

14th ITS European Congress Toulouse 2022

POST-CONGRESS REPORT

SMART AND SUSTAINABLE MOBILITY FOR ALL.



**EUROPEAN
CONGRESS**

TOULOUSE

30 May - 1 June 2022

Smart and Sustainable
Mobility for all.

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The 14th ITS European Congress - Post-Congress Report

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8

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INTRODUCTION

The Congress's principal theme "Smart and Sustainable Mobility for all" was chosen to illustrate the radical role Intelligent Transport Systems, digitalisation, and cooperative, connected and automated mobility can play in addressing the key challenges in the mobility and transport sectors. Deployment of ITS can take us further down the road to a mobility world that is accessible, equitable,

affordable, has zero fatalities, has zero emissions, is resilient when stressed, is seamless across continents and is sustainable. How to achieve these benefits was presented in policy discussions, technical and research paper sessions, demonstrations, technical tours and the Congress Exhibition.

The Congress was organised around five key Topics:

Topic	Title	pages
1	Services for citizens	27-33
2	Innovative solutions	34-40
3	Green & sustainable mobility	41-44
4	Large-scale trials to deployment	45-47
5	Cities as Logistics hubs	58-51

The European Programme Committee, chaired by Lisa Boch-Andersen, appointed rapporteurs for each topic tasked with capturing the key messages and outcomes from the Congress, the exhibition and the demonstrations. The headline theme was addressed by a wide range of different types of sessions, over 150 in total - Plenary, Special Interest, Technical, Scientific -as well as specialised Workshops and Forums.

Part 1 of this Report summarises the Congress proceedings. The second part paints a picture of proceedings at the Plenary Executive Sessions. The third part focuses mostly on the Technical & Scientific papers and the Special Interest Sessions. The final part summarises the proceedings at the ITS Summit.

I give my profound thanks to the marvelous team of rapporteurs who contributed so much to making this report happen:

Topic 1 **Carol Schweiger**

Topic 1 **Sharon Kindleysides**

Topic 2 **Risto Kulmala**

Topic 2 **Håkon Wold**

Topic 2 **Tim Morris**

Topic 3 **Jill Hayden**

Topic 4 **Maggie Wieteska**

Topic 5 **Tim Morris**

My thanks also to the moderators and note-takers for the ITS Summit: Tom Kern, Delphine Krieger, Marieke Martens, Jenny Simonsen and Margriet van Schijndl

My colleagues from ERTICO, the Toulouse Host team and MCI all deserve thanks for their quick and cheerful handling of all my enquiries and questions.

PROFESSOR ERIC SAMPSON
CHIEF RAPPORTEUR

BRUSSELS July 2022

PART 1

Summary

There were around 110 Congress sessions in all. 65 were Special Interest Sessions; 140 papers were presented in 35 sessions roughly divided as follows – Topic 1: 30 papers; Topic 2: 70 papers; Topic 3: 10 papers; Topic 4 10 papers, Topic 5: 10 papers. In the three Plenary Sessions senior industry executives, public officials and international experts shared their perspectives and extensive experience of ITS topics encompassing policy, strategic, economic, technical, organisational and societal aspects.

There was an eye-catching and very busy Exhibition involving around 100 organisations. It included a large area to give over 20 start-ups a space to showcase their ideas and have discussions with future sponsors and customers. In addition to these indoor activities there were 16 managed demonstrations and technical tours to local control and service centres.

The ITS Summit was a key element of the Congress with over 80 Ministers, industry leaders and senior representatives of national and local governments coming together to hold cross-sector discussions on common transport challenges and possible solutions. This year's Summit discussions focused on exploring the practical aspects of the Mobility Data Space – a data sharing community for everyone who is looking to build the future of mobility. There is a full description of the Summit in Part 4.

Topic 1: Services for Citizens was the second busiest. There were vigorous discussions about MaaS covering long-term deployments, app design, integration with Traffic Management, and user acceptance. There were more sessions than before on inclusivity and gender considerations in ITS. Data sharing and exchange were prevalent throughout this topic area. We had detailed discussions on the fine line between data sharing and privacy. But several areas were less visible than expected.

For example the use of behavioural science to design MaaS schemes was absent apart from one paper.

Multimodal journey planning has been a Congress 'regular' in the past and there were several mentions of the need to improve it. We might learn lessons from the OJP4Danube, LinkingAlps, EU-Spirit and Ride2Rail projects. They all have different architectural approaches, different data sharing protocols, variable definitions, and different use-cases.

We had interesting examples of how to improve traditional ITS services such as parking and real-time traffic information. Discussing the potential for MaaS to change travel behaviour continued to be mentioned, but with little evidence to suggest that this has actually happened.

The use of 5G in services continued to evolve. Papers and sessions explained new applications covering land, sea and air as well as cross-border issues. A key issue for many travellers is a new design of interoperable booking service to enable EV users to reserve charging based on their preferences and needs.

We saw a marked focus on making services meet users' needs while avoiding accidental exclusion or bias; and on making services work at a commercial level beyond trials. Austria has a nationwide platform that integrates traffic information for all modes of transport (including road, rail, public transport, cycling, and walking) provided by central authorities.

Several forward looking sessions focused on integration from an institutional, technical and standards perspective. However there was continuing conflict between making mobility and ITS services commercially attractive and addressing accessibility and societal needs.

Topic 2 Innovative solutions was the most popular of the congress with regard to paper and session numbers. Most dealt with automation (especially automated driving) as well as connectivity and data, continuing the trend of the last decade. Connectivity featured prominently with a mix of technology innovation and practical trials. We heard about a variety of familiar use cases and some new ones such as railroad crossings, selective vehicle priority, and the management of major road works and events.

Automated mobility was clearly advancing. We saw a shift from fundamental research towards evaluation, demonstrations, legal frameworks, type approval, and solving practical deployment issues. The idea of a totally autonomous vehicle seems to have faded. Instead sessions focused on highly automated vehicles working with equipped infrastructure. The sensing and detection solutions required by automated driving and advanced driver support systems were comprehensively covered along with new ways of utilising Artificial Intelligence.

Many papers and presentations focused on collecting and using data from a wide range of sensors and devices. Accuracy of data, and harmonisation of data standards, featured strongly. Digital twins were presented dealing with real time road network activity, recommended heavy vehicle routes, and modelling the coexistence of connected and non-connected vehicles.

Cybersecurity issues received a lot of attention particularly resilience against ransomware attacks, and the need for secure protocols for connected and autonomous vehicles. Other topics addressed included assessing value from ITS solutions, and the benefits from increasing safety and protecting vulnerable road users.

Most of the papers dealt with trials and users'

experience of well-known systems but some exciting new ideas were introduced such as enhancing connected and automated driving through advanced applications of AI. New solutions developed initially for the road maintenance sector can monitor the condition of traffic signs, the appropriateness of road works signage, accumulation of water, snow or ice on a road, and other factors that affect driving safety.

The use of CCAM was discussed for strategic road networks, smart metropolitan intersections, national and sector borders, and new roles in global logistics. In previous congresses the emphasis was limited to just local hot spots, junctions and road sections.

This Topic is always going forward. The evidence was there in the technology readiness levels moving towards demonstrations and deployment, and also in the society readiness levels. Increasing emphasis was given to verifying the safety, mobility, and environmental impacts of solutions, and validating the infrastructure requirements.

Topic 3 Green and sustainable mobility was very forward thinking - unsurprising given the surging interest and importance of the climate change and net zero agendas. Electric Vehicles featured prominently with grumbles about technical and financial constraints with charging infrastructure continuing from Hamburg. Wireless charging for stationary vehicles was new with reports on the current state of developments. Denmark has created a handbook to help municipalities plan for charging infrastructure.

Mobility as a Service delivered a number of small innovations but no major breakthroughs. Motorway operators are exploring options to support MaaS such as EV charging, park & ride hubs, HOV lanes, car-sharing. However

in a survey of willingness to give up a car for MaaS only 12% said yes. The survey results illustrate the factors making people most likely to consider it, which in turn assist deciding how to encourage it.

Modal shift has been a Congress favourite for some time but shifting from road to waterways is a new and efficient way to decrease freight transport emissions. A single vessel is able to replace up to 200 HGVs. With remote control of lock gates a 50% increase in waterway freight by 2030 is hoped for.

Emissions can be reduced by more efficient driving and a session discussed whether driver behaviour change should be mandated or encouraged through training. We await results from the MODALES project which uses a mobile app to encourage it using active recommendations on the trip and passive ones after. There were 3 sessions on future traffic management systems to support sustainable mobility. Several papers reported starting work on user perceptions and willingness to use new modes.

Most papers in **Topic 4 From large-scale trials to deployment** focused on sharing lessons learned, and identifying gaps in knowledge or the availability of digital tools. There was a movement from proof of technology studies to proof of benefits. International standards and cross-border collaboration were widely acknowledged as key to successful deployment.

Many papers addressed the importance of accurate and standardised data for the operation of services. Others argued about the technology required to ensure that C-ITS messages reach end users – Road Side Unit solutions or existing cellular based comms? What is the minimum network coverage for an adequate service? These issues were still prompting debate.

Given the importance of public perceptions of some new services there was surprisingly little on this human factors topic. Work on the perceived safety of Autonomous Vehicles found a very large range of responses. It concluded that a positive perception of safety correlated with a positive attitude towards technology overall and vice versa. For AVs to deliver future benefits we need a better understanding of this, and how people's attitudes might be influenced.

A feasibility study into drones for medical deliveries found that electric drones brought significant advantages in terms of emissions and time-savings. However range and payload limitations introduced additional challenges. Legacy regulations were identified as the main barrier to deployment. Although this topic was moving forward with a strong focus on C-ITS numerous non-technical factors were identified which impact successful deployment – for example the need for enabling legislation, resolution of privacy concerns, and gaining trust and educating the public on the benefits of C-ITS.

Topic 5: was Cities as logistics hubs. Given the difficulty of sharing city space between freight, public transport and private vehicles urban logistics was an important if numerically small topic. There was exploration of how micromobility and sustainable solutions could be better integrated in the urban environment, to reduce the impact of freight moving around built up areas and help balance innovation and reliability in logistics processes.

There were discussions on data sharing and how public and private entities can work to facilitate this, as well as emphasis on federated data networks for TEN-T freight corridors. Papers also covered the importance of data and data sharing in understanding freight flows and targeting areas for improvement and

investment. Automation, and interoperable logistics platforms and routing applications also featured.

Safety in logistics transport was prominent. For example Antwerp's Safe Freight Planner designed specifically for freight transport inside the city centre focuses on routes that avoid conflict between heavy transport and vulnerable road users.

It was clear that intelligent and data driven logistics is becoming a topic of increasing interest both within Europe and globally. However, it was equally apparent that some of the traditional problems and barriers to attaining efficient logistics operations survive - such as limited data sharing and operators reluctant to be more transparent about their processes and procedures.

ITS in 2022 is at an interesting place on the road to a new generation of mobility that is

Accessible Equitable Affordable Resilient
Has zero fatalities Has zero emissions and is seamless across national boundaries. In other words, **Smart and Sustainable Mobility for All**. Toulouse demonstrated that we have taken some big steps towards connecting the dots but we're not finished yet and there are some difficult problems still to be solved. Almost none are technology - they are about our behaviour. The younger generation adapt easily. In the past a driving licence at 17+ was the passport to mobility freedom; today there's no age requirement and it is the right apps on your phone.

But as well as our willingness to change we need to look at excessive organisational concerns regarding regulation, integration, competition, and collaboration. We need to change the ways we deal with changes. Remember - To go fast, we go alone. To go far, we go together.



The essential interlinking of data and connectivity as required for automated shuttles (Sánchez, Blanco, Dafonte, Blanco, Rodríguez, Rosales and Pérez in TP 20)

PART 2

Plenary Sessions

Plenary 1

Next generation mobility: powered by technology, driven by sustainability

Moderator	Christian Desmoulins	Actia Groupe France
Keynote address	Anne-Lise Thieblemont	Qualcomm, USA
Speaker	Christopher Haas	Google Cloud
Speaker	Joost Vantomme	ERTICO-ITS Europe, Belgium
Speaker	Herald Ruijters	DG MOVE, European Commission; Belgium

The Moderator opened the session and explained that looking back over the previous year of ITS the key words were safety and efficiency. The Plenary reflected the increasing importance of sustainability and he would ask the speakers to set out what they were doing and what was needed to reach the safe and efficient and sustainable end point.

In her Keynote address Anne-Lise Thieblemont drew attention to the massive developments over the past decade with in-vehicle sensors and infrastructure connectivity particularly telecoms speed. The telecoms industry was used to rapid refreshment and short product cycles whereas transport infrastructure was designed for very long life so a backwards and forwards compatibility was a key factor for ensuring sustainability. The development of highly automated and autonomous driving was another area where communications solutions needed to work jointly with AI, location referencing and traffic management technologies in order to support emerging sustainability and digitalisation strategies. Her final message was the need for systems connectivity: there was no single solution to better mobility rather the way forward was sub-systems working together.

Joost Vantomme noted that ERTICO was a high level public-private partnership with over 120 member organisations doing exactly what

Anne-Lise had described as necessary to take mobility forward. In its 30+ years of existence ERTICO's scope had developed from a focus on the automotive and research sectors and physical infrastructure to include the IT, energy, aeronautical and climate sectors in order to get the holistic view of sustainability challenges. ERTICO had been conceived as a coordinating body helping all parties to move forward with innovation and although the underpinning technologies were more complex the benefits from co-working were unchanged. He stressed the need for agility in setting policies and cited the case of his teenage daughter who had no driving licence. This was because for her the 21st century mobility passport was no longer a driving licence but the right apps on a smartphone.

In reply to the moderator's question Herald Ruijters reviewed the Commission's ITS strategy with emphasis on the need to add resilience to the key safe and efficient and sustainable objectives, especially significant given hostile events in Eastern Europe and before that the Covid pandemic. He stressed a different aspect of connectivity: the need to see that all aspects of a strategy were considered so for example a sustainable transport strategy would involve electric vehicles which in turn might have implications for energy policies as well as smart infrastructure. It was also essential to think of small scale solutions as well as major

initiatives: making transport as a whole smarter would deliver a big sustainability gain from many small initiatives and the Commission's plans for developing the ITS Directive aimed to enable that.

Christopher Haas explained that as well as supporting client bodies in their sustainability projects Google had a number of internal policies regarding carbon-neutrality and reduction of energy usage. He offered three ways to improve sustainability: moving IT systems into the cloud with regional rather than longer distance delivery, developing smarter critical infrastructure based around edge computing to reduce the need for extensive carbon-consuming support systems, and strengthening smart edge computing so that only critical insights were reported up the chain with key decisions devolved wherever possible. He stressed the benefits cloud computing brought for equity as it significantly reduced the start-up costs for bodies wanting to launch new products.

The moderator asked how smaller organisations could use smart mobility developments to help them overcome the disruptions of the past 2 years. Joost gave the example of supply chains in the automotive industry. In the past you consumed locally and tended to supply locally but the strong trend has been to produce locally but consume globally which develops the awareness of other actors in the sector. When something impacts a sector the important action is cooperation of everyone involved and this can be helped by ERTICO - which is not a profit-making body. Small bodies can benefit from this as easily as the larger ones.

Herald reviewed the Commission's plans for developing the regulatory framework for ITS actions. A key objective was a level playing field and that had implications for the availability of data. Across the EU transport data sets

differed on content, standards used, data quality and accessibility which made it difficult for new organisations, especially smaller ones, to enter a market. The Commission aimed to establish a common pan-EU data space to bring all member states to a common minimum high level of interoperability. This was proving to be difficult to implement as some MSs were enthusiastic about the safety, efficiency and sustainability objectives but were slow to endorse the regulatory changes needed to achieve them.

Christopher said that Google had various ways to help small businesses for example the availability of affordable services such as the Cloud but also collaborative projects with Google Research staff. There were two aspects of the latter: as a large company Google staff had worked on optimising its own operations and the results of these studies had been shared with cities so that they could deploy proven solutions. The other aspect was collaborating with researchers on new problems and there had been a number of successes in the general area of optimising decision taking so for example travellers could be offered routing options with priority for time or priority for cost or priority for fuel consumption. Some results from this work were visible in Google Maps options.

Anne-Lise said that a key comment for her had been 'leveraging as much as possible what consumers have today' and that translated as getting the knowledge of what works to the widest possible audiences but also to the key points. There were many examples of improved traffic management processes being deployed on autoroutes and similar but these high quality roads were relatively safe and the priority was surely the rural roads with poor accident records.

The moderator asked panellists what was new in sustainability. Joost suggested that it should be interpreted as using available resources in an energy-efficient way and 'resources' ranged from individual vehicles to whole cities. The key for more sustainable cities was connectivity so that mobile units had access to all types of information from both close and distant localities so that efficient and effective decisions could be taken. It was also essential to make sure that end-users were involved in consultation and awareness programmes at all stages.

Herald identified three gaps in progress to greater overall sustainability: data, multimodality, and the sense of urgency to reach agreement – for example based around a revised Directive – on the actions needed. He had commented earlier on data needs; improvements in multimodality were needed to offer travellers the maximum information about choices and associated costs. And on timing the loss of momentum following the pandemic needed to be addressed at once.

Christopher also identified understanding data as a key barrier for both the producers and the users. We still have too many data silos and we must open them so that all classes of users can examine it, understand what messages it is conveying and then develop new applications from it.

An audience question focused on urban air mobility. Joost referred to a recent meeting he had attended where an initiative had been launched to see if the control and connectivity environment of a driverless car could be adapted for a drone. This was a promising step for expanding the multimodality point mentioned earlier.

To conclude the session the moderator asked the keynote speaker for any comments on the position of ITS in France and her organisation's relations with the city of Toulouse. She felt that overall it was very healthy and mentioned in particular an innovatory project based around a highly intelligent bicycle that offered valuable potential for safe multimodal and sustainable personal transport. On the second part she pointed out a key omission from the discussion so far – data security and the associated issues of ownership and liability. This was sometimes side-lined because it was only considered as part of information services to a smart phone but the more important aspect was data used as a part of information or control systems in cars, trucks, trains, aircraft or ships where both the 'vehicle' and its passengers / freight loads needed to be protected. This was a key point for future sessions or congresses.



Plenary 2

Manoeuvring around obstacles on the road to deployment

Moderator	Ian Patey	WSP, UK
Keynote address	Ismail Ertug	MEP, Belgium
Speaker	Johannes Springer	T-Systems, Germany
Speaker	Sophie Foucque	Michelin, France
Speaker	Elodie Viau	ESA, France
Speaker	Benoit Perrin	EasyMile, France

The Moderator welcomed delegates and speakers to the session with some thoughts on the evolution of mobility over past years. He introduced the Keynote speaker who would review the transition to a cleaner and more sustainable mobility.

Ismail Ertug reflected on his first entering the European Parliament when the world of mobility was very different but there was still a focus on connecting the different modes and different solutions in order to improve the sustainability, efficiency and effectiveness of the overall system. Since then the component solutions had been improved especially with digitalisation and connectivity but transport remained a dominant source of greenhouse gases. What could be done? There were various priorities: improving connectivity of systems and information helped users to understand options and associated costs; improving public transport to make it more attractive; improving infrastructure to support smarter mobility in general. Electrification was a key driver for better sustainability together with more research on new fuels for all transport modes. He concluded that the smart mobility of the future needs digitalisation, sustainable systems, and smart solutions.

The moderator asked each panellist to give initial thoughts on the obstacles to deployment

and their proposals for dealing with them. Johannes Springer was concerned with moving from small-scale trials of systems to widespread regular use where a common barrier was a lack of smart - and technology-neutral - regulation. Sophie Foucque explained that her interests were extending mobility through better collective provision which in turn demanded a better understanding of driver behaviour and the use of systems to support driving efficiency. Safety was a key element of sustainability but not often recognised as such and both technology and better availability of data were potentially able to contribute here. Elodie Viau noted that she was representing the space sector which had strong links to 'terrestrial ITS' for example through location referencing, road user charging, meteorology and telecoms. The space sector was a challenging environment and solutions used for data handling were often valuable developments for other areas of ITS. Benoit Perrin explained his company's driverless vehicle products and identified a key deployment barrier as waiting for all elements of a solution to be perfectly developed and available. Often it was more productive to recognise that a solution was not complete but to deploy and learn lessons from real-world use.

The panel discussed how to accelerate the evolution of deployed systems and whether

growth took place naturally/organically or did it need to be encouraged. Johannes noted the importance of using what already existed: for example for some time all new vehicles that enter the market have had extensive connectivity capability and millions of users had connectivity through their smart phones so natural development happened. However a key barrier was the lack of a common minimum level of activity, strategy and regulation across the EU so what was encouraged in some countries was not permitted in others so the commercial supply side was constrained.

Sophie argued that organic growth was normal and gave the example of measures to reduce road accidents. It had long been recognised that a key causal factor was driver behaviour so an app had been developed that could be used by drivers to audit their own performance. The obstacle to greater road safety through wider adoption of this type of process was a lack of regulation to require its fitment, no global standards for the necessary sensors, and interoperability across different vehicle and component manufacturers.

Elodie wanted to address timescales because it was often possible for a public-private partnership to work together to launch a smaller-scale innovation very quickly because the public body shared some of any launch risk and thereby gave the commercial partner confidence to act. The points already made regarding standards and interoperability were important especially interoperability – the services from space systems did not stop at national or international borders so global interoperability was essential to ensure users' had resilient and trustworthy products.

Benoit spoke about barriers to more rapid deployment of highly automated vehicles. He explained that it was necessary to prove to regulators that products had the required

level of driving competence but also were safe in use. This latter point was open to interpretation: what was 'safe'? If the use case for the automated vehicle was fairly narrowly specified then it ought not to have to prove "total safety" as if it were being deployed in every type of use case but regulators were not always able to see this line of thinking. The technology problems were either solved or understood; the obstacles to progress were almost all related to regulations.

Johannes examined the extent to which services should be free of charge to users. He stressed that the real costs of providing a service had to be covered by some body, the key issue was usually how the payment should be collected. Some services ought to be funded by public bodies and tax revenue; others were more appropriate for a direct 'user pays' relationship. A frequent point of debate related to using data provided essentially free of charge by vehicle manufacturers which needed significant cleaning and processing before it could be offered as a reliable service and for this latter stage charges were applied. If this cost/payment issue was not fully thought through and resolved then it would represent another obstacle.

The moderator asked the panel given that current data availability meant we could create almost any service how could we establish what customers were looking for? Sophie argued that aggregating services meant that users had the option of selecting from the mix the combination that best suited their needs. This led to discussion on the innovation process: how to strike a balance between over-regulation stifling innovation and insufficient monitoring with markets out of control.

Elodie emphasised the sequence of events: a clever innovation needed to be followed by standards and interoperability concerns, both

of which involved regulators. The other key balance was between innovators needing a good business case and the wider societal need. The public sector needed to explain why investing in the mobility sector lead to all-round benefits.

The moderator asked how the public sector could support innovation without acting in an anti-competitive way. Benoit stressed the need to focus support on the pre-market activities leaving commercial bodies to take knowledge forward as products. It was very helpful if Governments encouraged regulators to follow closely what innovators were doing. There was one key area where public-private collaboration needed to be strengthened: “last mile” delivery. Cities and similar authorities were content to support small scale trials but there was a gap as they were reluctant to sponsor the bigger experimental deployments that opened the way to large scale ‘commercial’ deployment and brought the knowledge about how to scale up. Cities and authorities needed to recognise that they too were clients of technology.

An audience question asked what could be done to bring the different ITS communities closer together. Elodie noted that discussions at Congresses, such as the one under way, were

excellent methods for sharing both problems and solutions but it was also important to involve the political level so that top level decision makers understood what was happening and what more needed to be done. Johannes said that in the case of planning the deployment of 5G setting up a neutral discussion platform embracing all shades of stakeholders had significantly helped progress.

The moderator asked all panellists for a brief statement of what one thing if implemented would improve the overall situation.

Johannes proposed connecting all significant infrastructure to the internet through a low latency data link accessible by all types of traveller.

Sophie argued that sustainable mobility rested on connectivity of sectors and that needed regulation.

Elodie endorsed Johannes’ suggestion which needed to be based on both satellite and terrestrial modes.

Benoit stressed again the need for larger scale experimental deployments within use cases that were understood and well-defined.



Plenary 3

Sharing City Space: The ‘smart’ solution for all

Moderator	Margriet van Schijndel-de Nooij	TU Eindhoven, Netherlands
Keynote address	Ricardo Muñoz Núñez	Google, Germany
Speaker	Bart Lannoo	Be-Mobile, Belgium
Speaker	Vassilis Agouridas	Airbus, France
Speaker	Young Tae Kim	International Transport Forum, France
Speaker	Xavier Sanyer	Greater Barcelona Metropolitan Area, Spain

The moderator welcomed delegates and gave a brief overview of the session. She introduced the Keynote speaker who looked at the idea of a ‘smart city’ from different perspectives. Ten years ago he had heard the vision of a smart city as one where private vehicles were banned, driverless transport could be summoned from a smart phone, parking spaces were not needed and the city expanded its green spaces. That clearly had not happened and showed that becoming ‘smart’ was complex. Designing or redesigning cities needed access to reliable data plus powerful visualisation tools in order to balance planners’ needs, architecture options, affordability, energy and resource consumption, a variety of transport services and a variety of housing units. A prominent issue for cities was ‘last mile’ delivery of goods reflecting the massive rise in on-line shopping. This area needed to be more efficient and more environmentally acceptable.

The moderator invited each panellist to give a short statement on how the city space problem looked to them. Young Tae reflected on how the pandemic had forced changes in transport habits with a reversal of the previous priority for public transport and prompting many new approaches to personal mobility. Adapting to Covid had not been straightforward and amending city space would be equally difficult as the infrastructure was designed for a long

life and was configured to support established policies.

Vassilis wanted to examine how different modes might justify their current use of space and a key point was how local authorities coordinated the various stakeholders. In most cases city space was interpreted as land but the area above cities needed to be considered. The arrival of delivery drones, “air taxis” and similar technologies offered new possibilities for mobility but also prompted questions – was the space above cities public or national and depending on the answers what were the practical consequences? The European Commission had prompted debate on this with its designation of ‘use spaces’ above cities. Urban air mobility needed to link to both urban (planning) and mobility policy development.

Bart emphasised three points: first not thinking of city space as exclusively for car drivers wanting to get as close as possible to destinations and this also required access to information on parking availability. The second point was freight vehicles delivering to shops etc plus the deliveries from e-Commerce and also collecting products and waste where management of access routes and times were critical. Third, in many cases urban consolidation centres would improve

efficiency for all particularly where the goal was some form of multimodal trip.

Xavier agreed with earlier speakers on both the importance and the complexity. All types of stakeholder wanted access to city space, in particular the centre, and at peak times. Barcelona was trying to help the freight industry with guidance on access management at the same time as it was working to make the city more liveable with low emission zones and new schemes to support the 'great forgotten' - pedestrians. Public transport was being supported with development of new payment and ticketing schemes. A difficult issue was managing a city strategy based on all types of solution that aimed to optimise benefits for all classes of user.

The moderator noted that speakers had referred to working to optimise the overall system and asked them for examples where this had been successful. Young Tae stressed the difficulty of not starting from scratch: city infrastructure designs and usage patterns were invariably well established so changing space allocation was slow and difficult. Two possible ways forward were Mobility as a Service (MaaS) and increased multimodality.

Bart noted that changing usage might imply different infrastructure - for example a project to move freight to water in an city with existing canals required additional loading and unloading facilities. By contrast many cities were naturally allowing new space for shared services particularly bicycles so the key here was making sure that appropriate data was collected and supplied to journey planners. Vassilis identified a different type of problem in that existing users and potential new users of city space tended to have different externalities so the approaches to sharing or changing allocations would be driven by different priorities. Bart took this point a stage

further and noted that a city user might be a resident and it might be a tourist and their needs and motives were different.

Xavier agreed that user engagement and consultation was complex but it had very high importance. Users had to feel a part of solutions not problems and it was essential to explain how city administrations balanced the benefits to society as a whole from shared space solutions such as public transport against demand from a large volume of individual travellers. A key issue was education - making clear to all types of user what was already available.

The moderator picked up the point about optimising for wider societal benefit and asked how this might impact the roles of the different sector actors. Vassilis suggested that this type of process needed reliable data but it also rested on participatory governance: issues needed to be debated within a co-creation process involving both the public and private sectors. Users were not simply a part of a solution: they should be active contributors to finding solutions.

Young Tae focused on 'mobility' which has many more dimensions than 'transport' as it links to climate change, diversity, accessibility, energy policy and other important areas. Xavier noted that increasingly private sector bodies wanted to take on services normally provided by the public sector but in most cases the private sector body did not have the wider societal responsibilities of the public sector and this raised a number of problems especially for regulators. Young Tae gave a different example of this: in most countries central government had separate bodies for transport, industry, health etc but in local government the different disciplines were much closer together which tended to make it easier to find consensus solutions.

The moderator asked whether considering changes to city space allocations had wider implications for example safety. Young Tae noted that traditionally safety was seen as involving a human factor, a vehicle factor and infrastructure but the modern approach was considering the overall safety system. If road space was reallocated then infrastructure could be modified in parallel to improve safety.

Xavier described a project in Barcelona where a general shortage of transport, and particularly public transport, had been addressed by rearranging space to encourage car pooling. In this case the space reallocation had helped employment possibilities as well as local businesses. Bart reminded that making changes to space allocations had implications for data sharing in order that information on the new structures of services was widely available and linked users to reservation and payment services. Vassilis argued that developing a city's air space both eased some of the inner city demand but also increased it as urban air mobility needed supporting ground infrastructure. The key was to focus on areas where conventional access was difficult or where the air element offered special advantages.

The moderator asked how experience of amending city space allocations could be shared more widely. Xavier agreed that it was important for cities to share their experiences but some caution was needed as cities differed

and one solution definitely did not fit all. He gave the example of Barcelona looking at cycle lanes in Netherlands cities where many of the key features could be adopted but different local behaviours and topology meant that some options were not suitable for transfer. Young Tae reminded that the key transport issues are linked so deciding to develop one policy, for example decarbonisation, meant that a lot of thought was needed to explore consequences elsewhere in the overall system.

The moderator asked panellists how to encourage meaningful urban space sharing. Young Tae stressed that change needed to be incremental as cities were well-established with current patterns; the ITF might be able to support a knowledge sharing initiative. Vassilis thought the problems were not technology but getting clear thinking on decisions and sharing knowledge on what works. Bart agreed: 'doing it' was straightforward once it was clear what to do. Xavier endorsed thinking through possible problems well before a solution was implemented as it was very difficult to go back.

Ricardo Muñoz Núñez returned for a final word welcoming the discussion that had addressed the negative aspects as well as the positive and endorsing the ERTICO slogan 'connect the dots' which in this case meant establish what users want and explore how to provide it efficiently, safely and sustainably.



Plenary 4

Why aren't we there yet? Getting MaaS to work (and everywhere)

Moderator	Guilherme Johnston	Connected Places Catapult, UK
Keynote address	Kristian Hedberg	European Commission DG MOVE, Belgium
Speaker	Vincent Georjon	Tisséo, France
Speaker	Alexandre Cabanis	Ubitransport, France
Speaker	Sami Sahala	City of Helsinki, Finland
Speaker	Sandra Witzel	Skedgo, UK

The moderator welcomed delegates to the session focusing on the status of MaaS. The concept was no longer new but it was not yet working as originally planned. Economic crises and the pandemic had disrupted progress; the session would look further and deeper. He welcomed the Keynote speaker.

Kristian Hedberg began with a brief geopolitical scene-setting emphasising the critical need to address mitigation of climate change and disruption of European energy supply by careful deployment of sustainable ITS solutions. He argued that MaaS is a key digital tool that can offer multimodal options for travel but it relies on digitalisation and many EU Member States had some catching up to do. He encouraged the industry to raise the bar and accelerate the deployment of various mobility services, including MaaS, and integrate all mobility offers to support seamless journeys. The Commission aimed to support developments through its Sustainable and Smart Mobility and Data Strategies. The EU should be among world leaders but while there had been many debates about concepts national and regional pilot projects showed that the potential was not yet fully developed.

Adopting the session title he asked why we were not there yet – new developments and policies were needed to increase the collaboration

between various modes while recognising the need to work with legacy systems. A harmonised and trusted framework was critical to moving forward which included a greater willingness of actors to make data available from which new services could be made available. Transport service operators in particular needed to be more open even though that had a cost and created competition. Extending digital services should not become new challenges.

The moderator asked each panellist for a brief statement on how they viewed the topic. Vincent argued that from a position as the principal local transport provider MaaS is seen as the icing on a cake composed of mobility services. Toulouse was expanding and with 12,000 new inhabitants of every year and cars used for 90% of the trips around Toulouse, MaaS was a necessity. It was critical to provide incentives for those moving around not using a single-occupancy car.

Sami suggested that MaaS was following the same development path as other innovations – initial excitement at the potential then concern over slow progress. The hype about MaaS started around 2014 and kept building for two years. We were now in the lower segment of the innovation cycle/curve – realisation that the future of MaaS is more doubtful now that key issues have been recognised. The hype

was built because of the business expectations that MaaS was predicted to become a big commercial enterprise and it would result in significant marketplace growth from a monetary perspective. The second phase has been dominated by calls for the public sector to control and operate MaaS, or sometimes the complete opposite. It was not yet clear how MaaS would settle in a matured third phase with developed business models; time would tell.

Alexandre suggested that journey planning had been seen as the dominant element of MaaS until Covid-19 had disrupted all thinking. Three phenomena were subsequently driving the market: (1) a change in user expectations, (2) the budgets of authorities, and (3) regulations. Suddenly the industry had to adopt the solution of bringing mobility services closer together. The transactional features at the heart of MaaS require deep knowledge of integrated fare payment so industry players who provide journey planning and other features need to cooperate with suppliers of integrated payment. His key message was that MaaS was not a one-man job; it needed political will, data standards, and all the industry players working together.

Sandra discussed the need to step back to look at the whole mobility environment in which MaaS operates. We are aiming to use it to change and disrupt our transport patterns which have developed from the invention of the car and have shaped our cities and infrastructure. It can't happen rapidly. MaaS can be a powerful tool to help us facilitate that change away from a mode-focus but it has to start at the users' needs since MaaS can be localised, tailored and personalised for each implementation and each users' requirements.

The moderator asked how the public and private sector actors could be brought closer

together. Vincent said that as a part of MaaS planning Toulouse had decided to base future developments on the current public transport app so the sectors would be closely combined as a result. Sandra noted that the successful deployments she had been involved in tended to involve quite closed communities so one "branch" of the collaboration was fairly fixed and so easier to understand.

Sami said that roles and responsibilities were key. Every city needed to do its homework to establish the different roles and responsibilities in the value chain as it was hard - especially for the public sector - to change the requirements for those roles and responsibilities. The other big problem that was not really being addressed was roaming which was vital for the longer term and which did not really exist yet. It should not be necessary to reinvent the wheel to deliver roaming: the telecoms sector figured out how to do it a while back but for MaaS there was still a long way to go.

Alexandre argued that MaaS evolution had hit the difficult spot where service providers, mainly the 'information' sector, were finding it hard to identify the common ground with the transaction sector (ticketing, fares etc). Both sectors but especially the organisations active in the private sector had to learn to share information. There were other difficult areas: if a service provider opted to add incentives for using MaaS what was the best place to provide the incentive? It could be linked to a transaction done in a MaaS app, or linked to an app for a person's employer, or linked directly to a bank account? It typically took much time to find the right solution.

Sandra emphasised that we were still at an early stage with MaaS development and we needed to take it further than just including a variety of modes - personalisation was needed tailored to each type of traveller and their specific

characteristics. MaaS had to be seen as more than just a way to connect multimodal trip chains; it should evaluate and recommend options as an answer to questions such as “what’s the best way to get to work today?”. It ought to be able to advise a single woman traveller, say, on the safest trip sequence for a planned journey.

The panel discussed possible roles for MaaS in improving the environment. Companies in France with over 50 employees have to have a mobility plan to reduce emissions and MaaS can help with preparing them. Because MaaS services usually include more sustainable modes than using a private car they can contribute to meeting part of the net zero objectives at the EU level. Sandra noted that MaaS solutions have been able to provide CO2 impact assessments for some years but travellers have only recently started to pay more attention to them. This emphasised the behavioural aspects of MaaS – the environmental benefits were out of reach if users did not opt in to use services. Moreover, a regulatory framework needed to be placed on top of the MaaS services to make it harder to use a car and so help to ensure that using MaaS would be better than using a privately-owned car.

An audience question asked if MaaS was something only for cities as it seemed not to

be spreading to outer regions. It was pointed out that in a sense MaaS had to start in cities as that was where the worst air quality and congestion problems were found as well as the component systems of the ultimate services. But most public authorities recognised a need to extend out from cities to be nationwide, and there was a lot of work underway developing the offerings for long distance trips to include the first and last mile elements.

The final panel discussion covered where MaaS was moving to address the headline question “are we going to get there?”. In France the 2019 law to provide open data was beginning to facilitate the deployment of MaaS. Also, the ability to sell fares should be accessible to any fare seller from any app and this needed to be the case across Europe. As already discussed interoperability was an essential goal that MaaS should strive for. MaaS can be a good solution to address climate change, counter the impact of a pandemic and reinforce transport resilience. However MaaS needed to avoid making the mistakes of the past regarding accessibility and inclusivity. Ways had to be found to ensure MaaS addressed underserved communities, single travellers especially women, and to think about the needs of the people who were not in the room.



PART 3

Discussion and papers sessions by Topic

Topic 1

Services for Citizens

The overall situation

The topic covered a very wide area:

- Mobility as a Service (MaaS), real-time information, ticketing and payment
- Data marketplaces/common data structures, security, privacy and ethics
- Safer mobility, accessibility, affordability
- Institutional and legal issues, regulation and de-regulation
- Micromobility and active travel
- Intelligent traffic and mobility management

There were three major elements (1) integrated mobility supported by data sharing/ exchange, MaaS, mobility hubs, artificial intelligence (AI) and standardisation; (2) equity, diversity, accessibility and inclusion including gender challenges and gaps; and (3) technology tools to improve safety and security, and reduce emissions and congestion.

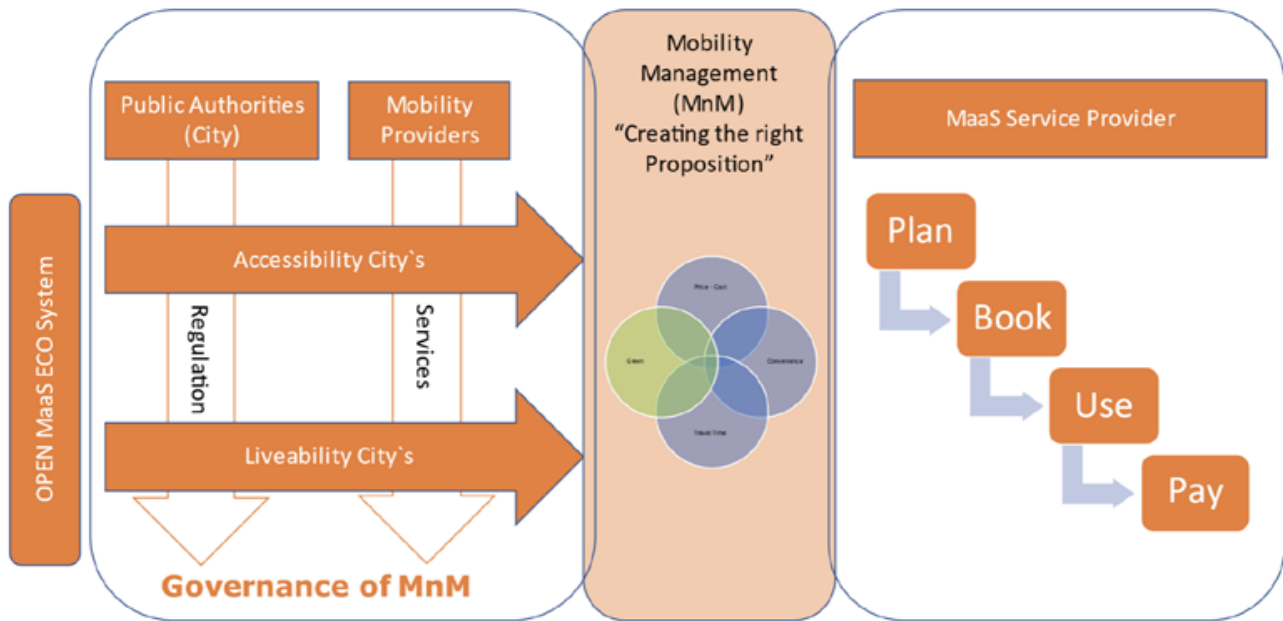
As in several earlier Congresses there was a significant number of discussions about MaaS covering pilots; personalisation and usability; overcoming myths; management and operations; readiness; and acceptance. MaaS pilots were

mentioned running in Spain, Austria, Toulouse, a border zone between the Hauts-de-France and Île-de-France regions, and the Saint-Etienne metropolitan area in France. One approach presented on MaaS app personalisation “combines the information about users’ mobility patterns and their individual preferences along with real time traffic updates to proactively recommend personalised routes.” A number of papers described how MaaS and mobility data are displayed to the user have an impact on travel behaviour according to. The session on “New MaaS Ideas” looked at ways of encouraging the wider use of applications, particularly around making the app more useful or attractive.

There were several discussions of gender considerations in ITS – specifically how to ensure that technology solutions consider inclusivity and do not accidentally create barriers due to lack of accessibility or gender. These discussions included: making MaaS more gender equitable; addressing the gender gap in micromobility specifically e-scooters; and using gender and diversity sensitive methods and tools for mobility planning.

Several sessions focused on integrated mobility and multimodal planning and the integration of MaaS and TM 2.0/TSMO was discussed:

Next steps for MaaS/On Demand



Next steps for MaaS/On Demand (Roelof Hellemans in SIS 19)

Data sharing and exchange were very prevalent throughout this topic area. SIS 13 looked at "Sharing AND caring: walking the fine line between data sharing and privacy in the mobility space" and the associated challenges of the exchange eg how might the players best cooperate? Should standards show the way? and how to guarantee the highest protection of users' data.

In contrast to the high visibility topics cybersecurity for protecting users' interests and services was not mentioned as much as expected. There was also a gap on utilising behavioural science to design MaaS schemes; no papers on MaaS alluded to this even though MaaS is presented as a way to impact travel behaviour. There was little evidence to suggest that this has actually happened.

Research into the acceptance of MaaS by car users revealed four key reasons why owners would not replace their car with something else (eg a carshare): uncertain availability of a shared vehicle; the need to collect from a defined place; the need for advance reservation; and the need to pick-up and return the vehicle at an agreed time. Other barriers such as liability issues, costs of using a shared vehicle, and social status related to vehicle ownership were reported as less important than the four reasons mentioned above.

Demand for rural area travel is often underestimated and Rural MaaS was mentioned in only one paper in this topic, which reported a study of travel demand in three rural areas with different population densities in the United Kingdom:

Alternative mobility solutions

New Mobility Services

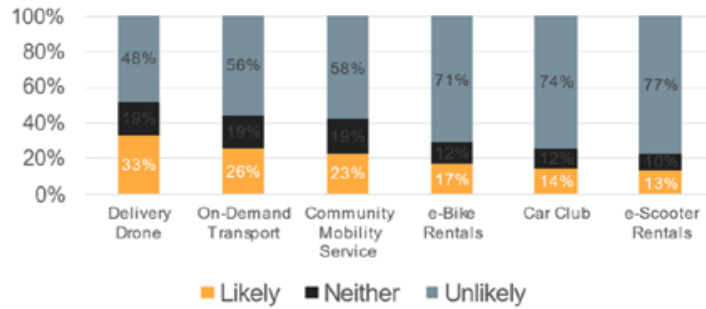
- Respondents were asked hypothetically what new mobility they would prefer in their area
- Residents are wary about new forms of transport, but delivery drones and on-demand transport are the most considered

Travel habits

- Younger respondents are more open to all modes of transport, especially delivery drones. They are also more positive about using Smartphone Apps for both bookings and payments than older respondents

Barriers

- Across all respondents, credit and debit cards are the most positively viewed form of payment
- Preference for driving is a major barrier for some new mobility schemes, and many respondents are wary about new technology and security



	Essex	Northumberland	Somerset
Delivery drone	29%	35%	35%
On-demand transport	27%	25%	26%
Community mobility service	21%	24%	24%
e-bike rentals	14%	17%	19%
Car club	12%	18%	13%
e-Scooter rentals	11%	14%	14%

Preference for alternative mobility services in rural areas (Patrizia Franco in RP 8)

What was new?

Traditional ITS services such as parking and real-time traffic information were covered in this topic however, the use of technology in parking has been greatly extended especially parking linked to electric vehicle recharging.

There was recognition of the problem that mobility services still lack adequate accessibility, and that this discussion needs to expand to incorporate equity and inclusivity as important factors in designing services particularly because of their digital nature.

‘Democratic Platforms’ (data sharing technologies and collaboration arenas for reflection and co-creation) were being used to redesign transport practices and to elicit requirements on future digital interfaces. Typically the properties of a Democratic Platform are:

- Flexible collection and transformation of data from different data sources.
- Flexible access to collected data from different front-ends and applications exploring prototype solutions.

- Efficient coordination, search, and manipulation of data flows captured in real-time from different data sources, also known as ‘event streaming’.
- Durable storage of collected data for later retrieval.
- Flexible connection to analytics and visualisation frameworks.
- A focus on short turn-around time for changes in the platform and development of connectors to integrate with existing systems.

A gender and diversity sensitive methodology (GaDAP) addressed the diversity among women and men in relation to mobility. GaDAP was developed and tested in various environments of planning for smart cities or smart mobility in 11 countries. A key takeaway from this planning method was that GaDAP translates theory into practice by using a five-dimensional framework for putting intersectionality into practice: Inclusive Transport; Affordable Transport; Effective Transport; Attractive Transport; and Sustainable Transport.

- The use of 5G in ITS continued to evolve and the Congress had various sessions on different familiar and new aspects:
- A session “Optimising hub-to-hinterland logistics in European ports and world-wide” described how 5G is being used for port operation and supporting video surveillance, drones, teleoperated driving or automated driving from hub-to-hub or hub-to-hinterland etc.
- The 5GMETA EU project has created a cloud platform to collect and deliver vehicular information to simulate, facilitate and feed new products and services. An application allows users to plan a trip using a prediction module and the app organises the time departure and the route to ensure the user will arrive on time.
- Validation of the trials and study of business opportunities for future 5G applications was presented as a part of 5G-HEART (HEalth AquacultuRe and Transport) validation trials funded by the European Commission’s Horizon 2020 Programme.
- Carpooling is not a new concept but using artificial intelligence to improve carpooling was. A unique matching technology being used in 4 countries and tested in the Toulouse metropolitan area has a mobile app that acts as a smart mobility assistant. It learns users’ daily mobility habits; predicts users’ next trips; tailors and optimises door-to-door itineraries; and integrates carpooling with public transport.
- Ways of encouraging modal shift and providing travel information to those without digital devices were presented. A new Green Light Optimised Speed Advisory (GLOSA) app for cyclists ensures they receive a green wave through traffic signals and a speed

indication display at the side of the cycle route and colour changing lights along the route allow all cyclists to benefit from the advice not just those with the app.

Forward v Constrained

Forward:

Austria’s major traffic infrastructure and traffic service providers established a nationwide intermodal traffic information platform (VAO) that integrates approved traffic information of all modes of transport (including road, rail, public transport, cycling, and walking) provided by the authorities. For real time road traffic information, all federal states of Austria, major cities, ITS organisations and Austria’s motorway operator joined forces in the project and developed a harmonised real time traffic information network. It provides a countrywide authorised data basis for traffic information, traffic management and traffic analysis. VAO uses this data and has successfully implemented high-quality intermodal routing that is used by partners and b2b customers to create powerful end user applications.

The European Commission (EC) and the European Union Agency for the Space Programme (EUSPA) are assessing the possible evolutions of the European Global Navigation Satellite System (EGNSS), specifically Galileo and the European Geostationary Navigation Overlay Service (EGNOS), to introduce new services. With a timeframe set to 2030 the Integrity Complementing High Accuracy Service via EGNSS (ICHASE) project will assess feasibility and added-value of an EGNSS systems and services evolutions to broadcast a new EGNSS High Accuracy and Integrity Service. Autonomous Driving (AD) applications are of primary interest for such a service that must meet stringent target performances in terms of precision, availability and continuity, “Time To First Fix”, latency, reliability, and integrity.

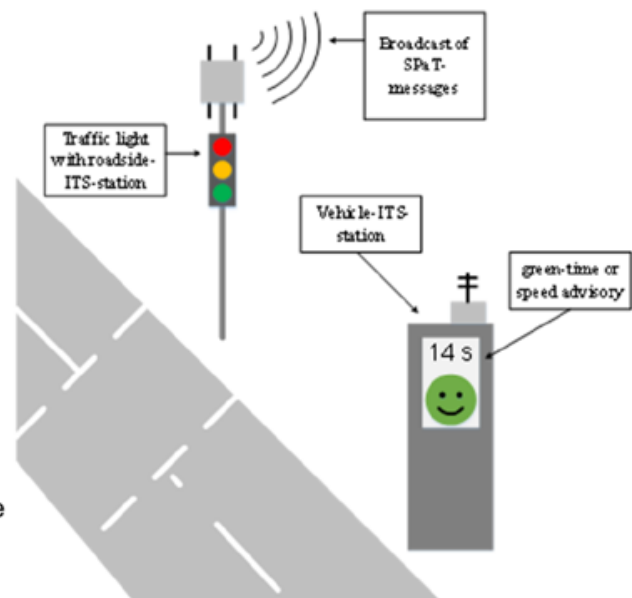
Several technology enhancements in parking were presented. These included providing automated access to parking via a MaaS app; using crowdsourcing to define in real-time the current status of the parking in a city; using an open source platform to detect entrances and exits from parking using edge processing; and using a camera-based 3D sensing system for autonomous parking. The SocialPARK app

gives drivers opportunities to report an available parking spot they discovered or have left (drivers are incentivised to provide truthful information); discovering available parking spots in real-time; providing reservation options; notifying drivers about parking availability; providing navigation to parking; and providing parking vendors the opportunity to easily register and manage their parking spaces.

Increasing comfort - Speed advisory pillar

First pilot

- Signal light including roadside-ITS-station
- Broadcast of SPaT-messages (signal phase and timing)
- Speed advisory pillar including vehicle -ITS-station
- Display with remaining green -time and speed advice



Olaf Koch Speed Advisory display for GLOSA for cyclists in TP 6

Using blockchain technology in toll operations was a new concept to help multiple toll operators overcome challenges in this environment including discrepancies in multi-operator environments due to the blacklist/red list update processes between different operators and the payment processor; and cybersecurity. This idea was being piloted in Mexico.

A paper on Developing Sustainable Urban Mobility Plans (SUMPs) by Juliana Carvalho from the University of Porto, Portugal won Best Research Paper of the Congress with a forward looking perspective included developing and describing a collaborative design approach

Constrained:

There was continuing conflict between making mobility and ITS services commercially attractive and addressing accessibility needs and the wider potential for MaaS to give users access to accessibility data.

Smarter mobility applications tended to remain city-centric and focused on those with access to smart-phone technology and digital payments; other users are on the whole excluded. Even the shuttle provided to improve accessibility to the conference venue had a very high entry step which was difficult for those with mobility problems to manage.

Only one paper examined moving from the “company car” to an employer-financed mobility budget. A survey of mobility managers

in Belgium showed that if MaaS were available, 25.3% of employees would use their cars less but 10.4% would use their cars more!

	% that would use more	% that would use less	Net impact
Public transport	35.3%	7.4%	+ 27.9%
By foot or by bicycle	29.2%	8.0%	+ 21.1%
Car	10.4%	25.3%	- 14.9%

Share of respondents who would change their behaviour because of MaaS; David Schoenmaekers in TP 17

Providing a variety of transport data to users to encourage modal shift was discussed in several papers and sessions, but there is limited evidence that it actually encourages behaviour change directly. For example, the findings from the paper “The Mobility Display as a Catalyst for Modal Shift” do not clearly prove that the data display directly influences travel behaviour. Until behavioural science is used in the design of MaaS, we will continue to see pilots and longer-term MaaS deployments that may not be sustainable as they may not result in changes in travel behaviour.

One session (SIS 18) focused on the perceived value of MaaS against car ownership. The premise had always been that MaaS had to provide a better level of service than the private car but discussion at this session argued that travel behaviour and culture that have taken years build it can only be changed by a quantum shift in technology, a paradigm shift in thinking and acting; and various push and pull measures. Another aspect of MaaS that was not new was that there is no single MaaS solution - every area should have its own kind of MaaS.

There was one significant constraint mentioned in this session: the MaaS ecosystem must be able to compete with the car-ecosystem. Interviews were conducted with transport service providers (TSPs) across Europe. MaaS platforms owned by transport operators favour their own services or the services of other operators with whom they have a promotional agreement. MaaS platforms are unwilling to integrate offerings from a number of, usually competing, operators. Operators refuse to share their transport offering and data - they may consider that the costs of sharing data (including the costs of technical integration) outweigh the benefits (eg increased occupancy, ridership, turnover etc) or they fear that sharing their data could lead to loss of commercial power and branding. It was suggested that a public authority would not be an ideal MaaS operator, but instead should be closely involved with the process of developing the solution and supporting the other stakeholders in its development.

Interviews conducted with TSPs across Europe:

- MaaS platforms owned by transport operators favour their own services or the services of other operators with whom they have a promotional display agreements.
- MaaS platforms are unwilling to integrate offerings from a number of, usually competing, operators.
- Operators refuse to share their transport offering and data - they may consider that the costs of sharing data (including the costs of technical integration) outweigh the benefits (e.g. increased occupancy, ridership, turnover etc); or they fear that sharing their data could lead to loss of commercial power and branding.
- Public authority would not be the ideal MaaS Operator, but instead should be closely involved with the process of developing the MaaS solution and support the other stakeholders in its development.

Build the MaaS eco-system to compete with the car eco-system.
Maria Kamargianni; MaaS providers survey in SIS 18

An in-depth discussion about the fine line between data sharing and privacy in the mobility space revealed just how complicated it is to protect an individual's data - the individual being the traveller or driver. Further, travellers accept terms that they do not understand regarding data sharing and privacy. Regulations around sharing of personal data should address how data is treated. For example, if dynamic mobility service information is developed using source data, such as live traffic information, we need to ensure that an individual's identity is not released if there is a report of an incident involving a specific individual. This means that part of the focus must be on anonymising data. Numerous questions and issues were raised:

- Guidance on who should interpret these data rules.
 - What does "anonymised data" mean?
 - There are too many definitions of "open data."
 - The EU's Data Act applies to personal and non-personal data, but the distinction between them is hard to make.
 - Even if you don't take the trip, your data could be shared.
- How do we ensure data is not used out of the context of the individual?
 - All data flows have to respect minimisation and consent.

One approach could be to have all of your data in one app that could then be used by multiple apps - this would be putting the user in charge of their personal data.

Topic 2

Next generation solutions

The overall situation

The topic was the most popular one of the congress with regard to the numbers of submissions. Most of the papers and sessions within the topic dealt with automation (especially automated driving) as well as connectivity and data, continuing the trend of the European as well as global ITS congresses of the last decade.

Connectivity

Resilient connectivity was seen a prerequisite for development of a safe, efficient and sustainable mobility system. Discussions covered C-ITS services, pilots and deployments, various 5G applications, use of Bluetooth and WiFi signals, V2X networks, use of connected vehicle data, traffic management utilising connectivity, and metropolitan mobility management. The use cases dealt with hazard warnings, rail level crossings, emergency or public transport vehicle priority and other traffic signal services, variable speed limits, collaborative traffic management, mobility management, road works and event management as well as traffic flow analysis and forecasting.

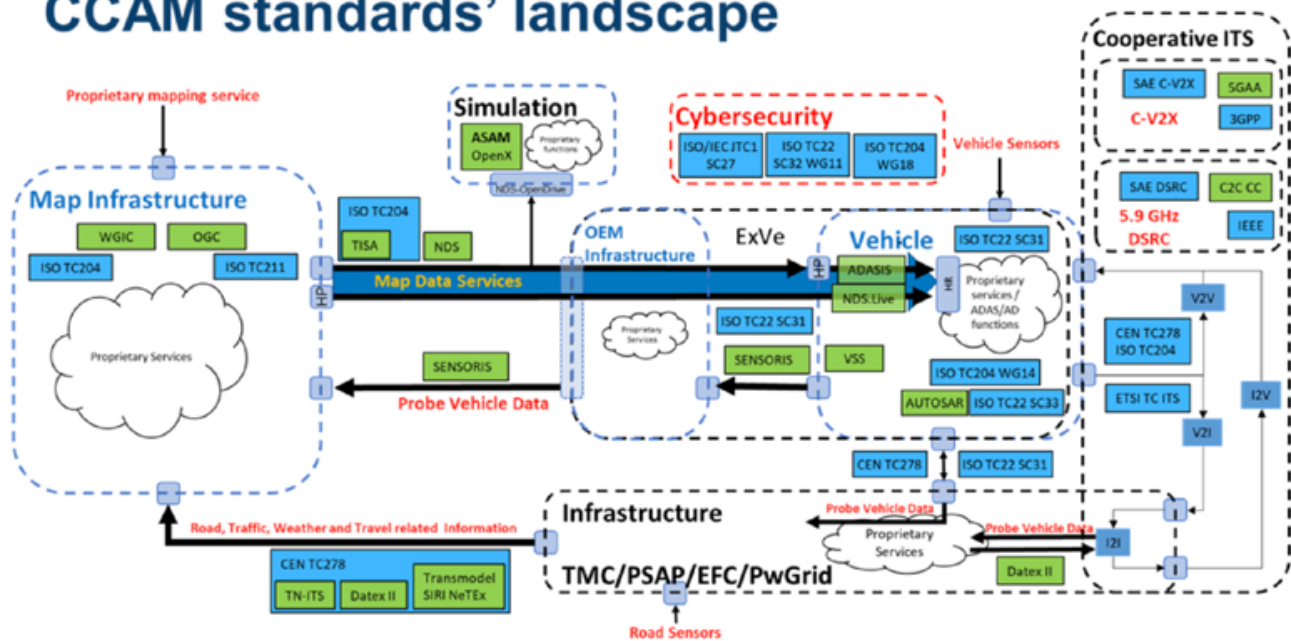
Presentations and discussions on Demand Responsive Transport for automated vehicles featured use cases for autonomous public transport vehicles, including traffic signal priority for vehicles using SPATEM / MAPEM messages over 5G connections. Integration of automated vehicles, whether public or privately operated, was a topic of focus for the congress

generally. Cross-border integration and interoperability of connectivity were prominent in the congress. 5G technologies featured in various SIS with a focus on connectivity and low-latency data processing across a range of connected automotive sectors, including CCAM and infrastructure services. Standardisation and commonality in data exchange protocols was another prominent topic.

Automation

Automated mobility was clearly advancing; the discussions indicated a move from fundamental research more towards pilots, evaluation, demonstrations, legal frameworks for use on open roads, type approval adaptations, and solving practical issues in deployment. The use cases included automated driving on motorways, first mile/last mile shuttles and delivery vehicles, automated buses and trucks, automated parking. Sensing and detection solutions required by automated driving and advanced driver support systems were covered widely and comprehensively along with accurate positioning solutions. Multi-sensor fusion for positioning was utilised in many projects and deployments. Several speakers expressed concern with regard to the present “wild west” situation in location referencing in transport. We urgently need an open standard that public authorities can use and contribute to so that we have a common way to encode detailed road network features.

CCAM standards' landscape



CCAM standards landscape by Jonathan Harrod Booth in SIS 2 "What is the future for location referencing".

Infrastructure support for automated driving often featured, including both smart and digital infrastructure, electronic traffic regulations, digital twins, and local dynamic maps in addition to the legal prerequisites. The need for visible and good quality road markings and other physical infrastructure support was debated in a number of sessions.

Infrastructure support was highlighted as a necessity for the defragmentation of Operational Design Domains (ODDs). Fragmentation of ODDs results in a high number of occasions where the control of the vehicle is transferred from the vehicle's automated driving system to the human driver or vice versa, and these transfers always constitute a road safety risk. Distributed ODD awareness of the automated driving systems of the vehicles was presented as the solution where infrastructure-based and other information of the values of ODD attributes enabled safe transfers of control and in some cases also the defragmentation of the ODDs.

The human factors aspects received attention by considering the design, human-driver like driving behaviour, and user preferences in

addition to the issues related to foreseen issues of mixed traffic of both human operated and self-driving vehicles.

Digital maps were discussed in several sessions and mentioned as a safety critical tool for automated vehicles. Different techniques for generating HD-maps were presented, including GNSS, relative accuracy, maps containing conceptual information and point clouds from LIDAR. It seems to be difficult to evaluate and certify the quality of HD-maps; as it is important to maintain reliability, quality and freshness, further work towards real time update of map databases is needed.

Data

Many presentations focused on data collection and data utilisation from a wide range of sensors and devices. Data management, utilisation and exchange were addressed in numerous papers with sessions totally devoted to the topic or in connection with connectivity and automation. Emphasis was also given to the accuracy and precision of the data, with harmonisation of data standards related to geographical positioning featuring strongly.

The importance of data sharing was stressed even more intensively than in previous congresses. Whenever somebody makes an effort, someone has to pay for it – it can also be the taxpayer. Nevertheless, in the case of CCAM both the infrastructure and automated vehicles clearly benefit from having access to the other party's data as both parties will improve their own data provision to each other via data sharing. The practice seemed to be a clear win-win. The importance of making data sharing a reality in practice was expressed in numerous sessions and discussions during the breaks.

Digital twin is a well-used term with regard to automated driving. In some SISs there were discussions on what a digital twin actually is. A digital twin is a replica of the infrastructure and with data analytic capabilities. They are more than HD digital maps, they also need connectivity and freshness of data as static maps are already out of date. Digital twins of different levels dealt with real time road network characteristics and flow status, recommended heavy vehicle routes, local dynamic maps in individual vehicles, and coexistence of connected and non-connected vehicles was another prescient topic.

There was discussion of the need to move away from the traditional transactional model of public-private cooperation to develop base data sets that can be turned into value added services by third parties. Regulation (eg EU) can be a barrier to innovation in digital twins today, and adopting the concept of failing fast to innovate – more familiar in the US but something EU culture doesn't naturally facilitate – could perhaps bring better results in a shorter timescale, but it requires public authorities to step back from always seeking to put out perfect datasets. Lower percentiles are applicable for datasets such as floating

vehicles, and it doesn't always need to be fully validated.

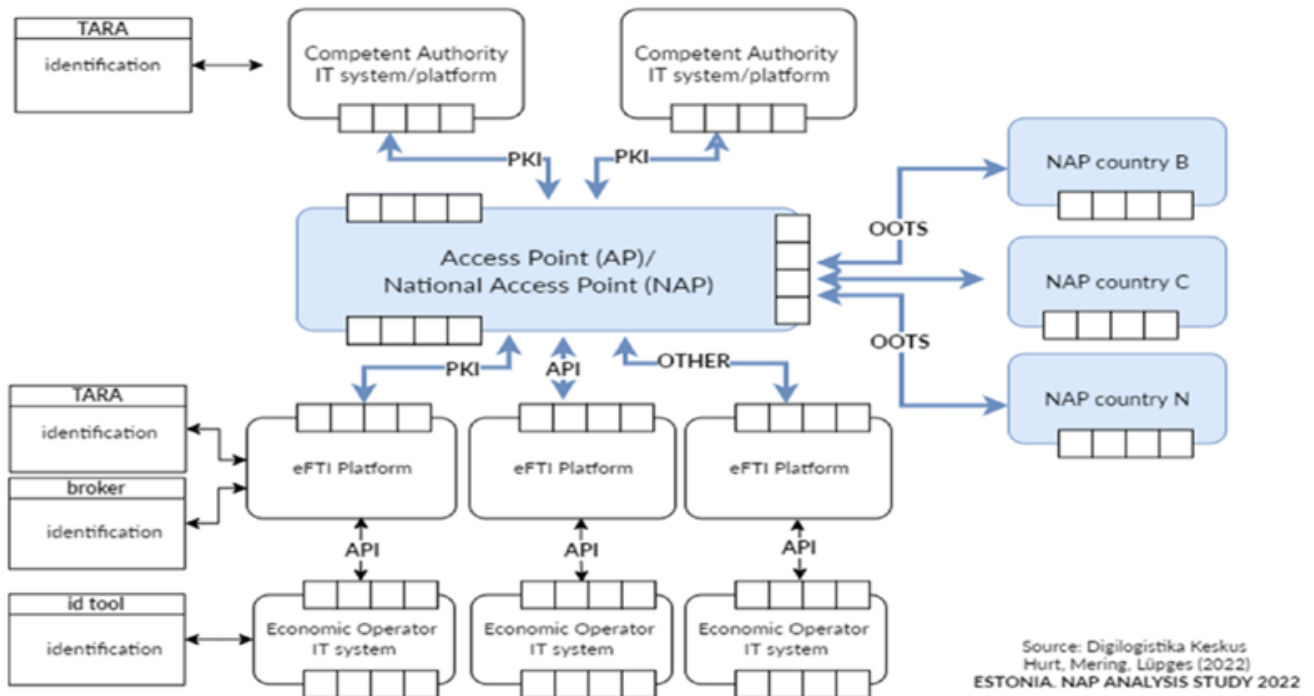
The harmonised deployment of the European mobility dataspace was discussed, along with the concept of RTE (Real Time Economy) for data – about getting the right data at the right time. Cross-border data exchange pilots taking place jointly in Latvia, Poland, Estonia & Lithuania were cited as examples. The pilots utilise a Common Access Point which competent authorities can use for accessing eFTI (electronic Freight Transport Information) data – built on Blockchain technology, with data exchange models and query models integrated in the overall architecture. eFTI Regulation establishes a legal framework for the electronic communication of regulatory information between the economic operators concerned and the competent authorities in relation to the transport of goods in the territory of the European Union.

The importance of the mobility sector as the connector of all other sectors was stressed along with the need to ensure harmonisation of NAPs in NAPCORE – data needs to match its purpose so first define the use case adopting a bottom-up approach, but also adopting a new way of thinking, to enable machine readable formats.

It was highlighted that for Datex II for B2B data sharing platform mobility models there are a many use cases but as yet no business cases; community building might help to resolve this. The NAPCORE project featured in several sessions as a key European project for the improvement of data exchange and harmonisation for ITS in Europe. NAPCORE has partners from most Member States in the EU and other countries in Europe and all are working to improve coordinated and interoperable data exchange.

Common Access Point for Competent Authorities for accessing the eFTI data

NATIONAL ACCESS POINT (NAP) within eFTI ARCHITECTURE



NAPs within eFTI (electronic Freight Transport Information) architecture by Eva Killar in SIS 3 Harmonised deployment of the European Mobility Dataspace

TN-ITS is a technical specification and a platform for road data exchange providing a standardised interface between road operators and map makers; further specification work is also included in a sub-working group of NAPCORE. TN-ITS will contribute to the update of critical attributes related to safety and efficiency, in order to keep the digital maps for ITS fresh and updated. The key question from a presentation on TN-ITS was whether the specification now is feasible for deployment. It will be an important element in the work with HD maps and digital twins for CCAM as the highest level of quality will need automated data production.

There is mention of mobility on demand for rural transport services, and consideration of how data-driven decision making processes can create viable business models for Digital Demand Responsive Transport in this often overlooked area.

Other sub-topics

Cybersecurity issues received a lot of attention at the congress, with resilience against ransomware attacks on traffic control systems and the need for secure protocols for connected and automated vehicles being high on the agenda.

Other topics addressed included use of satellite positioning data, impacts of ramp metering and intelligent truck parking, smarter road maintenance and construction, incident detection, law enforcement, advanced logistic operations, use of multi-agent systems, environmental traffic management, a fully flexible electronic tolling system, and urban loop on-demand rail mobility system using autonomous electric rail pods.

There were discussions of innovative freight and supply chain innovations, such as the MZIGO - Next-Generation Modular Freight

Container Solutions concept, which promotes an ecosystem for all stakeholders in the supply chain by utilising automation techniques to optimise goods transportation.

Equitable value from ITS solutions and the benefits for increasing safety and protecting vulnerable road users was another visible topic at the congress. Incorporation of sustainability in next generation mobility solutions was another topic that was highlighted in several sessions, including the first plenary. Digitalisation was discussed in reference to cross-border cooperation, and that this can only be facilitated from a consistent language and knowledge sharing exercise.

Plenary 3 focused on sharing city space, and speakers highlighted the complexity of smart solutions and the importance of sustainability and green credentials in considering the best fit for the urban environment. Reshaping urban space was highlighted a challenge given that the road infrastructure in cities was designed in the past for problems of the past. The discussions identified a need for more flexible and adaptable solutions to reach smart urban mobility goals.

The importance of thinking about the third dimension - airspace - when considering mobility in an urban context was also brought up questioning whether airspace is publicly owned city space. Urban Air Mobility development needs to be coordinated with other forms of urban mobility, in order to co-

create innovation at a multi-organisational level, and we should consider how we use airspace to reach areas currently unserved by other forms of transportation. The need to consider pedestrians in the digital mobility agenda more prominently was also stressed including the ambition to make solutions part of the fabric of urban infrastructure. This would ensure that people could easily find and use active transport services: locating an e scooter or bike should be as easy as finding a station or landmark.

What was new?

Most of the papers dealt with trials and experience of well-known systems but some exciting new ideas were introduced. The use of Self-Adaptive Multi-Agent Systems (AMAS) in machine learning was proposed for transport mode detection and traffic forecasting.

Interesting ideas for enhancing the use of connected and automated driving included more advanced applications of AI for reconstruction of lidar point clouds, object classification and situation prediction as well as cooperative perception. AI and deep learning were also applied to automated incident detection as well as vehicle surveillance for law enforcement purposes.

Use of digital twins in the planning, design, and evaluation of the cybersecurity measures was proposed as a very promising approach verified with application to C-ITS.

Experience summary

	Strength points	To be improved...
Design	<ul style="list-style-type: none"> - Standardization (e.g. DATEXII, ETSI, C-Roads, etc.) - Interoperability by design (jointly Cities/Countries) - Theoretically "future-resilient" (e.g. ITS-G5 + C-V2X) - Real operational services, not just prototypes 	<ul style="list-style-type: none"> - Specification not yet consolidated - DATEXII <-> C-ITS not yet fully harmonized - Not yet proven either scalable or future-resilient
Infrastructure	<ul style="list-style-type: none"> - Mixed V2I (ITS-G5, CV2-X, 5G) - RSU corridor, for use-case optimized short-range coverage 	<ul style="list-style-type: none"> - Turin specific: Traffic-Light system operator (controllers) is the local power utility company and separated from TL service provider (i.e. 5T, providing bus priority, fluidization, etc.)
Procurement	<ul style="list-style-type: none"> - Procurement should include h/w and s/w maintenance... - Long-term vision shared with suppliers 	<ul style="list-style-type: none"> - ...not always possible - S/w licensed "as is", what if it fails? Risk assessment? - Market solutions not yet available as "whole" platforms
Governance	<ul style="list-style-type: none"> - Free-of-charge "safety" services - Evaluation-based adoption 	<ul style="list-style-type: none"> - Needs coordination with car OEM (when market ramp-up?) - Evaluation needs at least a pilot implementation (costs...)

Lessons learned in the pre-deployment of C-ITS in Turin. Riccardo Lesca in SIS 59 The role of C-ITS in cities tackling public policy issues

More comprehensive utilisation of CCAM for strategic road networks, smart intersections in metropolitan areas, across national and sector borders, and global logistics was discussed in the congress compared to previous ones where the emphasis was more on local hot spots, junctions and road sections.

Interesting advances included a radio frequency exposure management "by design" approach proposed for body worn P2V devices used by road workers as well as the use of 6mm high paint drops along the centre of road lanes to encode data in a similar way to the Braille system for 1cm position accuracy of (automated) vehicles. The condition of traffic signage and its appropriateness, notifications of accumulation of water, snow or ice on the road, or other factors that affect safe driving can all be monitored, thanks to AI and IoT-based solutions that have been developed specifically for the road maintenance sector

An exciting context of virtual passengers for road cars was discussed. This included the process and concept of synthetic data generation in an automotive context, specifically for driver and passenger monitoring purposes as a safe alternative to real data capturing.

There was also consideration of the relevance of more traditional adaptive ITS technologies, such as ramp metering, and how these can be

incorporated effectively as part of a connected digital highway environment. The move from centralised traffic management to more local and individual vehicle-oriented traffic management was brought up in the sessions.

Proposed revisions to the Intelligent Transport Systems Directive 2010/40/EU featured prominently in SIS discussions.

Finally, the concept of environmental traffic management was at last moving forward with technology scenarios and the mapping of system level actors, actions and outcomes related to local climate actions.

Forward v Constrained

The topic "next generation solutions" by default will always be looking forward.

In the case of connectivity and automation the topic was clearly advancing, both in the technology readiness levels moving towards demonstrations as well as partial and full-scale deployment and also in the society readiness levels. More and more emphasis was given to verifying the safety, mobility, and environmental impacts of the solutions, as well as validating the infrastructure requirements. The trend was also visible in the number of presentations which now shared experiences and lessons learned from the pilots and pre-deployments of CCAM.

The concept of interactive and cooperative traffic management was also discussed in Toulouse. The public traffic manager as the orchestrator of such traffic management is widely accepted but mandatory routing by the orchestrator was not seen as a good solution. Many preferred to indicate which parts of network or road sections should NOT be used as then each service provider could find and provide for their customers the optimum navigation and recommendations on the allowed parts of the network.

The constrained areas this time were the cybersecurity and liability topics, especially the latter. A moderator of one automated driving session made a comment “Liability is the big elephant in the room that everybody tries to ignore”.

The philosophy of green, sustainable and equitable transport was presented and linked to how the ITS community can take advantage of existing data and connectivity solutions and how cloud computing can be used to augment existing ITS systems, though as one astute

observer commented, “if you stand under the cloud too long don’t be surprised if it rains!”.

Another recent development was a feature of maps that provides a light navigation mode to incentivise active travel modes, for use by cyclists or e scooter users for example.

In general, the trend in CCAM was also moving towards more deployment in cities and city streets in addition to the dominating motorways. However, the stakeholder and road user variety is very wide in cities and also the urban infrastructures are really large and complex requiring also large investments in the digital infrastructures. It was widely realised that realisation of automated mobility has to be done step by step, keeping things as simple as possible, enabling addition of new functionalities and continuous technology evolution. If we wait for everything to be ready, it will be a long wait indeed – a lot can be done with current satellite positioning and 5G. It was pointed out that we already have an organically growing evolution employing the step-by-step approach.

Topic 3

Green and sustainable mobility

The overall situation

Topic 3 was especially interesting in that a high proportion of all sessions at the congress referenced green and sustainable mobility because of its current importance as a key driver for all transport activities. In the sessions directly addressing the topic, the main themes were:

Electric vehicles

Electric vehicles are the most advanced technology for reducing carbon emissions from road transport. Battery EVs accounted for 6% of total new car registrations in Europe in 2020,

while plug-in hybrids represented 5%. Numbers are growing, but it is still a relatively new area with research and development still required to address issues such as charging infrastructure requirements.

A trial system for wireless (inductive) charging of AVs while stationary was being tested by the province of Groningen in the Netherlands. The current state of development and newest project results were shared following a successful demonstration. Challenges include precise positioning requirements, interoperability and EMC regulations.



Julia Langen in TP 21 Electric vehicle ecosystem

An alternative method of charging is the use of a catenary wire over the carriageway for EV HGV charging, which has been trialled in the ELISA project in Germany over 2.5 years.

Such a solution is necessary due to the long trips undertaken by HGVs and the difficulties

caused by the weight requirements of batteries if they could not be easily charged on-route. There have been relatively few planned and unplanned maintenance visits required which is a positive result as this was an area of concern for some due to the potential for traffic disruption.



Dominik Gurske in TP 25 Digitising logistics

On policy aspects the Danish Road Directorate is creating a handbook to help municipalities plan charging infrastructure for passenger cars in public areas. They have identified that 68% of Danes have the potential for home chargers and can travel to work on a single charge. However, there may still be a need for superfast chargers for longer trips. The commercial market is not yet sufficient to drive installation, so municipalities need to support. The European Commission led a discussion on the main challenges and upcoming next steps for setting up a data ecosystem for alternative fuels. It focused on how best to coordinate EU action in both ITS and AFs areas, including the NAPs, EAFO and TENtec, as well as PSAs such as NAPCORE and IDACS.

Modal shift and Mobility as a Service (MaaS)

MaaS contributes to sustainability by facilitating modal shift away from individual passenger cars towards greener alternatives such as public transport, micromobility and ride-sharing. There have been some early adopters but

MaaS is not yet used widely. Two surveys into perceptions of MaaS in Belgium had provided some interesting findings. Companies had an interest in offering MaaS services to employees, especially bike share. And the public were interested in MaaS and believed they would drive less; even in all socio-demographic groupings. This suggests that policies should not be focussed on just one target group, such as young people. In contrast a survey in Finland of willingness to give up cars for MaaS found that only 12% said yes. However the results provided information about factors making people most likely to consider it, which will be useful for deciding how to encourage it.

An interesting study in Austria looked at options for motorway operators to support MaaS. It is more usually considered for urban operations, where cities have influence over multiple modes of transport so they can influence modal shift between them. Key options for motorway operators' involvement are EV charging, park & ride hubs, HOV lanes and car-share schemes.

The Horizon 2020 project HARMONY (below, from SIS 18) is investigating perceptions about cars compared to public transport and how they relate to the relative use of public transport

in cities. It is hoped that this information could help operators to influence people who see the value of their car being higher than it probably is in reality.

Perceptions about cars and alternative modes



Other topics included remote control of locks from control rooms to support a 50% increase in freight by 2030, because a modal shift from road to waterways is a very 'green' alternative when a single vessel can replace up to 200 HGVs; and an edge cloud solution to process and display useful statistics about park and ride usage which is hoped to encourage modal shift and thus improve emissions

Efficient driving behaviours to reduce emissions

In the interim before low emission vehicles make up the entire vehicle fleet there may be potential to encourage low-emission driving behaviour. The MODALES project is investigating the use of a mobile app to encourage behaviour change through active recommendations in trip and passive ones after. However, the app relies on receiving data through the vehicle's OBD2 port which brings challenges: there are differences between manufacturers and OBD protocols, because the port was not designed for this purpose. This will make it difficult to create a universal solution.

Future traffic management systems to support sustainable mobility

The ERTICO TM 2.0 innovation platform had established the foundations for how public-private cooperation could be designed in cooperative and dynamic traffic management.

A key objective was for traffic management to shift from car-centric to multimodal mobility management. This could support the move to 15-minute cities, where most services are within 15 minutes' walk / cycle.

Copenhagen provided an example of what can be achieved with smarter traffic management. They started with an objective in their ITS programme 2015-8 to be carbon neutral by 2025. To support this, they aimed to achieve a 10% reduction in journey times for cycles, which has been achieved.

Five years ago, there were already more bikes than cars, with people preferring to cycle. This is shown by the fact that people cycle in all weathers and use cargo bikes, etc.

This outcome has been achieved by a variety of contributing measures including:

- Multi-modal traffic modelling provides a detailed model of cycle movements
- Providing bespoke VMS and detectors for cycles, to enable traffic management for cycles as much as cars.
- A pilot of bike Green Light Optimal Speed (GLOSA) is underway

The most important factor has been the focus on incentivising cycles so people want to use them!

Bike Variable Message Signs (VMS)



Kim Brockmann Moller in SIS34



Elsewhere, potential improvements to traffic management included

- Estimation of real-time emissions using floating car speed data and an emissions model.
- Use of predictive rather than reactive control, by comparing measurements to historic patterns eg in Balzano 50kph variable speed limits are set when emissions are predicted to reach a certain threshold before it is reached
- Use of traffic data (car / bike / pedestrian) to adapt the luminance of street lights
- 'Blue waves' to improve journey times for canal traffic in Holland

In future it will be important to consider braking and tyre emissions which make up a significant proportion of harmful particulate emissions.

What was new?

While there was very little in terms of completely new ideas there was significant innovation in the developments of existing concepts. Several papers reported on trials including EV charging, use of edge computing to monitor impacts, and mobile apps to improve driver behaviour. The policy focus in this topic was on new traffic management systems, and how best to encourage MaaS and modal shift.

There was also a focus on investigating user perceptions and willingness to use new modes, which is key to innovation as success will be limited without user acceptance.

Forward v Constrained

Generally the topic came across as experimental and very forward thinking which is not surprising due to the surging interest and importance of the green and net zero agenda. Few concerns were expressed about significant constraints on progress, with the main ones being: the difficulty of moving people away from car ownership for MaaS, and both technical and budget constraints for EV charging infrastructure.

Topic 4

From large-scale trials to deployment

The overall situation

The majority of the papers within this topic focused on C-ITS deployment across Europe primarily sharing lessons learned and identifying gaps in knowledge and digital tools available. There was a pronounced trend of studies moving from proof of technology to proof of benefits: a C-ITS road works warning study in Germany confirmed a positive cost-benefit-ratio, in trials in Bordeaux over 60% of participants said journey comfort was increased by using connected services and C-ROADS showed these services can result in up to 7.8% decrease in fatalities. A need for international standards/frameworks and collaboration was widely acknowledged as being a key to the successful deployment of new services or technologies

Many papers discussed the importance of the availability of accurate and standardised data for the operation of C-ITS and other transport services. It can reduce the time to implementation, save costs, allow the sector actors to co-create for societal change, and enable well-anchored solutions that become reliable and efficient when implemented in operational environments, so achieving a sustainable change within the transport ecosystem”.

An example of an existing neutral access data used for seamless C-ITS service coverage

across different geographical and governance jurisdictions was that in Netherlands where the urban data access platform provided as a public/private partnership provides fast and reliable transfer of data from roadside systems and other sources to road users and vice versa.

Some technical papers discussed the details of the best technology to ensure that C-ITS messages reach end users: road side units or leveraging existing cellular based comms? What is the minimum network coverage required to provide an adequate service? What to do in the cases where it is not possible to provide full coverage? The value of simulations eg simulation of urban mobility was highlighted through exploring these questions.

Special Interest Sessions (SIS) at the congress primarily centred around city AV trials with a couple being part of wider living labs research.

Horizon 2020 projects SHOW, AWARD and HARMONY stood out as demonstrating innovative work which considered automated vehicles and drones within context. Monitoring feedback at a local level eg coverage in local newspapers and in depth monitoring of AV user behaviour (collecting data about how their brains are responding) showed a level of consideration of the ‘human’ aspect that was unique.

LESSONS LEARNED FROM THE EU ADS REGULATION

Innovative Approaches

- Blending acceptability criteria
- New assessment method
- Flexibility

Coordination and collaboration

- Global
- European
- National
- Local

Best Practices from other fields

- Safety Management System
- Risk assessment tools
- Infrastructure
- Simulation and virtual testing
- Operational experience feedback



Draft EU ADS Regulation ([link](#))



Cristina Galassi in SIS 46 Regulating AVs in the EU: lessons learned for Public Authorities

AV trial presentations were painting impressive pictures of cities transformed to be more human centric, but we are definitely not there yet. A question posed several times was ‘when are AVs going to be economically viable?’- because as long as you need a person supervising an automated vehicle the business case doesn’t add up.’ Trials that were considering questions around what weather should we expect AVs to withstand (snow covering road markings is a particularly difficult one) were interesting but noted that they were not getting close to considering full automation.

The logistics of on-demand AVs in cities were raised: should people never have to wait more than a few minutes for a vehicle, so that the experience compares to the convenience of owning a car? How big should the vehicles be to enable this and how many would need to be available at any given time?

Considering the importance of understanding public perceptions of the deployment of new services and how people respond to or comply with in-vehicle messaging, there was very little on Human Factors. Some points were discussed: it was recognised that it is important

to consider what in-vehicle messages to deliver for maximum value to the end user – filtering messages was found to be essential to avoid overwhelming drivers. A study looking into the perceived safety of AVs found a very large range of responses and concluded that the positive perception of safety looked to be related to a positive attitude towards technology overall and vice versa. The study discussed the importance of understanding how new technologies or services are perceived in a successful deployment and recognised the need to for further work to better understand people’s attitudes and how they could be influenced for AVs to bring the most benefits in the future.

What was new ?

There was wide agreement that automated vehicles (AVs) are currently not flexible enough to deal with complex situations such as uncivil behaviour. This will be an important topic to explore in the future as AVs are currently programmed to strictly respect driving and safety rules and do not present the human flexibility which is required.

Tolling/Road user charging has been becoming increasingly more important as the uptake in EVs results in a decrease in fuel tax. Germany has one of the biggest tolling systems in the world which, since 2005, raised over €79Bn for the federal government. This tolling system uses mobile networks and GNSS (Global Navigation Satellite System, ie Galileo and GPS), based on distance on all German motorways and federal trunk roads, emission class and weight class of vehicles.

A study looking at the feasibility of using drones for carrying medical goods in the UK found that electric VTOL drones present significant advantages in terms of point-to-point direct servicing, emissions, and time-savings, though range and payload limitations introduce further challenges. Legacy regulations were identified as the main barrier to deployment of such services. This session prompted much conversation. It was argued that drone transportation of goods is a use case likely to bring the most benefit to regions of the world with very limited infrastructure like remote areas of Africa. Conversely deployment will not be possible if they are not widely accepted by the public in a given area for privacy or safety reasons.

Forward v Constrained

This topic was clearly moving forward with a focus on C-ITS and autonomous vehicles. However, numerous non-technical factors were

identified which have been playing a key role in determining the success of the deployment of C-ITS: enabling legislation including technical directives for vehicle manufacturers; lack of public understanding on privacy; access to sustainable funding; gaining trust and educating the public on the benefits of C-ITS

There were many AV trials under way with definite interest and funding but it was arguable how long these trials would continue if we did not present full automation soon to reinforce financial viability.

Trials of MaaS had shown that the way forward was not to make owning a car less appealing, it was about giving people an even better alternative. The ideal MaaS system was described at many sessions - a highly personalised tool making trip suggestions based on individual needs eg women seeking the safest routes to get home at night.

But the wider context was unclear. It was agreed that a monopolistic market was not a good thing, but if every city had its own app would we be creating more silos? How could supplier companies keep a brand identity if they were displayed on the same page and directly compared? These types of questions remained to be considered but would be difficult to incorporate in even a small scale trial.

Topic 5

From large-scale trials to deployment

The overall situation

Given the difficulty of sharing city space between freight, public transport and private vehicles urban logistics was an important, if numerically small, topic. There was exploration of how micromobility and sustainable solutions could be better integrated in the urban environment, to reduce the impact of freight moving around built-up areas and help balance innovation and reliability in logistics processes.

There were discussions on how public and private entities could work to facilitate data sharing, as well as emphasis on federated data networks for TEN-T freight corridors. Papers also covered the importance of data and data sharing in understanding freight flows and targeting areas for improvement and investment. Automation, and interoperable logistics platforms and routing applications also featured.

Safety in logistics transport was prominent. For example Antwerp's Safe Freight Planner designed specifically for freight transport inside the city centre focuses on routes that avoid conflict between heavy transport and vulnerable road users.

It was clear that intelligent and data driven logistics is becoming a topic of increasing interest both within Europe and globally. However, it was equally apparent that some of the traditional problems and barriers to attaining efficient logistics operations survive – such as limited data sharing and operators reluctant to be more transparent about their processes and procedures.

The detail

Digitalisation of logistics was a hot topic, with discussion of conceptual frameworks for measuring its impact on the operational performance of logistics processes which are based on impact quantification during, before and after different digitalisation scenarios have been implemented. More familiar concepts related to integration and optimisation of transport management systems, with a strong emphasis on breaking down barriers to enable effective data sharing. Urban logistics was a prominent theme with exploration of how micromobility and sustainable solutions could be better integrated in the urban environment, to reduce the impact of moving freight around built up areas and create an efficient balance between innovation and reliability in logistics processes.

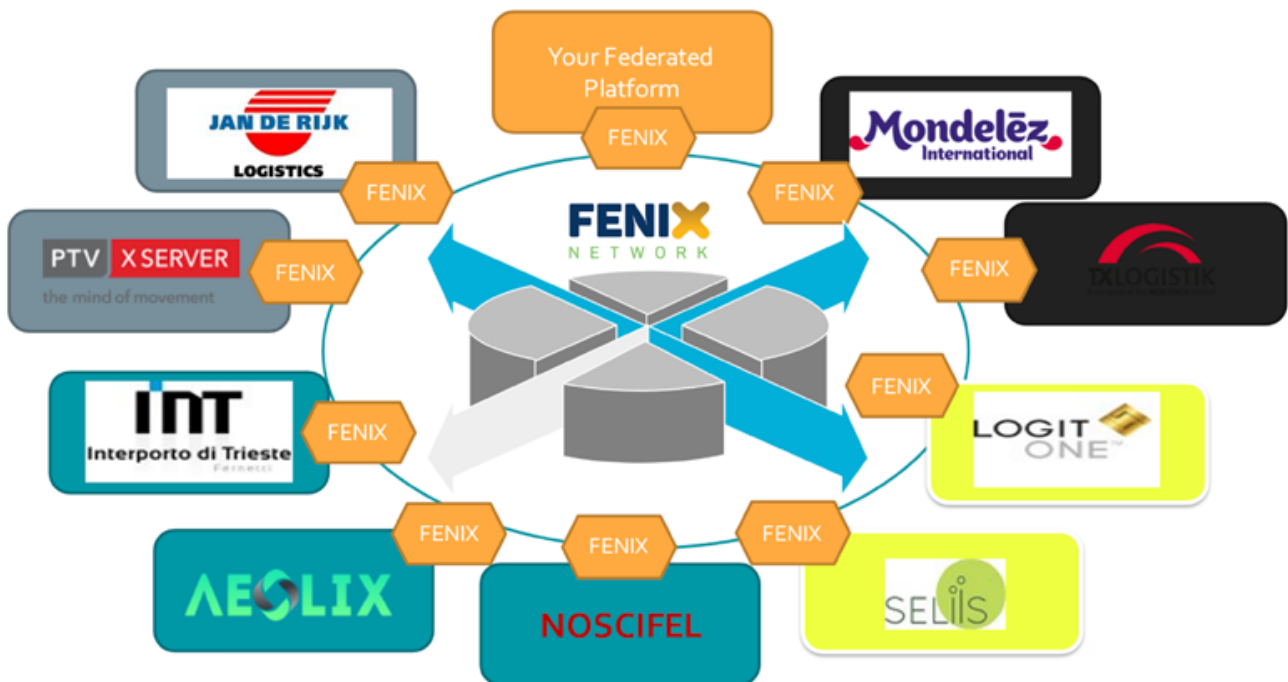
Integrated intermodal capacity was discussed, with a look at the practicalities of intermodal cross pilot architecture for the Rhine-Alpine pilot site, which featured planning and optimisation based on corridor services. The project is not just about data but is also focused on the services that can be developed using the Fenix connector. The solution enables distribution to distribution centre routing that is mode agnostic, enabling the user to ship as per their objectives (cheaper, faster, etc.) using GLNS (Global Location Number as a Service) to join the transshipment and localisation service aspects in a federated manner. A pertinent aphorism used to extoll the virtues of data sharing was, “To go fast we go alone, to go far we go together”.

There was much discussion on the common and long troublesome theme of data sharing, and how public and private entities can work to facilitate effective data sharing more openly, as well as emphasis on federated data networks for TEN-T freight corridors. Papers also covered the importance of data sharing in understanding freight flows and targeting areas for improvement and investment. There was a focus on improved data sharing between actors in the supply chain in the logistics end-to-end systems project, which considers the value of goods as being a key consideration in the importance of establishing efficient supply chain policy, offering an interesting take on logistics management processes.

Data sharing was further explored, in the context of digital transformation in logistics,

with updates on progress with the Fenix connector network (A European FEDerated Network of Information eXchange in Future Logistics), a project that continues to be of interest having featured at the ITS World Congress in Hamburg in 2021. There was focus on the Noscifel Fenix connector, which enables transfer of CO2 calculations to integrate environmental footprint considerations at the earlier stages of modal choice decision-taking, as well as providing slot status and container risk status to optimise customs controls for dangerous goods today. The connector also provides an anticipated risk analysis tool for container shipping: waiting times, gate times, parking availability - all displayed on a mobile app, with the ability to interface with GLOSA systems.

FENIX FEDERATED NETWORK OF PLATFORMS



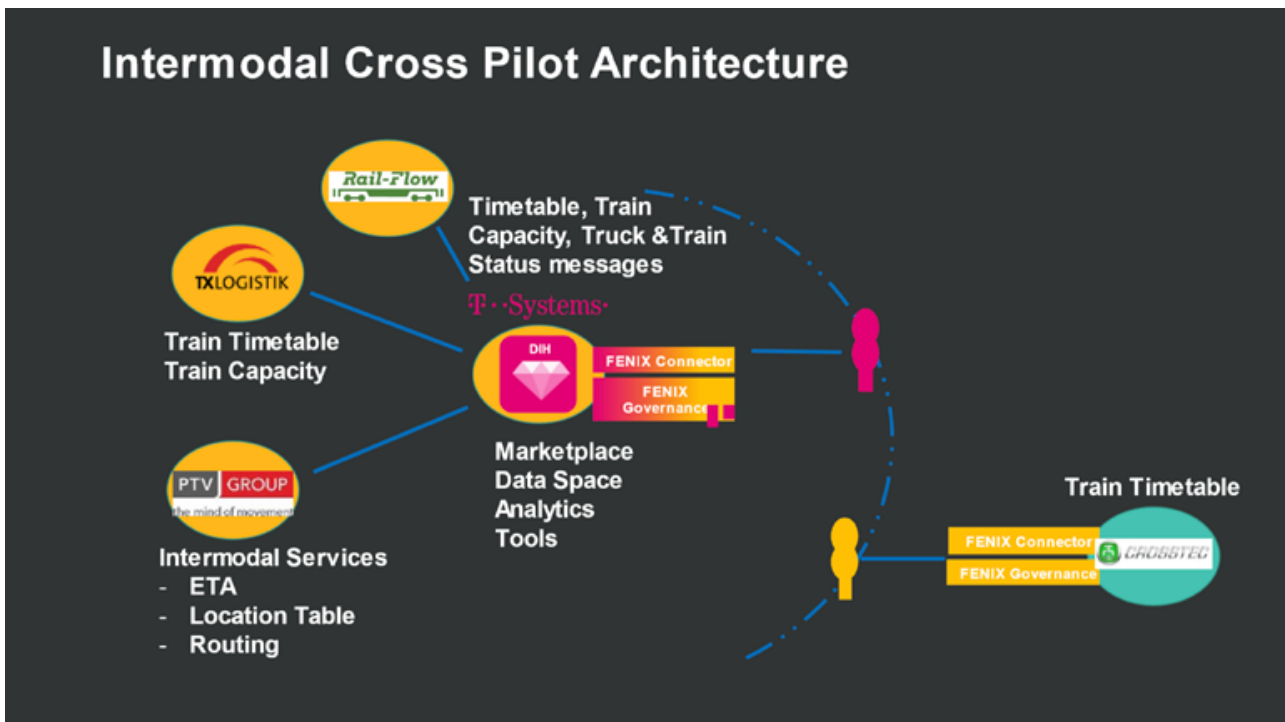
Fenix Network, SIS 50, André Perpey, NeoGLS

Federated logistics platforms were expanded on in the context of the Greek ecosystem, with exploration of use cases across three operational cross corridor pilots and two node based, such as at the port of Piraeus. Digitalisation of port processes - for import and export services -

was a key use case, as was intermodality as seen in the Cargo Bundling Marketplace (CBM) use case. Use case four featured an AI enabled traffic services platform, to inform parking and traffic management. Finally, the fifth use case was a corridor "yellow pages" and KPI platform.

It was highlighted that data sharing in logistics beyond FENIX is the next step, with the Green-

C-Ports platform an initial initiative.



Mode Free Capacity Planning, SIS 50, Krietsch & Kegler

There appeared to be little discussion on the importance of inter-urban logistics, or connectivity of the port and urban environments in port cities. There was also little in the way of discussion on equity, sustainability and resilience in evidence, with carbon neutral and zero-emissions logistics operations taking more of a centre stage presence.

What was new?

AGVs (Automated Guided Vehicles), whilst not an especially new topic or concept, were given a fresh perspective in terms of the opportunity to apply nascent automated driving technologies to outdoor logistics movements. Some of the innovations in logistics solutions fell under the heading of "Next Generation Solutions", such as MZIGO - a next generation modular freight container solution which facilitates efficiencies in end-to-end goods transport by allowing real-time tracking and flexible, interchangeable shipping units. The demonstration area also featured a drone concept with the capability to

make package deliveries in urban areas. Drones in logistics were further explored in the technical sessions, with a look at the optimum use cases and some of the trials in operation today. The majority focused on delivery of medical supplies, mail, or food, where the service can be faster, more reliable and produce less emission than traditional alternatives. Some of the existing constraints, apart from the already mentioned regulatory issues, are the requirement in many trials for an additional mode of transport to complete the first and final sections of the journey, as the drones are restrained by where they can safely land and take-off. This massively reduces the efficiency but does raise interesting challenges linked to integrating drones into connected supply chain solutions.

Agricultural logistics solutions featured at the congress, with a look at how hybrid communications can enable tracking of vehicles across international routes with limited communications network coverage by using Low Earth Orbit satellite services.

Forward v Constrained

It's clear that intelligent and data driven logistics is becoming a topic of increasing focus, both within Europe and globally. Whilst this is certainly encouraging, it's equally apparent that some of the more familiar problems and barriers to attaining efficient logistics operations still exist, particularly in the form of data sharing and willingness for operators to be more transparent about their processes and procedures.

There was more innovation discussion centred on open standards for logistics automation in a session on Yard Automation, where the limits of current technology were laid out. The question of whether innovation from other domains can be applied was raised in the context of speeding up Yard Automation, for example from the Autonomous Vehicles sector and broader digitalisation in logistics, with a recognition that all actors - from vehicle manufacturers and automation providers to yard operators and logistics planners - will need to work together to realise success.

This discussion also looked at how existing Advanced Driver Assistance Systems and automation systems in pleasure boats, buses, trucks, and construction vehicles might be better employed in yard automation. Some of the suggested key drivers for yard automation were for use on monotonous trips (for example in the mining sector) and the wider industry incentive to adopt zero-emission vehicles and charging infrastructure.

Also raised was the question of how best to define and promote the business case to encourage interoperability and collaboration between competitive enterprises, and the importance of connecting people and knowledge in creating innovation that boosts the competitive strength of the industry, with a recognition that successful pilots help feed the business case and develop the essential technology in parallel.

A useful definition of data sharing in logistics was put forward as, "Data sharing in a supply chain is referred to as the extent to which crucial and/or proprietary information is available to other actors of the supply chain for the completion of their daily operations."

There was further discussion of constraints in the context of the digitalisation of logistics, with the suggestion that enhancement is hindered by large companies, who often have their own platforms but do not necessarily aim for integration. This is frequently linked to the choice power of larger companies, and equally whilst digitalisation may be effective within medium-large companies it is often fragmented or absent along supply chains. It was highlighted that linking information that is already digitalised but not shared would make a big difference to enhancing end-to-end visibility of supply chains.

There was recognition of a need to consider e-commerce in the urban mobility mix and how we can make delivery services more efficient, perhaps considering more systematically how urban consolidation centres can be part of the logistics mix.

PART 4

The ITS Summit

The ITS Summits incorporated in Congresses aim to encourage unrestricted cross-sector discussion on transport concerns and priorities at city level to identify best practice and publicise it, pin-point the barriers to delivering policies or services and establish if they are well understood or need research. Over 80 Ministers, Mayors, Industry leaders and senior representatives of national and local governments from 21 countries met in Toulouse on Monday 20 May to review how intelligent and green mobility can contribute to sustainable growth and a better quality of life and environment for all citizens. The 2022 Summit focused on exploring the practical

aspects of the Mobility Data Space – a data sharing community for everyone who is looking to build the future of mobility. Five discussion groups looked at different aspects of the topic:

Data ownership; protection; privacy

Access to data across all data markets

Inclusion and digital divide

Interoperability

Mobility data sharing across public and private sectors



The Data ownership; protection; privacy discussion agreed that the proposed legislation would give more autonomy to data providers/generators to transfer and/or reuse their data. It represented a positive step for both consumer rights and business opportunities, but the details were complex and might be easier to address if deconstructed. For example in order to “address trust” it would be better to look separately at concerns raised from the perspective of the public, the private sector, and government agencies because each has

its own issues. More generally there needed to be consistency in the application of the law, a balanced perspective to avoid perverse effects that might preclude companies from sharing their data, and fairness so that all those owning and sharing data believed they were not being disadvantaged. An education and awareness strategy to promote understanding, responsibilities, benefits, and outcomes, and ultimately trust was needed. This strategy would need to be tailored to address the unique perspectives, expectations, and needs of the

public, private companies, and government agencies. Discussion also reviewed whether all mobility data should be given equal importance.

The group considering Access to data across all data markets noted that stakeholders in the transport data market varied considerably in size. Most current transport data had come from road vehicles and train operators who have had ready access to it; action needed to be taken to encourage the sharing of data so that a wide range of organisations could use it to deliver wider access to a greater number and range of mobility services. It was also essential to ensure that the views of smaller entrepreneurs were heard. They were more likely to innovate and thereby disrupt the status quo but less likely to feature at international regulation discussions. Both local and national authorities should ensure widespread availability of the data they generate or own by placing it on recognised open platforms to help to make sure that the mobility data market place does not become the monopoly of a handful of technology or manufacturing giants. Perhaps the most difficult issue was enabling trust so that data sharing was not impeded.

Discussion on the Inclusion and digital divide topic recognised an existing transport inclusion problem comparable with those of health, education etc. Today we only cater for a majority as incorporating the minority is not attractive commercially; it is a very diverse group requiring additional effort and costs. Some people are geographically excluded: rural areas left behind as there is not enough demand or the business models are not good for people offering services. Current data on the problem is incomplete – for example pedestrians are not always visible in the system, and our data only describes the current position and not how to stimulate the right things in the future. For people not yet a part of mobility how do we make the invisible visible, and really understand the needs of those unheard? We need to

include the group to get the goals we all have for mobility, sustainability, safety etc. Can we share existing data to get a better grip on the problem? Should there be a societal minimum transport expectation similar to education – for example to be able to move from home to work?

Interoperability was recognised as a difficult issue which is frequently a major barrier for smart mobility deployment. It is not just about data standards; it also depends on:

- Developing trust between all parties (solutions developers, buyers and users) as well as the ability to create a trusted environment in order to avoid unfair competition, while ensuring that some competition remains to regulate the market
- The importance of a good cooperation between public and private sectors combined with compatible business models

Public authorities can encourage solutions interoperability through their procurement policies especially by mandating standards. They can also use procurement and innovation requirements to foster collaborations between partners that may be competitors in order to secure a “co-opetition” approach. To deploy these approaches it is key that all players allow the public sector to lead the way regarding data release and standardisation, and that cities orchestrate the deployment of solutions to provide services for their citizen. There seemed to be scope to learn interoperability lessons from other sectors such as health and the use of patients’ data by clinicians and the patient’s own rights of access.

The Mobility data sharing across public and private sectors topic generated interesting discussions about ‘entitlement’ to data reflecting who has funded which element of its creation. There was agreement that there could,

and should, be a greater opening up of the data held by both the public and private sector and achieving that needs more discussion and perhaps more mutual trust. Data sharing rests on agreement of all parties regarding ownership, the intended use of the shared data and by whom, and any payments. It is a balancing exercise on several levels involving data owners and data users; between the end goals of the public sector (serving the citizens and the societal return on investment), and the

private sector (serving the financial return of investment); and finally between established players and new disrupters. Government needs to find ways to adapt regulations more rapidly – innovatory services using data are too often seen as a threat by regulators. However proposers of innovatory services need to remember that public transport infrastructure is designed for a very long life and the public sector needs to protect this investment. Regulation needs to be addressed as a partnership.

The Summit delegates were pleased to have the opportunity for a full and frank exchange of views on these sensitive and complex issues.

The conclusions of the participants in the Summit:

- **Data is essential to power new ITS solutions and encourage the greening of our society and its mobility systems;**
- **Ownership of data and access to it is complex and should be treated Europe-wide, not nationally and not locally;**
- **The availability of data and data sharing needs to recognise that the public and private sector have different objectives and obligations;**
- **The supply of data needs to reflect its importance for example in the case of road safety;**
- **Education and awareness are essential for every stakeholder; guidelines for both the private and public sector are required but also engagement with the general public to ensure they buy into the use of their data;**
- **Trust between all stakeholders is the corner-stone of the mobility eco-system and is essential for data sharing;**
- **Development of data for wider use in mobility needs greater cooperation between the private and public sectors;**
- **A clearly specified regulatory framework is required particularly for the private sector;**
- **It is difficult to collect data for inclusiveness because many of the people involved are invisible to current data collection sources – it is important to find a way to do this;**
- **It has been demonstrated that a successful national data market encourages the development of regional mobility markets and catalyses modal shift for users.**
- **Questions still remain as to whether the data market is failing or not, and the degree to which a basic regulatory framework is necessary.**
- **Data management is a balancing exercise on several levels: between data owners and data users; between the end goals of the public sector (serving the citizens and the societal return on investment), and the private sector (serving the financial return of investment); and finally between established players and new disrupters.**

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