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## Economic Commission for Europe

### Inland Transport Committee

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**Strategic questions of a horizontal policy nature:**

**Intelligent transport systems**

## Intelligent Transport Systems – Concept Note

### Note by the secretariat

The implementation of information and communication technologies to improve transport systems will profoundly impact the transport sector's ability to actively and positively contribute to achieving sustainable mobility.

Intelligent Transport Systems (ITS) are more than advanced technologies, they are systemic changes that aim to: (i) provide various and innovative services for different modes of transport, (ii) facilitate sustainable mobility by making transport more efficient, safer and environmentally friendly —and thus are considered among key stakeholders—as bridges across the current sustainability gap in transportation systems.

ITS state of the art is developing at such a pace that lawmakers have not kept up: ITS implementation still remains fragmented and not interconnected, partially due to a lack of internationally harmonized policies and in some areas even regulations. While huge progress has already been achieved in addressing specific technical issues, transport policy and institutional responses of a horizontal nature are being under consideration only in a handful of countries.

The Committee is invited to **consider** how it could promote the ITS policy dialogue.

## I. Introduction

1. Sustainable transport and mobility requires systemic thinking that translates into achievable results in improving road safety and energy efficiency, decreasing Greenhouse Gas (GHG) and pollutant emissions, and increasing the share of renewable energy in the sector, among other things. The use of communication and information technologies can be the catalyst in this process.

2. In order to successfully facilitate the transition to sustainable mobility, current transport systems require a new vision of development. Global megatrends of population dynamics, trade growth and rapid urbanization, as well as their impacts on the environment and the vulnerability of transport infrastructure to the effects of climate change, have been signalling the need to redesign and adapt transport systems to ensure their sustainable utility in the twenty-first century. Traditional efforts to enhance transport systems are alone not enough to respond to those systemic and interlocked challenges in a manner that would, alongside mitigating their negative externalities, ensure their worldwide transformation into universally accessible and affordable mobility for individuals and society. Moreover, transport systems of the future should provide safer and more secure systems that have minimal spillover effects on our natural and social environment. Transport systems development has been brought to a crossroads by ITS technologies and applications. ITS offer a paradigm change and present an opportunity to bridge the sectoral sustainable development gap through enhanced Information and Communication Technology (ICT) supported solutions.

3. ITS have been identified as key enablers of the transport sectors' role e.g. in achieving SDG 13 - Climate Change Adaptation and Mitigation goals. The Ministers' Round Table held during the twenty-second Intelligent Transport Systems World Congress in Bordeaux, France, 5-9 October 2015, led to the adoption of the 2015 Bordeaux Manifesto "ITS Addressing Climate Change"<sup>1</sup>, which clearly acknowledges the indispensable role of ITS in transport systems impact on achieving SDG targets, particularly within the scope of climate action, stating that:

(a) ITS can contribute to reducing CO<sub>2</sub> emissions and the pollution of air in cities by optimising network management, encouraging eco-driving and encouraging a shift from private personal cars to collective public transport and lower carbon transport modes.

(b) ITS can link in the integrated approach needed to reduce the CO<sub>2</sub> emissions services such as: connected and autonomous vehicles; satellite-based applications for transport; electro-mobility; parking and park-and-ride management; urban logistics and eco-traffic management.

## II. ITS at a glance

4. ITS have been described as advanced applications which aim to provide innovative services relating to different modes of transport and traffic management and enable users to be better informed and make safer, more coordinated and "smarter" use of transport networks (EU 2010). Their application helps in achieving sustainable mobility by making transport more efficient, safer and environmentally friendly. ITS can also be defined as 'any

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<sup>1</sup> Ministers from 28 countries took part in the round table discussions and endorsed the Manifesto.

system or service that makes the movement of people or goods more efficient and economical, thus more “intelligent” (United Nations, 2014).

5. ITS integrate telecommunications, electronics and information technologies (IT) with transport engineering to plan, design, operate, maintain and manage transport systems. The application of ICT across transport modes significantly contributes to improving usage of existing transport networks, environmental performance, efficiency, including energy efficiency, passenger and freight mobility, safety and security, including the transport of dangerous goods, while at the same time contributing to economic growth as well as increased levels of competitiveness and employment (EU 2010).

6. ITS provide state-of-the-art customized devices that can relay real-time information to road users and law enforcement agencies. In-vehicle and roadside ITS include all technologies related to driver assistance and driving automation, traffic management and vehicle control, that improve vehicle and infrastructure safety, and enable smooth and comfortable transportation by making use of specific vehicle functions and interacting with roadside infrastructure and other vehicles. Solutions such as stand-alone driver assistance can help drivers to, for example, maintain a safe speed and distance, drive within the lane, avoid overtaking in critical situations and safely pass intersections and thus have positive effects on safety and traffic management. However, benefits are further magnified if individual vehicles were able to continuously communicate with each other or with the road infrastructure.

7. Over recent years, the emphasis in intelligent vehicle research has turned to Cooperative ITS (C-ITS) in which the vehicles communicate with each other and/or with the infrastructure. Cooperative ITS can greatly increase the quality and reliability of information available about vehicles, their location and the road environment. Cooperative ITS improve existing services and will lead to new ones for transport systems users, which, in turn, will bring major social and economic benefits and lead to greater transport efficiency and increased safety.

8. ITS also provide transport system wide integration through applications such as door-to-door ticketing for commuters. Already available applications are offering optimization of transport routes for individuals across transport modes, providing recommendations for most efficient mix of transport services to get from home to a destination within a city or across continents, and to do it by purchasing a single electronic ticket. The same concepts can be developed and applied for freight transport, offering optimisation of transport routes and modes from production to consumption, thereby creating added value for the manufacturer and for the customer, while limiting environmental impact.

### **III. The role of ITS in meeting SDG targets**

9. ITS can, on the one hand, be viewed as enablers of policies designed to mitigate negative externalities of transport systems (through congestion charges, emission fees, etc.) while on the other hand as vehicles for facilitating more equitable public mobility (for pedestrians, cyclists and vulnerable road users in automobile dominated traffic environments), as well as more efficient trade of goods (e.g. e-CMR).

10. ITS can be the catalyst behind achieving sustainable mobility and at the same time maximising efficiency of transport services and infrastructure. The table below identifies a number of specific ITS applications that can directly contribute to concrete SDG targets and thus be essential for sustainable mobility.

Table 1  
**Transport and the role of ITS in achieving Sustainable Development Goals**

 <p><b>3</b> GOOD HEALTH AND WELL-BEING</p>	<b>Targets</b>	<p><b>3.6</b> – By 2020, halve the number of global deaths and injuries from road traffic accidents.</p> <p><b>3.9</b> – By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.</p>
	<b>Existing ITS solutions</b>	<ul style="list-style-type: none"> <li>• Vehicle Collision Avoidance System uses radar and sometimes laser and camera sensors to detect an imminent crash.</li> <li>• Driver Assistance Systems based on intelligent sensor technology constantly monitor vehicle surroundings and driving behaviour. They detect potentially dangerous situations at an early stage and actively support the driver</li> </ul>
 <p><b>7</b> AFFORDABLE AND CLEAN ENERGY</p>	<b>Targets</b>	<p><b>7.1</b> – By 2030, ensure universal access to affordable, reliable and modern energy services.</p> <p><b>7.2</b> – By 2030, increase substantially the share of renewable energy in the global energy mix.</p> <p><b>7.3</b> – By 2030, double the global rate of improvement in energy efficiency.</p>
	<b>Existing ITS solutions</b>	<p>Reliable delivery of electricity to vehicles through smart grid applications and/or utilizing:</p> <ul style="list-style-type: none"> <li>• Rapid flash charging buses such as the Geneva public transport TOSA pilot project;</li> <li>• Induction charging such as the Utah State University wireless induction charging bus prototype;</li> <li>• “Shaped Magnetic Field In Resonance” applied in Gumi, South Korea, that sends electromagnetic fields created by electric cables buried in the asphalt to public transport buses (while not to cars). A coil in the bus battery can turn the electromagnetic fields into electricity at a distance of more than half a foot above the road.</li> </ul>

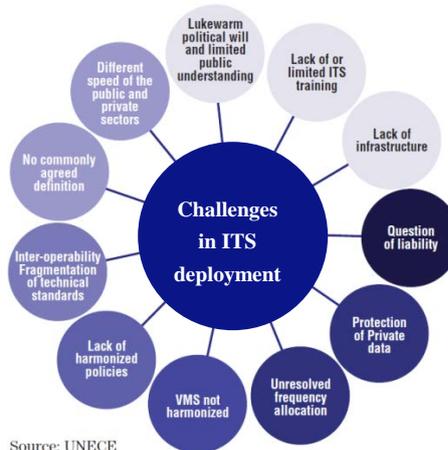
	<b>Target</b>	<b>9.1</b> – Develop quality, reliable, sustainable, and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.
	<b>Existing ITS solutions</b>	<p>More efficient use of existing, or the reduction of the need to build unsustainably large infrastructure can be achieved through “Platooning”- a collection of vehicles that travel together and actively coordinate information through Vehicle-to-Vehicle and Vehicle-to-Infrastructure technology.</p> <p>Platooning is agued as a solution for fuel and traffic efficiency, as well as driving comfort. The main goal of the platoon is to be relieved from the traffic congestion by vehicle automation technology. It operates each vehicle close together with compare to manual driving condition; hence every lane can carry approximately double the traffic than current manual system. This obviously shrinks the traffic congestion in highway. It maintains a close spacing aerodynamics drag that results in a major reduction in fuel consumption and exhaust pollutant. Result has shown how that drag reduction improves the fuel efficiency and emission reduction by 20 to 25 per cent.</p> <p>For these reasons a number of platooning projects have been continuing such as SARTRE, a European platooning project; PATH, a California traffic automation program that includes platooning; GCDC, a cooperative driving initiative; SCANIA platooning; and, Energy ITS, a Japanese truck platooning project.</p>
	<b>Target</b>	<b>11.2</b> – By 2030, provide access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities, and older persons.
	<b>Existing ITS solutions</b>	<p>The ITS applications can play an important role for transport, particularly in big cities by:</p> <ul style="list-style-type: none"> <li>• Signalised junction controls that can improve traffic flow and reduce air pollution;</li> <li>• Enforcement cameras to deter speeding and discourage running traffic lights;</li> <li>• Intelligent traffic signals that can increase the time available for people crossing the road, where and when this is needed;</li> <li>• Variable message signs can provide information on current travel conditions, the availability of parking spaces, or real time public transport information;</li> <li>• Information prior to or during the journey on urban public transport services (WAP, SMS etc.);</li> <li>• Electronic multimodal tickets, e-ticketing etc.</li> </ul>

	<b>Target</b>	<b>12.2</b> – By 2030, achieve the sustainable management and efficient use of natural resources.
	<b>Existing ITS solutions</b>	<p>Eco Adaptive Balancing and Control (EcoABC) – on the central level this system seeks to distribute traffic in an energy efficient way over the road network. Decisions are based on the eco Energy Map which is produced by the network and emission estimation and prediction modules.</p> <p>Once the best possible distribution of traffic over the network is calculated, targets for the control level are defined. The control level has several possibilities to achieve these targets. The new control models will improve their effectiveness by including vehicle drivers within the system optimization. For instance, drivers will be informed when and where there is a green wave, the speed profile they should maintain to stay within the green band, and the best ‘micro-route’ for their next trip segment.</p> <p>All these measures aim to (1) distribute and balance traffic over the network to reach a better capacity utilization, (2) reduce waiting times and number of stops, (3) smoothen traffic flow and (4) advise optimal individual routes to drivers. Such measures will not only improve the general traffic situation (i.e. less congestion and smoother traffic flows) but also considerably reduce fuel consumption and emissions.</p>
	<b>Targets</b>	<p><b>13.1</b> – Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries</p> <p><b>13.2</b> – Integrate climate change measures into national policies, strategies and planning</p>
	<b>Existing ITS solutions</b>	<p>ITS applications that are proven to reduce CO<sub>2</sub> emissions include:</p> <ul style="list-style-type: none"> <li>• Advanced navigation system</li> <li>• Dynamic Route Guidance System</li> <li>• ETC (Electronic Toll Collection)</li> <li>• Advanced Traffic Management System</li> <li>• ACCS (Adaptive Cruise Control System)</li> <li>• Advanced Logistics System</li> </ul> <p>Dynamic Parking Lot Guidance System:</p> <p>SPS pilot program carried out in San Francisco from 2009-2013 set out to improve drivers' parking experience. Sensors installed in the surface of each parking spot communicated with radio receptors about which spots were occupied. The information was then displayed to drivers via LED screens outside lots and through the downloadable SFPark mobile app. CO<sub>2</sub> emissions decreased by 30 per cent.</p>

## IV. ITS Deployment – the state of play

11. Over the past few years ITS deployment has started to take off and thus today it is no longer looked upon as a futuristic idea in a growing number of countries, but accepted as solution to daily mobility issues. At the same time, many obstacles to ITS – as identified in the UNECE strategy package on ITS – still remain to be an issue.

12. Good governance is essential and its shortcomings create an overarching web of impediments. There are several distinctive and very specific obstacles that need to be resolved by policymakers for ITS to begin realizing its full potential. In this overview, we will focus on interoperability, fragmentation of technical standards and harmonization of policies.<sup>2</sup>



Source: UNECE

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### A. Interoperability

13. Standardization currently focuses on cooperative systems and interoperability of ITS technologies. Since ITS have a global dimension, great attention is given to the creation of commonly agreed standards for the network architecture, protocols and transmission formats. Having such a set of commonly agreed standards could lead to a global harmonization of ITS services and applications. A key issue when working on such standards is ensuring interoperability. However, systems in use across different parts of the world remain incompatible and fragmented. This becomes problematic since vehicles travel across regions and national borders and therefore interoperability becomes essential not only within national frontiers, but also across regional trade blocks and internationally, at large.

### B. Fragmentation of technical standards

14. Most nations still have their own unique automotive safety and environmental regulations, which are not harmonised internationally despite the high level of globalisation of the automotive sector. As a result of this regulatory diversity, a hot-selling vehicle in one market simply cannot be sold in other markets. A car certified as having met all regulations in the country of origin cannot obtain approval for sale in other nations without incurring substantial additional time and financial costs. Looking ahead, technical changes in the automotive industry will continue at a dizzying pace as a result of consumer preferences for new vehicles (energy efficient and safer, ITS compatible and “smarter”) and stricter environmental standards, among other things (e.g. climate change mitigation).

<sup>2</sup> For a full review of challenges to maximize the impact of ITS please see the diigramme and *Intelligent Transport Systems for Sustainable Mobility* (UNECE, 2012).

15. Manufacturers' interests are to sell common platform vehicles globally and they will expect to do so efficiently (e.g. avoiding having to achieve compliance with different standards or regulations market by market). A workable, inclusive process for establishing an international legal framework must keep pace with the new technologies that the industry's emphasis on differentiating technology will most likely create.

### **C. Lack of harmonized policies**

16. Given that the design and industrial development cycle of innovative technologies is shorter than the policy cycle for such innovation, transport policy decision-makers and regulatory authorities must speed-up their efforts to maximize the potential offered by implementation. Industries are intensively developing and implementing innovative technologies in various transport fields. However, most regulatory efforts remain in the domain of national legislations (notwithstanding the EU case) thereby missing institutional coordination among other countries. Looking at the ECE region, which includes countries of North America, Europe and Central Asia, harmonization of ITS requirements is warranted across the borders, particularly in the context of the Euro-Asian transport linkages. Failing to do so would result in the promotion of ITS applications without internationally agreed-upon standards. This in fact could prove to be an obstacle to further development.

17. Therefore, perhaps one of the biggest challenges today would be to avoid the myriad of incompatible applications. The development of standards and agreements between neighbouring countries on common architecture are both difficult and time-consuming exercises. While waiting for them, the exchange of experiences and best practices, as well as the development of harmonized regulations are key to paving the way for interoperability.

18. An even bigger challenge however is to embrace a policy changes that moves away from traditional, supply-driven transport policies to modern, demand driven mobility policies that are able to build on new technologies in transport and communication.

## **V. Ongoing activities and actors in the field of ITS**

### **A. ITS World Congress**

19. The ITS World Congress is an annual international conference focused on ITS. The organisation of the annual ITS World Congress is one the achievements of the cooperation among ERTICO, ITS America, ITS Asia Pacific and ITS Australia. It brings together international ITS experts, professionals, public and private sector leaders, academics, researchers, engineers and students, representing all corners of the ITS industry, for the purpose of showcasing and discussing latest developments and ongoing challenges in its applications. These identified challenges mirror the above-described needs to harmonize policies, standardize technologies and ensure interoperability. Industry representatives present annually at the ITS World Congress are particularly emphasizing the importance of overcoming these obstacles for securing a cost effective and geographically broad and harmonized application of ITS products, such that would ensure the expected dividends of ITS applications. In other words, these opinions represent appeals to governments to work towards internationally harmonizing all ITS relevant regulations, and also to address the policy implications.

## B. ITS activities of UNECE – Vision and Strategy

20. ITS have been on the agenda of the UNECE Inland Transport Committee (ITC) and its subsidiary bodies since 2003. The first ITC round table on ITS in 2004 focused on technological issues and called for increased technical harmonization. ITS were discussed and became the object of specific legal instruments thanks to the work of several ITC bodies. Within their mandates, ITC Working Parties have been addressing a number of the listed ITS-related matters. The World Forum for Harmonization of Vehicle Regulations (WP.29) hosts a group of experts that provides general guidance on how to incorporate provisions of intelligent vehicle systems into the Vehicle Regulations (Informal Working Group on ITS – Automated Driving (ITS/AD)). The Working Party on Road Safety (WP.1) is engaged in debates on liability concerns and is charged with maintaining, as well as modernizing, the Convention on Road Signs and Signals and the Convention on Road Traffic (Vienna Conventions).<sup>3</sup> Furthermore, it pursues the harmonization of Variable Message Signs (VMS). Cooperation at working party level was established through the informal working group on automated driving, with WP.1 liaising with the WP.29 informal working group on ITS/AD.

21. The Working Party on the Transport of Dangerous Goods (WP.15) is examining how Telematics can be used to enhance safety and security. The Working Party on Inland Water Transport (SC.3) works on applications of River Information Systems, while the Working Party on Road Transport (SC.1) deals with the Digital Tachograph and e-CMR.<sup>4</sup> It is also in charge of the Pan-European road infrastructure agreement, the AGR. In addition, discussions regarding governance of ITS and the incorporations of their applications into transport systems also take place in:

- Working Party on Intermodal Transport and Logistics (WP.24)
- Working Party on Customs Questions affecting Transport (WP.30)
- Inter-governmental Infrastructure Projects (TEM and TER).

22. All these bodies have expressed their wish that the Inland Transport Committee and the Sustainable Transport Division provide strategic guidance and administrative support to them with regard to ITS, especially focusing on mitigating traffic congestion, improving road traffic safety, reducing pollution and noise and improving fuel efficiency. In addition, in 2010 the Committee emphasized the need to take action in support of ITS in a harmonized way and backed the launch of the strategic review on how ITS can contribute to sustainable transport and what role the Committee should play in promoting ITS solutions (UN 2012).

23. In response to the ITC position, the UNECE ITS Strategy Package with a Road Map and Best Practices Review outlines the areas and lists the activities ITC can embark upon, either as a continuation of ongoing tasks, or as new initiatives. The document establishes, above all, a Vision of sustainable intelligent inland transport systems. Such transport systems are configured to provide solutions that enable sustainable and accessible transport and mobility. Intelligent transport applications embedded in the systems technically support

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<sup>3</sup> The Vienna Conventions are designed to facilitate international road traffic and to increase road safety.

<sup>4</sup> The purpose of the e-CMR Protocol is to facilitate smoother international road freight transport and to improve good governance in road transport by allowing the use of electronic consignment notes. This Protocol relates to the United Nations CMR Convention (Convention on the Contract for the International Carriage of Goods by Road) signed in Geneva on May 19th 1956. It refers to various legal issues concerning transportation of cargo by road.

an economic and environmental optimization of modal split, facilitating tailor made mobility solutions based on individual needs for transport of both persons and freight.

24. Solutions can help overcome the physical limits of infrastructure development and growth without compromising increasing volumes linked to economic development, simultaneously, *inter alia*, enhancing safety, improving information for users, providing fair pricing solutions and securing access to mobility services for vulnerable groups (children, the elderly and persons with reduced mobility).

25. The Vision calls for international harmonization standards to provide for interoperability of technologies wherever they create added value and benefits. Harmonization will enable consistent use of many ITS solutions that today have limited impact e.g.: application of vehicles eCall systems (emergency calls upon road vehicle accidents).

26. Most importantly, the Vision also calls for transport policy and institutional responses to the ITS opportunities. At national level, it has already been happening in a number of countries, which are mostly high and middle-income countries. Sharing their experience at international platforms could facilitate that countries that have not yet embarked on the digitalisation of their transport sector are not left behind a “digital divide”.

27. The path to achieving this vision is set out in the twenty global actions identified in the UNECE Road Map that address ITS related technical and governance challenges. The Road Map emphasizes the need for across-the-board harmonization of ITS, in the absence of which ITS applications cannot and will not live up to their potential to holistically contribute to modernization and advancement of transport systems worldwide. With the adoption of the 2030 Development Agenda the implementation of the ITS Road Map of the UNECE Strategy Package has become even more important.

## **VI. Recommendation**

28. ITS can and will likely be a driving agent in shaping the future ways of mobility and the transport sector. Through the use of ITS applications, transport systems will become more efficient, safer and greener. However, as stated, technological innovations are faster than the policy, legal and institutional changes which are warranted for reaping the full benefits of their applications. This will only happen if the relevant technical solutions and services are successfully embedded in appropriate and internationally harmonized policy.

29. While significant achievements have already been made at the level of technical issues, particularly thanks to the activities of WP.29, at the level of policy and institutional changes, international dialogue is mostly absent. The Inland Transport Committee may wish to discuss how it could facilitate such policy dialogue of a horizontal nature.

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