collected consistently, in an accessible format and shared conveniently so that others can make use of such data. In 2021, a data sharing platform called Convex was established with the support of Zenzic and CCAV to enable aggregation, analysis and sharing of mobility data. Similarly, the Department for Transport is creating a National Access Point to facilitate access to publicly-held transport data.

The value here is that connectivity and data access may enable public sector bodies to realise value and improve safety performance by making transport data assets more available while private sector organisations can develop new products and services based on shared datasets.

[1] Ofcom (2020) Connected Nations Update: Summer 2020. https://www.ofcom.org.uk/__data/assets/pdf_file/0017/202571/connected-nations-summer-update-2020.pdf

Services

Services for road users based on connectivity and communication have been available for many years. For example, loop detectors and matrix signs on the controlled motorway section of the M25 have been used to detect vehicle flow and manage traffic since 1997. The eCall service was made mandatory for new cars in the European Union in 2018, requiring that vehicles are able to contact the emergency services in the event of a serious collision.

Emerging connected vehicle services include wrong way driver warnings, in-vehicle messaging, remote vehicle monitoring and management, truck platooning, usage-based insurance, road user charging, green light optimal speed advice (GLOSA), asset management and connected parking.

Connectivity also enables over-the-air (OTA) updates to vehicles. While manufacturers can use this technique to manage and upgrade vehicle functionality, regulators might be able to use an OTA-type approach to manage vehicle speed, emissions and security when entering a defined region.

Vehicle type

The benefits of connectivity differ depending on vehicle type and trip purpose and may be felt at a macro-level (system-wide effects) or a micro- (individual road user). All vehicles can benefit from system-wide effects by supporting better trip routing and scheduling and supporting more reliable journey times (and trip guidance can be tuned depending on vehicle type). At the micro-level, services can be customised according to vehicle type. For example, motorcycles can benefit from systems to alert car and truck drivers to the approach of a motorcycle at a junction or systems that provide specific live guidance on weather and road conditions that account for the dynamic characteristics of powered-two-wheelers compared to vehicles with four or more wheels. Trucks can improve fuel efficiency by participating in platooning (currently being trialled in the Helm UK project) and support safety by broadcasting any perceived risks when overtaking to other road users.

Road type

As with vehicles, different road types benefit from communications technologies in different ways. For strategic roads, there is value in being to communicate with upstream road users about conditions downstream, whether that is upcoming fog, congestion or a stranded vehicle. This aligns with Highways England's 'Connecting Our Customers' strategy, seeking to enable road users to make safer and more informed journey decisions based on information that they can make available. The UK has pioneered such services in the A2-M2 Connected Corridor project, which has piloted communication of in-vehicle digital signs, traffic light timing and road works information to vehicles. In urban environments, connectivity can already support more efficient routing but in future may help to support safety by allowing infrastructure-based sensors to provide hazard information to vehicles at complex junctions. For rural roads, metadata in maps could help drivers and vehicles to operate more safely at crash blackspots by sending information about appropriate speeds and specific risks (such as low friction surfaces).

Mapping

Basic digital maps underpin satellite navigation systems – a representation of national roads is used to provide road users with an optimal route. More advanced systems use live traffic information to improve routing and journey time prediction and provide lane-level guidance. However, some organisations (e.g. Ordnance Survey, TomTom, Here) are developing high definition (HD) roadmaps. These provide centimetre-accurate 3D models of highway environments with detailed metadata including road geometry, line markings, signs and lane rules. These facilitate ADAS and automated driving by helping vehicles to localise and perceive their environment. They can also aid roads authorities by providing detailed information on the state of their assets.

However, a critical challenge for HD maps is ensuring they are up-to-date and that vehicles have access to the latest version of the map – and this depends on communications between vehicles creating and using HD maps. Reinforcing this point, it is apparent that even the most comprehensive and accurate UK national speed limit map is still only 96-98% accurate – a critical issue when trying to improve speed limit compliance and road safety.

Automation

With human error a contributory factor in the vast majority of road crashes, automated driving is promoted as one means by which road safety may be improved. Although the 5G communications standard may help to deliver automated driving, CAVs are unlikely to depend fundamentally on connectivity for safe operation in the near future. However, the ability to manage CAVs effectively will depend on V2V and V2I communications. Such systems can help CAVs to detect and respond to other road users more readily, to have access to the very latest high-definition mapping information and to be controlled by a remote supervisor when necessary.

One motivation for developing automation is to release the time spent driving for other productive or social purposes; if good connectivity enables vehicle occupants to watch streaming movies, engage in multi-way video calls or play online games in a vehicle, road users may be incentivised to use automated vehicles when they are available. However, if a vehicle requires the driver to resume control following a period of automated driving, it will be essential that the driver's alertness state is assessed to confirm their readiness to resume control. Such driver monitoring systems are likely to be a key component in improving road safety and their inclusion in European vehicle regulations and the EuroNCAP vehicle safety assessment programme will drive increasing adoption over the coming decade. They may also address some of the broader issues around the complexity of in-vehicle interfaces (greater functionality accessed by touchscreens, voice controls etc.), identified in a programme of research by TRL.

The Department for Transport should liaise with CAV developers to understand their genuine requirement for connectivity and how this may accelerate access to the potential safety and efficiency benefits of AVs.

Regulation

Vehicle manufacturers and technology developers have a critical role in delivering the innovations that can improve safety. However, experience suggests that regulations are necessary to compel manufacturers to introduce safety technologies and ensure their benefits

are achieved widely and rapidly. The European Commission's General Safety Regulation (GSR) and the Pedestrian Safety Regulation (PSR) will oblige car and truck manufacturers to introduce a range of safety measures to their vehicles in the coming years. It will be important for the Department for Transport to track these regulatory changes to ensure the UK is well positioned to gain the anticipated safety benefits of such regulations and that any implications for vehicle connectivity are understood and managed.

Consumer readiness

As with any new safety-relevant technology, we must be sure that it genuinely meets a consumer need, that it can be used safely and intuitively and that its introduction does not produce unintended negative outcomes. It is important that user adoption surveys and consumer trials inform our approach to the introduction of new connectivity technologies and help to maximise safety. These should consider the role of driver training, licence acquisition, in-vehicle interface and user instruction materials in supporting safe and appropriate use of in-vehicle technologies.

Privacy and security

The collection, transmission and use of data that is potentially sensitive and / or safety critical, matters of user privacy and cybersecurity are paramount. It is vital that such concerns are addressed in considering the wider use of communications technologies. Fortunately, the UK was rated best in the world for automotive cybersecurity by KPMG in the Autonomous Vehicle Readiness Index (2020) while the Law Commissions of England & Wales and Scotland are close to completing a review of the legal framework for CAVs.

ROLE FOR GOVERNMENT

The Department for Transport can play a critical role in convening and aligning stakeholders around the need for connectivity to achieve road safety and efficiency aims and supporting international efforts to coordinate regulations where these align with UK goals. This will give:

- mobile network operators the confidence to accelerate installation of transmitters and increase communications coverage on the road;
- vehicle manufacturers and technology developers clarity over the future timeline and specification for connectivity, allowing them to develop products and services that exploit new communication-based technologies;
- local, city, regional and roads authorities guidance on how to regulate communications technologies in line with their own requirements.

Importantly, it will enable citizens and businesses to benefit from the advantages that connectivity provides, improving road safety, increasing efficiency and improving productivity – all of which will contribute to the UK's competitiveness in the global market.

The Department can also continue to support CCAV and Highways England in the development of a coordinated strategy and supporting technology trials that help to ensure road safety outcomes are maximised.

As a charitable partnership that successfully convenes government, private sector and road safety professionals, RoadSafe is ready to support this approach.

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