EU strategy on cooperative intelligent transport systems

SUMMARY

Digital technologies, and systems based on them, are being rapidly introduced in transport all over the world. Cooperative intelligent transport systems (C-ITS) in road transport are part of this development, and one element in a wider drive towards vehicle automation. These systems use technologies allowing road vehicles to communicate with other vehicles or road users and roadside infrastructure. By increasing the quality and reliability of information, C-ITS can improve road safety and traffic efficiency as well as reduce energy consumption and emissions from transport, provided that cyber security and data protection are ensured.

The European Commission has put forward a strategy outlining the path towards commercial deployment of C-ITS in the EU by 2019, seeking to avoid market fragmentation and maintain EU competitiveness. The main steps proposed are to adopt a legal framework for providing investors with legal certainty, to make EU funding available for projects, and to continue cooperation with EU stakeholders and international partners. The strategy addresses key issues such as data protection and cyber-security, systems interoperability and technical specifications. In the meantime, several ongoing pilot projects are consolidating the experience to be shared.

The European Parliament, a long-time supporter of C-ITS and defender of personal data protection, is preparing a report on the strategy.

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Glossary

**Automated vehicle**: a motor vehicle using different kinds of on-board equipment to perform (at least some of the) driving tasks automatically. Levels of automation are defined by SAE International Standard J3016, from level 0 (no automation) to level 5 (full automation).

**Autonomous vehicle**: an automated motor vehicle that operates in isolation from other vehicles, using internal sensors and needing connectivity for navigation only (GPS). The more connected a car is, the less autonomous it is. In the same context, some sources use the term 'self-driving' in place of 'autonomous'.

**Connected vehicle**: a motor vehicle equipped with devices enabling it to communicate with other vehicles, personal devices (for instance, smart phones) or the transport infrastructure via networks such as internet or radio. It primarily helps optimise traffic flows and does not need to be automated.

**Cooperative intelligent transport system** (C-ITS): a system consisting of vehicles and infrastructure capable of communicating with each other and with road users through vehicle-to-vehicle technology (V2V), vehicle-to-infrastructure technology (V2I), or vehicle-to-everything (V2X) technology.

**Intelligent transport system** (ITS): a system that uses information and communication technologies in transport. Relying on computers, electronics, sensors, telecommunications and satellites, it is used in infrastructure and vehicles, (road) traffic management, mobility services and interfaces between road and other modes of transport.

**Self-driving vehicle**: a fully automated motor vehicle equipped with technologies enabling it to perform all driving functions without any human intervention. In this sense, 'self-driving vehicles' belong to the wider family of 'automated vehicles'.

Context

While the everyday functioning of our society depends on transport, increasing road traffic generates congestion, safety and environmental problems. Despite efforts and improvements, around 26 000 people die and 135 000 are seriously injured on European roads every year. Congestion costs in the EU are estimated at about 1 % of GDP, and transport is currently responsible for almost a quarter of the EU's greenhouse gas emissions, with road transport accounting for more than 70 % of them. Moreover, according to European Environment Agency (EEA) forecasts, EU passenger transport will grow by 40 % and freight transport by 58 % between 2010 and 2050. Meanwhile, the growth and ageing of the European population has a big impact on mobility needs.

Transport is undergoing a transformation, enabled and partly driven by digital technologies. Data exchanges make it possible to match transport demand and supply in real time, reduce the human error factor in accidents, integrate all modes into a multimodal system and develop sustainable mobility.

Using diverse advanced applications for data exchange, intelligent transport systems (ITS) are already employed in all transport modes, be it for rail traffic control, tracking of shipping containers or aviation management. They are also used by travel information services, journey planners and traffic management and safety applications. In road transport, ITS serve tasks related to electronic tolling, dynamic traffic management, real-time navigation support and tracking systems, information services on safe and secure parking, emergency call systems in case of an accident, and other driver-assistance systems. ITS can improve travel safety and traffic management, reduce the environmental impact of transport and maximise its benefits for all users.
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Today’s vehicles are increasingly ‘connected’, meaning they are capable of exchanging information with their surroundings. Cooperative intelligent transport systems (C-ITS) use this connectivity to further enhance the impact of ITS. Based on technologies enabling vehicles to communicate with each other (V2V), the transport infrastructure (V2I) and other road users (V2X), C-ITS can increase the quality and reliability of information, improve traffic efficiency and road safety, and bring users greater comfort.

While connected vehicles and C-ITS are part of the wider transition towards automation in transport, some experts\(^1\) estimate that it is the already high level of connectivity and coordination between vehicles and infrastructure, and not automation as such, that is likely to bring the biggest system-wide energy efficiency benefits. Moreover, while researchers continue seeking solutions to the multiple issues related to achieving higher levels of vehicle automation,\(^2\) C-ITS are already available and can start saving lives right away. C-ITS need to be seen as an enabling technology, not an objective in itself.

In their 2015 declaration on automated and connected driving, the transport ministers of the G7 states and the European Commissioner for Transport highlighted the potential positive impact of these new technologies on road safety and pledged to encourage them. The introduction of transport services based on digital technologies is progressing rapidly all over the world, with several countries heading for their market deployment.\(^3\)

An EU approach takes shape

The EU has introduced common rules for road transport and interfaces with other modes under the ITS Directive (Directive 2010/40/EC), later adding specific rules on travel and traffic information systems, truck-parking information and the eCall emergency system.

In a move forward, in 2013 the Amsterdam group, an alliance comprising road authorities, cities and vehicle industry members, put forward a roadmap on the deployment of C-ITS in Europe. Several Member States support automated driving through national programmes, and others have started C-ITS deployment under real-life conditions.

By supporting initiatives such as the C-ITS platform (set up in 2014) and the C-Roads platform (set up in 2016), the European Commission has brought together private and public stakeholders. In 2016, the C-ITS platform put forward policy recommendations addressing the main technical and legal obstacles slowing down an EU-wide C-ITS deployment. According to the platform, coordinated EU action is urgently needed, as the technology is ready. Furthermore, the industry is deploying C-ITS equipped vehicles in other parts of the world and will be ready to do so in the EU in 2019, if the necessary legislative framework is in place on time. For its part, the C-Roads platform is developing and sharing technical specifications to ensure the interoperability of the C-ITS initiatives deployed\(^4\). C-ITS are also related to the work of Gear 2030 – a high-level group that gathers industry, NGOs and policy-makers.

As for the EU political level, in their April 2016 declaration of Amsterdam the EU Member States’ transport ministers urged the Commission to develop a European strategy on connected and automated driving, adapt the EU regulatory framework and coordinate research and innovation.

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The strategy

In November 2016, the Commission put forward its C-ITS strategy (COM(2016) 766) as part of its clean energy package and the move towards automated mobility. Building on the recommendations of the C-ITS platform and a public consultation, the strategy
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envisages the commercial deployment of C-ITS services as of 2019. It is linked to other Commission initiatives in the area of growth and jobs, digital internal market and low-emission mobility, and requires strong cooperation across the transport, industry and telecommunications sectors. To achieve continuity and interoperability of C-ITS services, the Commission will introduce an EU legal framework for common standards. It intends to address security and data protection, ensure legal certainty for investors, foster EU competitiveness and avoid market fragmentation.

While the strategy concerns all modes of transport, its focus is on road vehicles. Taking a phased approach, it defines services that have a long-term impact on road safety and sustainability and facilitate automation. These are divided into two lists. The 'Day 1 list' contains non-complex services that are ready to be deployed and allow user benefits to be achieved even with a limited penetration of C-ITS in vehicles and infrastructure 'hot spots'. It covers hazardous location notifications (such as warnings about road works, weather conditions and emergency vehicles approaching) and signage applications (such as the red-light violation warning and in-vehicle information on speed limits). The services will be based on common, technically interoperable standards, and the driver will remain in control of the vehicle at all times. This will not entail any liability issues different from those valid today. The 'Day 1.5 list' contains services that are considered less mature and can be introduced later, such as information on fuelling and charging stations, parking management and information, traffic information and smart routing. The lists will be updated in cooperation with the C-ITS platform. For a fast uptake, C-ITS services must be available to end users across the EU from the start and must ensure continuity of service.

Specific actions
The Commission plans to implement a set of specific actions:

- To secure communications from potential hacking and cyber-attacks, the Commission will develop a common certificate and security policy and publish guidelines in 2017.
- The protection of privacy and personal data is critical to ensuring acceptance of the new services by end-users. As C-ITS messages can indirectly lead to the identification of users, they are considered 'personal data' and must therefore comply with the EU data protection rules, and be processed only with the informed consent of users. The Commission will publish guidance on data protection in 2018, consult the EU data protection authorities and develop a data protection assessment template.
- To transmit the wide range of services, a hybrid communication approach will be used, combining different technologies. The most promising combination for the deployment of Day 1 services is the mix of existing cellular networks and short-range communication (see box). The Commission will adopt measures to ensure that communications on the assigned frequency are functioning and to protect it from interference.
- To ensure interoperability, the Commission will develop a template for a compliance assessment process for Day 1 services, based on C-ITS deployment initiatives. It

Radio frequencies and standards
Since 2008, the EU has had a specific frequency band (5.9 GHz) allocated to safety-related communication, which will now also be open to the C-ITS communication. It must be ensured that introducing V2X messaging to this frequency does not interfere with road tolling, which uses an adjacent frequency (5.8 GHz).

EU short-range communications will be based on the ETSI ITS-G5 standard, which is compatible with the US standard (IEEE 802.11p). While the ITS-G5 is well-designed for messaging within 300-500 metres, other types of communication may be used for longer distances.
encourages more Member States to join the C-Roads platform, which coordinates C-ITS implementation at operational level and at the testing and validation phase.

- By 2018, the Commission will set up a legal framework through adopting delegated acts under the ITS Directive (2010/40/EU) on the continuity and security of ITS services, data protection, hybrid communication, interoperability and compliance assessment processes. It will continue cooperation with international partners.

As about half of the benefits from C-ITS are expected to be achieved in urban areas, the Commission recognises that cooperation with local authorities is key to avoiding increased car use and emissions caused by facilitated driving.

**Estimated costs and impacts**

Investment needed for the Day 1 services is estimated at up to €3 billion for about 30 million cars connected annually. It covers mostly car-equipment costs, mainly linked to installing the hardware required to support the C-ITS services in vehicles and less to purchasing aftermarket devices (replacement parts and accessories introduced after the sale of the car by the original manufacturer). In comparison, annual infrastructure costs are limited (about €95 million), but may prove to be decisive for potential investors among highways agencies and urban transport authorities.

The expected benefits include reduced travel times and improved transport efficiency (thanks to intersection-related services, parking information and smart routing), followed by lower accident rates (by about 5 % per year) and fuel consumption. For the safety benefits to materialise, services need to be provided with a disclaimer, to avoid drivers' over-reliance on the system. C-ITS can help professional drivers avoid congestion, find parking or rest areas and reduce transit time, thereby improving their job quality. The more advanced services could enhance the safety of vulnerable road users, as pedestrians entering the road or approaching motorcycles could be signalled to drivers. For road authorities, improved traffic flows may postpone investment into new infrastructure. Once the basic services are introduced, others could be added at little additional cost.

Since no large datasets are available yet, information comes mostly from ongoing projects. Based on several studies, the Commission has estimated the market potential of cooperative, connected and automated driving at dozens of billions of euros annually, leading to the creation of many new jobs — requiring new skills and competences — in the automotive, telecom and adjacent sectors. However, most estimates do not account for potential job losses for drivers, linked to higher levels of automation. An analysis produced for the Commission concluded that, in the long term, benefits outweigh costs by a ratio of up to 3:1. It warns, however, that while a strong uptake is key to achieving significant benefits, these are likely to come only 5-10 years after the initial investments.

All in all, the benefits are more societal than individual and are only achievable in the long term, which may appeal to fleet operators, but dissuade individual end-users.

**EU funding**

As effective C-ITS need high-performance infrastructure, the EU has stimulated investment in broadband networks and transport infrastructure. Support for deploying Day 1 services is available through the Connecting Europe Facility (CEF), the European structural and investment funds (ESIF) and the European Fund for Strategic Investments (EFSI). Research and innovation projects related to the Day 1.5 services can get support from the Horizon 2020 programme. In a wider perspective, the EU has supported research and deployment projects targeting cooperative, connected and automated
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vehicles for years. The funding focus has now shifted to integrating transport modes and making progress towards automation, with over €130 million of co-funding made available under the CEF and Horizon 2020 in 2014-2016 (the first years of operation of both programmes).

Examples of EU-funded C-ITS projects

Compass4D piloted three projects for C-ITS services (road-hazard warning, red-light violation warning and energy-efficiency intersection service) in seven European cities. The SCOOP@F pilot (now in phase 2) connected about 3 000 vehicles with 2 000 km of roads so as to improve the safety of road transport and road operating staff during road works or maintenance. The FREILOT pilot project demonstrated that new automotive and traffic technologies can reduce fuel consumption and CO₂ emissions in urban cargo transport by 13%. Currently, Horizon 2020 is funding projects such as CODECS, developing harmonised standards for innovation, testing, standardisation and deployment of C-ITS services; ECORoads, focusing on infrastructure safety checks inside tunnels; and CIMEC, supporting the accelerated take-up of C-ITS in cities.

Deployment initiatives

Initial pilot projects and deployment initiatives tended to focus on personal transport, but are today increasingly also targeting freight and logistics. Geographically, the take-up has been faster in less challenging environments (motorways) than in complex urban settings.

On motorways, a number of field operational tests, cooperative and large-scale integrated projects have paved the way for creating a transport corridor. Following an agreement between the German, Dutch and Austrian transport ministries, the relevant highway operators and partners from the automotive industry have launched a cooperative C-ITS corridor Rotterdam – Frankfurt am Main – Vienna. Deployed gradually, it will allow for an exchange of traffic information between vehicles and the roadside infrastructure and ease information flows among the first vehicles equipped with cooperative systems. In Germany, the open trial operation started in April 2017, with trailers using short-range communication for roadworks warnings. Two other similar initiatives are under way. For their part, the coordinators of the trans-European transport network (TEN-T) Core Corridors have been asked to ensure the deployment of ITS and C-ITS along their corridors.

In cities, C-ITS can support the management of urban transport systems, bringing potential benefits through better traffic data, more efficient urban freight delivery and improved use of infrastructure. The pilots tested, for instance, the provision of real-time information on unloading areas to delivery vehicles (Bilbao), the recommended speed and countdown to the green signal (Trondheim), and green-light priority to public transport (Kassel) and even cyclists (Copenhagen). C-ITS can be used to facilitate parking and incident management, car sharing and, at a later stage, automated driving.

However, nothing obliges cities to introduce C-ITS. To start considering such a step, they need strong arguments justifying the allocation of budgets, showing benefits, cost-effectiveness and performance gains over their existing systems to ensure public acceptance, including among non-users. No two cities are alike and there is a lack of understanding of the costs needed for the introduction of C-ITS, their maintenance and suitable business models. Some larger cities hold the view that increasing their network operational capacity through further ITS is nearing the point when returns start diminishing. Moreover, while current traffic management systems are closed circuits, installing C-ITS means opening these systems to new actors and adding new liability and security concerns. With the C-ITS potential in mind, cities need to consider how to...
integrate them into their sustainable mobility planning geared to reducing the use of private cars.

**Outstanding C-ITS issues**

The process of developing an EU approach spearheaded by industry has involved a wide variety of stakeholders since the early stages. Participating in the work of the C-ITS platform, they shared their views and, on most issues, achieved a common vision.

**Defining rules on access to data** generated by a moving vehicle ('operating data', which excludes data imported by vehicle users, such as navigation destinations and mobile phone contacts, and data transmitted by roadside units and other vehicles), remains a specific point of disagreement. Automotive industry representatives maintain that direct third-party access to vehicle functions could increase the exposure to hacker attacks. Instead, they propose making the relevant data available to third parties on an external server (the 'extended vehicle' concept). Disapprovingly, automotive aftermarket distributors (providers of motor vehicle spare parts, tools, servicing and repair) argue that this concept has nothing to do with protecting personal data and that if applied, it would make vehicles release only a restricted set of data, considered insufficient for many digital services. They warn that it may hamper new services, products and competition.

Stakeholders' main concerns have to do with the lack of trust among competitors proposing similar services on the one hand, and by transport authorities, on the other. Hopes are high that the Commission will help build a trust network through clear standards for interfaces as well as solid data protection rules and certification policy.

**The European Parliament’s views**

The Committee on Transport and Tourism is preparing an own-initiative report on the strategy (rapporteur: István Ujhelyi, S&D, Hungary).

Already in its 2009 resolution on the Intelligent transport systems action plan, the Parliament had stressed the importance of defining a common platform architecture for standardised interfaces and protocols to facilitate the use of ITS and C-ITS. The Parliament had also insisted on the involvement of all stakeholders in the development of the new systems and on the protection of personal data. Data protection issues were also the main focus of the Parliament when the 2015 eCall emergency system was being adopted.

In its 2015 resolution on the implementation of the 2011 white paper on transport, the Parliament recalled the need for effective use of frequencies and interoperability between ITS, and asked the Commission to ensure interference-free radio frequencies via a regulatory framework. In its resolution on the 2016 Commission work programme, it requested the Commission to draw up a master-plan for the deployment of C-ITS.

**Recent developments**

The European Economic and Social Committee (EESC), in its opinion of 31 May 2017 (rapporteur: Stefan Back, Group I, Sweden), insisted on the importance of privacy and data protection and leaving room for local and company specific solutions, when justified.

In February 2017, the European Automotive Telecom Alliance (EATA), an industry initiative promoting large-scale and cross-border deployment of connected and automated driving in Europe, presented a deployment roadmap containing pilot projects for testing connected and automated driving functionalities, including hybrid communications, in five EU countries (Belgium, France, Germany, the Netherlands and
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Spain. In March, 27 EU Member States, Norway and Switzerland signed a letter of intent for cooperation on testing automated road transport in cross-border test sites.

In the March 2017 Valetta declaration on road safety, EU transport ministers asked the Commission to explore the potential of connected and automated driving technologies to enhance road safety while ensuring data security. The Commission announced a public consultation on C-ITS issues for the third quarter of 2017, and affirmed that while technical specifications for C-ITS could be legally binding, the decision whether to deploy them would remain with Member States and/or stakeholders.

Main references

Endnotes
2 The issues to be solved include the reliability of human-machine interaction, the consistency of robotic decision-making and the connectivity between road users. The non-technological issues concern legal frameworks, standardisation, and awareness measures, all of which need to take into account the significant ethical aspects involved (European Roadmap Smart Systems for Automated Driving, EPoSS, 2015).
3 For an overview of carmaker technologies, individual projects and the state of progress of testing automated cars in several EU countries and the United States, see the 2016 EP study Self-piloted cars: the future of road transport?, pp. 40-59. An overview of progress in eight EU countries as well as the USA, Australia, Japan, South Korea, China, Singapore and United Arab Emirates can be found in the 2015 ERTRAC Automated driving roadmap, pp. 18-20. For the USA, see also the NHTSA page on Vehicle to vehicle communications, and for Australia, the 2016 Smart Transport for Australia Report. China has implemented several big R&D connected-car projects and two of their largest companies are developing their own platforms for connected cars (Connected car report 2016, Pwc, pp. 43-44).
4 Making use of the CEF co-funding and open to all Member States, it currently links deployment activities in AT, BE, CZ, DE, DK, ES, FI, FR, NL, NO, SE, SI and the UK.
6 Under Directive 2010/40/EU, the Commission has the power to adopt delegated acts for a period of seven years (till 27 August 2017). In March 2017, the Commission proposed that this power be extended (COM(2017) 136).
7 An industry-commissioned study estimating impacts of connected and autonomous vehicles on the UK economy forecast that their annual economic benefit will grow to £51 billion (£60 billion) by 2030, generating over 300 000 jobs (Connected and Autonomous Vehicles – The UK Economic Opportunity, KPMG, March 2015).
8 Bordeaux, Copenhagen, Helmond, Newcastle, Thessaloniki, Verona and Vigo. Although the project ended in December 2015, the cities decided to continue operating the C-ITS services, without EU co-funding, for at least one more year.

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