EUROPEAN CONGRESS

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ITS: The Game Changer.

ITS: The Game Changer

Post-Congress Report

ORGANISED BY ERTICO ITS EUROPE

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The 15th ITS European Congress – Post-Congress Report

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1409 Sqm
EXHIBITION AREA

8
ASSOCIATED / SIDE MEETINGS

4
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113
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1397
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INTRODUCTION

The Congress's principal theme "ITS: The Game Changer" was chosen to illustrate the powerful 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, efficient, 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, the Congress Exhibition and the Smart Mobility Summit of Cities and Regions.

The Congress was organised around five key Topics:

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 115 in total – Plenary, Special Interest, Technical, Scientific – as well as specialised Workshops and the Smart Mobility Summit of Cities and Regions.

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

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

Topic 1	Risto Kulmala
Topic 1	Marieke Martens
Topic 1	Tim Morris
Topic 2	Jill Hayden
Topic 2	Lone Dörge
Topic 3	Tim Morris
Topic 4	Darren Capes
Topic 4	Paula Claytonsmith
Topic 5	Carol Schweiger
Topic 5	Karla Jakeman

My thanks also to the moderators of the ITS Summit: Marieke Martens, Margriet van Schijndel, Goktug Kara, Rikesh Shah and to Bart van Arem our Scientific Director. My colleagues from ERTICO and MCI all deserve grateful mention for their quick and cheerful handling of my numerous enquiries and questions.

PROFESSOR ERIC SAMPSON

CHIEF RAPPORTEUR

BRUSSELS June 2023

PART 1

Summary

PART 1 | Summary

There were around 113 Congress sessions in all: 72 were Special Interest Sessions with 5 Strategic Futures Sessions. 152 papers were presented in 34 sessions roughly divided as follows – Topic 1: 60 papers; Topic 2: 27 papers; Topic 3: 13 papers; Topic 4 22 papers, Topic 5: 33 papers. In the four 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 stands staffed by over 80 organisations. Some of the stands (European Commission, ITS Mobility Germany, ITS (UK), ERTICO) presented work by projects representing a further 40+ organisations. The Smart Mobility Summit of Cities and Regions was a key element of the Congress with a focus on supporting the local and regional authorities' agenda of driving innovation and implementing smart and sustainable mobility solutions for public benefit. The Summit was built around discussion groups on four main topics: allocating city road space; setting and using mobility indicators; collecting and using mobility data; and transitioning to sustainable mobility. It involved over 50 senior representatives of national and local governments from 30+ countries together with some of their suppliers of ITS services. There is a full description of the Summit in Part 4. Here's a picture of what has happened under each of the 5 main Topics; the topics are addressed in Section 3 in detail.

The topic of **Cooperative, Connected and Automated Mobility** attracted the highest number of papers and sessions. Connectivity and automation related matters were both presented and discussed from various angles. Cooperative ITS (C-ITS) services was moving to full deployment so the focus was on implementation issues such as long-term operation of services. Satellite communications and 5G technologies showed how ubiquitous connectivity enables interference free services.

Contributions on automation were more focused on technology development especially for sensors, machine vision and machine learning. Most of the technical papers dealt with trials of familiar systems but some exciting new ideas were introduced for example linking vehicle platooning to traffic management and collision alerts; using cloud computing in last-mile electric automated shuttles; and monitoring of driver status and driver misbehaviour.

Policy took centre stage in a session on public-private partnerships for successful C-ITS deployment with the main achievements, innovations and key challenges discussed. There was also a look at how, when regulating and legislating, National Road Administrations approached challenges and barriers, such as standardisation or communication.

This topic was going forward rapidly. Connectivity technologies were more prominent than in previous congresses and the connected services portfolio had expanded. Much progress had happened in automation and automated driving especially in the depth of the discussions between public and private sector stakeholders. In contrast the fast moving robot taxi business was not addressed at all in the papers presented.

Topic 2 Digitalisation and the data value chain was decidedly popular. Mobility data provision, data sharing and data exchange were core issues. National Access Points featured in several sessions with links to a Common European Mobility Data Space.

A regular problem was data sharing incentives and learning how to share data and information for the common good without jeopardising the functioning of markets.

Several speakers mentioned initiatives to give better information to the public about access restrictions in cities. Electronic Traffic Regulations based around road authorities' efforts to digitise national traffic rules and regulations also attracted a lot of attention. There was a clear need for cross-border interoperability and mutual trust was identified as a key success factor.

Trust and developing stakeholder collaboration were mentioned in most sessions. Cooperation among many stakeholders was always difficult and was still challenging. It required trust, resources, and practice – often achieved through EC, ERTICO and other European consortium projects. There were few radically new innovative suggestions; rather there was continued development of existing ideas and research. The themes of improved data to support policy, and addressing emissions through behaviour change, had progressed further since Toulouse. Infrastructure owners, authorities and road operators seemed to be more actively involved and better understand the value (and necessity) of data provision and data management.

This was probably the busiest **Freight and Logistics Topic** for a decade with two core themes: digital logistics platforms and reducing delivery chain costs. There were interesting discussions on the benefits from using digital twins for last-mile logistics. Delivery chain cost efficiencies featured prominently. An interesting topic was the idea of a common platform for deliverers and customers to facilitate delivery management. The Topic saw much innovation but also improvements to existing services. Autonomous trucking was advancing and there was discussion of the economic benefits from connected truck convoy concepts. There was a sobering look at how ITS and logistics can aid areas of geopolitical turmoil with examples of ITS as a game changing tool delivering public services and safety in Ukraine.

Intelligent truck parking was a prominent topic, with a look at the optimum information provided, methods of delivering it, and how drivers used it once received. The use of public transport for freight movement featured with a focus on low-carbon footprints for last-mile deliveries and creating shared value. A development on the horizon was supplying freight data *via* an electronic Freight Transport Information platform – a topic, eFTI, we are sure to see in future congresses.

ALICE the European Logistics Innovation Platform

Future Traffic Management, Topic 4, was very busy. The popular issues were the need to reduce carbon, better manage urban travel and address road safety especially the vulnerability of active travel users. Cycling and walking had gained a key role in urban mobility as a solution for many issues like last-mile freight delivery, air quality, noise, sustainability, health, congestion, and equitable access. Achieving 'Vision Zero' fatalities and emissions levels on road infrastructure is a key challenge that future traffic management can address. Digital technologies are already used extensively for improved road safety, efficiency, travel experience, environmental protection and contributing to social and economic development.

Cooperative intelligent transport systems offer high quality information for road users and road authorities to help them make transport smoother and safer. To make the most of this more data needed to become available. This pointed to strengthened cooperation on traffic management by increasing the interaction between road authorities, traffic managers, service providers, fleet managers, vehicle manufacturers and infrastructure operators.

There was strong interest in the use of data and data science processes for enhancing traffic management. The issue of the collection, reuse and re-purposing of data was explored in relation to using stopped vehicle alerts from eCall data.

Topic 5 New mobility services was a mix of innovative ideas and schemes for going in a more person centric direction. Many papers looked at how to encourage people to take up new mobility solutions plus a broader thinking on how activities could be used as blueprints and implemented elsewhere by adapted adoption. With its high speeds and massive capacity 5G was enabling a wide range of new services and applications. These services could leverage vehicle-captured data, or exploit a vehicle's resources in order to be deployed and run on top of them. We saw many exciting new ideas:

- Drones at complex traffic junctions for vehicle classification and tracking.
- A virtual reality bicycle simulator to develop behavioural models for cyclists.
- New mobility for neglected groups of society using all mobility modes even e-tuk-tuks.

There were busy sessions on real-time mobility data sharing and the benefits from initiatives such as the ITS Directive and the Common European Mobility Data Space. The potential for MaaS had been discussed in Congresses since 2014: What were the expectations of citizens? governments? the private sector? Was the technology ready for a seamless journey and switching modes? Was MaaS a future ready solution awaiting a future ready culture?

The earliest Congresses were showcases for declassified military technology or knowledge research projects, rather than exploration of new services. Lisbon demonstrated that there's now much more joint working so instead of suppliers telling users "Our system does this you should buy it" the focus is now "tell me what you want to achieve and we'll work together to design and deploy solutions that deliver it". Consequently the last few Congresses have reported work on getting open access pools of reliable data used by a range of services; and addressing more than one problem with just one solution and no unwanted side-effects – for example sharing city road space between cycling and walking and also freight and passenger traffic; or increasing mobility while following a Green agenda AND improving safety AND NOT reducing flows.

Lisbon 2023 showed that European ITS can deliver mobility that is:
• Accessible • Equitable • Affordable • Resilient • Has zero fatalities
• Has zero emissions.

But hitting two or more of these targets at the same time was still very hard. Most of the technologies were ready but the associated policy setting and regulation were lagging behind. If we had a clear political drive; if we accepted the price of deciding to reach key goals quickly – then Zero fatalities and Zero emissions were within our reach. The problems that remained were mostly about policy makers waiting for the perfect solution or the unwillingness of us as users to adapt our behaviour. The Congress Chief Rapporteur, in his closing summary, argued "the message to all of us is that we need to change – NOW. I live in a farming area in N Yorkshire where there's a saying: Don't wait for the storm to pass – learn to work in the rain."

PART 2

Plenary Sessions

Plenary 1:

Digitalisation – what can mobility users expect?

Moderator	**Joost Vantomme**	ERTICO – ITS Europe, Belgium
Keynote speaker	**Michael Schuch**	Swarco, Austria
Panellist	**Lucie Kirstein**	National Academy of Science & Engineering, Germany
Panellist	**Pearse O'Donohue**	European Commission DG CONNECT, Belgium
Panellist	**Teemu Heikura**	Fintraffic, Finland
Panellist	**João Barros**	Nexar, Portugal

Joost Vantomme, the Moderator, welcomed everyone to the session and gave a little background. The move to "digitalisation" was visible around the world but it was rarely well-understood. In most cases a balancing act was needed that recognised the different positions and requirements of 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). The public and private sectors needed to acknowledge that the other side had different objectives and obligations regarding the availability of data and sharing it – and that the two requirements could co-exist. The session would explore some very topical questions for example: What are the benefits of data sharing? Can I access mobility services without data sharing? Must I opt-in? How do we develop trust between the stakeholders?

He introduced the Keynote speaker **Michael Schuch** who argued that we needed to re-establish confidence in digitalisation. Users felt that their privacy was at risk and at best had a healthy scepticism about what organisations were able to access their personal data and what it was being used for. Trust was at stake; we urgently needed to consider how we could reassure users that digital solutions and ITS services offered more opportunities than risks.

The way forward was to increase openness. We needed to tear down the siloes that restricted exchanges between different sectors – and often between stakeholders in the same sector – and deliver positive messages supported by evidence to explain that sharing mobility data is key because it unlocks collaboration and builds trust. Reflecting on the Congress's overall Theme he argued that sharing was a game changer and that digitalisation was the key enabler leading to many benefits. We needed to show users real examples of the gains from digitalisation. He believed that there were three main classes of benefit: Improved quality of life including making the planet greener; improved safety; and opening numerous new possibilities and opportunities.

We needed to develop cooperation and trust between the involved parties to enable rapid digital progression leading to more, and better, ITS solutions.

The Moderator asked each panellist what was the impact of digitalisation in the sectors they represented and a brief comment on what their organisations were doing. He welcomed **Pearse O'Donohue** and noted that in discussions on the Common European Mobility Data Space potential stakeholders were concerned that the Commission planned to create a centralised database, or adopt new mandatory standards. Could he clarify the objectives of the CEMDS?

Pearse explained that the European Commission aimed to make the European Union a world leader in a data-driven society. The key concept was the creation of a single market for data that would allow its free movement within the EU and across sectors for the benefit of end users, businesses, researchers and public administrations. The Commission felt strongly that in many areas data was underused for a number of reasons: what was available was not publicised so potential beneficiaries were unaware what was there; the rules for access to data were too restrictive; the necessary skills for exploitation were in short supply; the owners of data were themselves unclear about the resources they had so were slow to share them.

It had been widely agreed that it was essential to shake up the sector to benefit users and in particular provide opportunities for micro businesses to use the data to generate good for the economy. As part of a drive to put in place a data governance regime the Commission had proposed a Regulation on harmonised procedures – also known as the Data Act. The aim was to ensure that the rules for access and use of data were fair, practical and clear and that privacy, data protection and competition law, were respected. To support this work there had been an initiative to develop pooling of European data in key sectors to create common and interoperable data spaces with clear and fair rules on access and re-use of data. The data spaces also had investment in next generation tools and infrastructures to store and process data plus tools to give users rights and skills to stay in full control of their data.

Pearse noted that digitalisation had a wider impact than just data for example on telecommunications. Deployment of 5G was essential for many safety initiatives and the implementation of Connected, Cooperative and Automated Mobility. 5G was becoming a reality due to ITS and *vice versa*. Massive investment was needed to reach the high level goals for the environment and safety but 5G and digitalisation were indeed Game Changers.

The moderator asked **Lucie Kirstein** with various siloes emerging from various data initiatives, where could Europe intervene to foster "de-siloification"? **Lucie** suggested that the earliest benefits for users would emerge from the creation of data spaces. It was important that the detailed structures of data spaces had been shaped by the needs of the relevant sector – one size did not fit all. In Germany there were a number of initiatives under way to complement that by the Commission; the Acatech website hosted about 400. Experience to date had revealed a number of key lessons. First, it was necessary to be clear on each space's governance structure as that would influence the business models for participating organisations. When planning new spaces or development of existing ones it was sensible to be open to using lessons learned from other data ecosystems.

To be successful in opening up the availability and usage of data it was essential to get engagement from everyone. Germany's experience suggested that achieving this would be helped by having clear policies for data sovereignty, to have a single entry point to the data space, and to ensure straightforward processes for peer-to-peer data exchange.

The moderator welcomed **João** Barras and asked whether the physical infrastructure was ready for connecting roads with vehicles in an optimal way? **João** opened with a focus on the data requirements of highly automated vehicles (AVs). There were frequent grumbles that widespread implementation of AVs was taking longer than expected. This was undoubtedly true if measured as the deployment of level 5 autonomous vehicles but the digitalisation of vehicles that was a necessary precursor to that brought many gains. The extensive vehicle sensors and video needed for levels 4 and 5 produced

data that could be used for insurance purposes and accident or incident investigation. Equipped vehicles generated comprehensive real-time information of great value for network management and a number of projects were collecting data on road surface defects and detecting available parking spots. The same sensors could also monitor driver behaviour and get a direct assessment of how drivers responded to the delivery of traffic-related information or instructions. The associated physical infrastructure was not evenly available and more investment was needed.

The moderator asked **Teemu Heikura** how could the EU help Finland remove bottlenecks. He replied that Finland firmly believed that access to more, and better, data would bring safer roads and better planning for both the public and private sectors so there was a national policy of encouraging the sharing of data. Associated with that was the goal of getting more data through crowdsourcing and data spaces were necessary to make that happen. A key bottleneck was understanding the importance of trust which had been mentioned by other speakers. It was vital for public understanding, for ensuring privacy and security, and was needed to underpin the work of commercial parties selling data and Finland welcomed the Commission's initiatives here.

The moderator asked panellists what steps might drive greater user mobility. There was general agreement that widespread availability of reliable and resilient 5G would bring many benefits. **Pearse** said that the EC was working on a number of actions to lower barriers to access to data, thereby make it easier to share data. **Lucie** would like to see more activity on stopping the creation of siloes and the opening of those that existed. This was a key issue for the Public sector which frequently found it hard to build bridges between different islands of work.

João would like to see more work on interoperability. The ITS industry was open to this but the business models were not mature so some form of incentives would accelerate progress. Ultimately more and better data would generate user benefits so the business cases ought to be straightforward.

Teemu said that while it was clear that a lot of work was under way already there would be gains if there could be more sharing of information on projects and collaborations. The other key factor was removing some of the suspicions regarding data use and privacy in order to develop trust and that needed engagement from all stakeholders.

To close the session the moderator asked each panellist for a succinct statement of what for them would be a dream outcome from data initiatives: **João** opted for fewer cars, more playgrounds and more trees. **Teemu** nominated improved interoperability. **Pearse** would like more rapid digitalisation leading to environmental improvements and also a reduction in siloes. **Lucie** chose fewer cars, more attention paid to human factors especially bringing people on the technology journeys.

Joost Vantomme thanked all speakers for their inspired contributions.

Plenary 2:

Connected, Cooperative and Automated Mobility: How green can you go?

Moderator	**Riccardo Boin**	McKinsey & Company, Italy
Keynote speaker	**Anne-Lise Thieblemont**	Qualcomm, USA
Panellist	**Rosalinde van der Vlies**	European Commission DG RTD, Belgium
Panellist	**Miguel Cruz**	Infraestruturas de Portugal, Portugal
Panellist	**Katja Hector**	Mercedes-Benz, Germany
Panellist	**Miguel Perez Juez**	ALSA, Spain

The moderator **Riccardo Boin** welcomed the panellists and introduced **Anne-Lise Thieblemont** the Keynote speaker. She explained that she would develop from the picture of digitalisation described in PL 1 to show the potential gains for sustainability. The basis for services was 4G and 5G connectivity where there were extensive infrastructure networks and multiple service providers. Already about 90% of connected cars had 4G and it was predicted that by 2030 over 95% would have 5G – essential for the higher levels of automated driving and software-configured electrified vehicles. The shift from 4G to 5G was running five times faster than the move from 3G to 4G.

Connectivity was key in Europe for delivery of the Green Deal and moving towards Vision Zero. The automotive industry was working with a range of technology suppliers to deliver software-defined vehicles ready for automated driving and ADAS. The target was reduction of greenhouse gases to net zero by 2050 and we should note that transport accounted for around 25% of the European emissions. The safety goal was halving of road fatalities by 2030 and zero by 2050. There had been a continued reduction in overall road fatalities over the past few years but the gross figures concealed key facts. Around 50% of the deaths were on rural roads and 70% of vulnerable road user fatalities were in urban areas. A vehicle with 5G, sensors and AI would be able to take the appropriate safety action based on real-time information about location, weather, traffic and road condition so deriving the benefits from connected and automated driving depended on extending the coverage of 4G and 5G and especially beyond city areas.

It had been estimated that C-ITS solutions would prevent, or significantly mitigate, 80% of incidents happening at intersections or as a consequence of lane changing. C-ITS could also cut vehicle emissions by reducing complete stops and heavy braking. A recent modelling exercise had shown the benefits appearing with as little as 20% market penetration of connected vehicles. **Anne-Lise** said that there was surely little doubt that connected, cooperative and automated mobility was a game changer for clean and safe mobility. Delivering it required cooperation between all classes of stakeholders on both the supply and demand sides but above all it required interoperability and that meant international standards.

The moderator commented that evidence from Plenary 1 and the keynote address suggested that all the key technologies were in place for safer, greener and more pleasant cities and mobility but the business models seemed to be lacking. What role might infrastructure operators play in accelerating take-up of CCAM. **Miguel Cruz** pointed out that CCAM was an eco-system so progress required extensive cooperation and co-working. This was especially so in Portugal as the road infrastructure organisation also had rail and air responsibilities and there was a high level objective of modal shift. He felt it was too early to state what hardware was needed for acceleration but a key issue was user behaviour and changing habits together with coordinated actions by the regulators in different sectors.

The moderator asked **Rosalinde van der Vlies** how the European Commission was coordinating its different CCAM initiatives. She noted that a strength of CCAM was the potential to help society as a whole: the advantages for the Green Deal and Vision Zero had already been mentioned but there would be inclusiveness gains for example new mobility services of benefit to people in remote areas and to deprived users. CCAM was also a catalyst for digitalisation. We needed to raise awareness of what CCAM could do so that citizens saw the need to buy in to enable the different solutions to develop.

Another key factor for the EU was improving the competitiveness of European industry. There were three elements for successful progress: a common strategic vision; this was in place with the Green Deal, the Smart Sustainable Mobility Strategy and Technology strategies. The second part was a supportive regulatory framework especially standards. This was complicated by a number of national regulations but there was a move to get the key parts harmonised across Europe. The third part was investment where there was a major R&D programme and a number of schemes to encourage deployment. A key factor here was the CCAM Partnership that involved stakeholders from across the community to ensure solutions were applicable in all sectors and that all voices were able to contribute opinions. There were important non-technology issues such as planning the re-skilling of the workforce and generally educating and training for a digital world.

The moderator asked **Katja Hector** what the OEMs were doing. There was an established programme to bring together cities, user groups and infrastructure owners/operators to use the data available from connected vehicles for a range of services. For example alerting drivers to a speed limit change at an upcoming school zone, to an accident black spot or a vacant parking space. The information flow was two-way meaning used not just to protect the vehicle occupants but also to alert vulnerable road users to sensitive situations. A new project was using data from a vehicle's sensors to monitor road surfaces for operators, generating local weather reports and detecting missing or non-functioning traffic signs.

Miguel Perez Juez explained that as someone from a public transport company he had key responsibilities to promote the use of green solutions, public transport and energy use reduction. Making advances in all areas needed technology deployment and CCAM had attractions for all of them. A trial autonomous small bus route was running and was popular with travellers; it also enabled many lessons to be learned for example the need for a strong technology partner as both hardware and software were evolving rapidly. It was clear that scaling up for more and larger vehicles was essentially straightforward requiring some extension of dedicated lanes but little additional infrastructure. The barriers to faster deployment were the need to limit the speed of the AV as it was sharing road space with conventional private cars that were less compliant with traffic regulations, and the lack of high level regulatory and type approval structures.

The moderator asked whether CCAM was a contributor to addressing climate change. **Rosalinde** believed that as addressing climate issues was complex there was no one 'Silver Bullet' but we could take steps to ensure that all initiatives moved in the right directions. Primarily we had to avoid working in siloes and develop cross-sector working. The Commission had tentatively invited proposals by cities seeking to achieve climate neutrality by 2030 and had received 400+ proposals from which 100 cities had been selected. These cities had been merged with the CCAM partnership to ensure maximum knowledge sharing and learning. Linking the public and private sectors and linking different classes of business was key. **Miguel C** said that the difficult areas for accelerating CCAM were the need for interoperability solutions, the lack of cybersecurity standards, and the intrinsic difficulty of testing solutions in extreme climate conditions. There needed to be Europe-wide solutions for all of these points.

Miguel P thought that the barriers to be overcome were first the need for a Europe-wide regulatory framework, ideally one where there was flexibility to allow national variations. Much investment was needed in infrastructure to put in place dedicated lanes or even reserved zones for CCAM vehicles and as a part of that lanes reserved generally for public transport. This might also mean development of traffic control centres. A public awareness and education campaign was needed partly focused on the new mobility services but also to ensure that users were familiar with associated changes to public transport and possibly to local traffic regulations. The point had already been made about cybersecurity but it was vital that users believed that the changes made were protecting individuals' privacy as well as system safety and resilience.

Katja agreed with the points on interoperability and cybersecurity but felt that the largest immediate problem was a lack of data scientists in the public sector as a result of which many cities were wanting to move forward but were very unsure what to do. One way forward was projects involving multiple cities enabling the smaller ones to learn from the larger.

The moderator thanked the panellists and the audience for joining the discussions.

Plenary 3:

Integrating road, rail, air and waterborne – multimodality by any means?

Moderator	**Jenny Simonsen**	ITS Norway, Norway
Keynote speaker	**Herald Ruijters**	European Commission DG MOVE, Belgium
Panellist	**Marit Brandtsegg**	Norwegian Public Roads Administration, Norway
Panellist	**Angelos Amditis**	ERTICO-ITS Europe Chairman, Greece
Panellist	**Miroslav Haltuf**	Europe's Rail Joint Undertaking, Czechia
Panellist	**João Caetano**	IMT, Portugal

The moderator **Jenny Simonsen** opened the session and introduced the Keynote speaker **Herald Ruijters**. He began by saying multimodality was a key point for him as it contributed to smooth and seamless journeys. And it was everywhere: the majority of freight movements involved multiple modes. The daily commute to work, the organised business trip, the leisure outing were all examples of a multimodal journey and of course travelling from Brussels to speak at the Congress was a multinational example. We needed to remember that multimodality was both physical – making the trip – and digital: assembling the timetable, ticket, route *etc* information needed. The key problem was not joining up the elements.

He gave a local example of missing physical infrastructure: the Lisbon airport did not link easily to the main rail station. In the case of digital information air travel websites did not link to data on ground travel to or from the airport. There was much to do and for the ≈ 400 cities of 100,000 inhabitants linked by the TEN(T) network the European Commission had started with draft legislation requiring plans for Sustainable Urban Mobility and Sustainable Urban Logistics incorporating Passenger and Freight hubs. The twin goals were moving freight from road to climate-friendly modes and ensuring seamless mobility between the nodes.

It was also necessary to do more on linking digital infrastructure and the Commission was working on a requirement for cities to share key mobility information and for development of Multi-Modal Travel Information Systems to improve delivery of real-time information. There was also MMDMS – Multi-Modal Digital Mobility Services based around sharing data and it was clear that there were many vested interests reluctant to open up information for wider benefit. Nevertheless the Commission was committed to taking the issue forward in the interests of smoother and seamless mobility for all.

The moderator welcomed the panel members and conducted a quick poll of the audience to test its multimodality – road, air, rail and maritime were all represented. She then asked the panellists for a short position statement. **Miroslav Haltuf** explained that his career had been entirely in rail and he had witnessed huge transformation as rail became an international, multimodal and digitalised solution. It was also the most environmentally friendly transport mode by a large margin but nevertheless was

researching new low carbon options and also trialling automated vehicles. The future for rail was competitiveness through cooperation.

João Caetano argued that most of our mobility didn't require multimodality which is difficult to achieve as the individual modes have evolved to do a specific job for a specific need. We select a mode primarily by the distance needed for the trip but multimodality can exist within a mode for example personal car, shared car, cycle, motorcycle, bus, tram, scooter, e-bike were all modes using road space. Currently we had a very fragmented eco-system of transport modes with multiple regulatory regimes tailored to different services. We needed to update it to enable true multimodality and encourage Mobility-as-a-Service but the public authorities involved were not all keeping up with the technology developments in this area and most were not accustomed to working with the private sector on regulatory matters. Each mode had to be prepared to change the way it worked which was a big challenge but an essential one for the future.

Angelos Amditis reflected on his journey from home to the Congress – metro to the airport, flight, taxi app to the city centre, walk from hotel. This contained all the fragmentation that had been mentioned such as no single ticket, multiple choice platforms *etc* but it would also involve multiple liability issues should something in the chain go wrong. He was involved in the transport management for Athens which as a large city (4.5M) had just about every possible mode and discussions about integrating them had led to the realisation that each mode's managers had almost no incentive to change. Bringing the modes closer together also needed investment in systems to interconnect and it was unclear who should carry this charge as earlier investment rarely went outside a single mode's requirements

We also had to think of freight multimodality and lessons from the previous few years on disruption to supply chains (Covid, Ukraine *etc)* emphasised the need for more flexibility. The way forward was complex. Not all the technologies for good multimodal solutions were mature and proven; and policy makers had to be more flexible than had often been the case as there were areas where the market regulation could be loosened and others where the various stakeholders had to be pushed hard to the negotiating table.

Marit Brandtsegg welcomed the emphasis from earlier speakers on collaboration and sharing and drew attention to the underlying principle that all transport customers should have all service options open to them and be able to choose their personal mixture quickly and easily. All transport modes were used by passenger and freight traffic so the modality debate often had the additional dimension of priority for (road) space. For Norway the majority of freight travelled by road and it was interesting to note that rail's 'green' advantage was being slowly diminished as technology developments reduced vehicles' emissions. There was one issue that to date had not been very visible in the Congress: the need to bring together vehicle location data, the ITS environment, and the local buildings configuration as movement towards a 'Smart City' depended on integrating more than transport services. The interoperability here needed much work. Technology alone would not resolve all problems: we needed much more collaborative working and we needed to think of the common goals for passengers and freight: safe, reliable, predictable, affordable.

The moderator asked **Miroslav** how should Europe's rail sector develop collaborative working with other modes? He noted that the sector was itself fragmented and described some of the key innovative areas where it was hope to achieve some convergence. The high level goals were a Single European Rail Area and a Single European Multimodal Dataspace. She asked **João** what needed to be done, and by whom, to achieve a less

fragmented eco-system? He thought that we should start by designing mobility services and then work to integrate the different modes. This would be difficult as it would require new service interfaces (both physical and digital) and it was frequently unclear who owned the interface and which organisation might be willing to pay the integration costs. A further point to note was the wider aspects – multimodality was hard enough with different cultures, different legacy systems, vested interests but it had to extend to the Energy, Telecoms and IT sectors too as mobility could not be isolated from them. The various stakeholders needed time to realise that being part of an integrated system was being a part of a larger, more forward-looking activity and of great benefit to them.

The moderator noted the need to bring many different sectors to the table and asked **Angelos** how might the process start? Who might take the lead? He argued that a dialogue was needed but it must not take forever. It could not be left solely to the market as a number of factors were societal – access, equity, availability *etc* where the public and private sectors legitimately held different views. The process could start with users – individuals, cities, consumer groups – setting out the need, the demand so that the suppliers could see what needed to change. The process needed to go faster than the usual EU machinery where most if not all Member States needed to agree on an initiative. We might perhaps begin with the data on safety that was already in an open public domain.

The moderator asked **Marit** what was her role in a road authority to move towards a more multimodal world? She was not convinced that a public authority should launch a consultation but it was essential to try to develop standards –ideally global and not just European – to support a consensus process. One issue that had not been mentioned so far was maintenance of the physical infrastructure and assigning that cost was likely to be difficult.

The moderator accepted an audience question on how might we persuade travellers to use multimodal services when it seemed that most just wanted to drive in their own car and be left alone ! **Miroslav** said that he was aware of research that suggested established MaaS systems would supply a better overall travel offer so users would find a more flexible, more affordable and more enjoyable alternative to the car. **Angelos** said that the overall objective of a multimodality policy was solutions that were faster, cheaper, readily available, greener and smoother so if we could achieve the delivery of that and explain it to citizens then surely the transfers would occur. **Marit** agreed and stressed that we had to help users opt in so the alternative to the car had to be significantly better in whatever aspect related to the traveller. **João** thought that we would not see a rapid large change of habits so we needed to focus on accelerating the incremental developments. He felt that some form of carbon pricing would become the strongest driver but delivering such a policy in an equitable way was exceedingly difficult. Nevertheless transport was the sole sector that had not reduced its emissions over the past 25 or so years so action was needed.

Jenny Simonsen closed the session as time was finishing and urged all attending to see it as the start of an important discussion and not the end. She thanked the panellists and the keynote speaker.

Plenary 4:

Managing urban mobility space – what can we expect from cities in the future?

Moderator	**Stephanie Leonard**	TomTom, Belgium
Keynote speaker	**Khaled Al Awadhi**	Roads and Transport Authority, UAE
Panellist	**Martin Huber**	BVM City of Hamburg, Germany
Panellist	**Francisco Sánchez Pons**	CTAG, Spain
Panellist	**Peter Staelens**	Eurocities, Belgium
Panellist	**Guido Lemeire**	Microsoft, Belgium

Stephanie Leonard the moderator welcomed everyone to the session and introduced **Khaled Al Awadhi** who would give a keynote address. **Khaled** said that he would give a brief review of some of the game changing developments in Dubai which would be the host of the 2024 World Congress. Dubai was a large (3.3M) and growing city and the Road Transport Authority had responsibility for 1500 buses, around 1,000 taxis and 7,000 limo/shared mobility services. The city wanted to extend mobility, improve safety and resilience and move towards zero carbon so there was close integration between infrastructure operation and traffic management following commissioning of a new control centre. Sustainability was a major objective so there was extensive electrification and a 2050 target that the whole transport system would be environmentally friendly with zero emissions. Ride sharing for all modes was a priority and there was already 500 Km of dedicated cycle lanes.

There was much interest in the deployment of autonomous vehicles to improve safety with a "robotaxi" project planned for the end of the year. The metro system was also driverless and extensions were being planned. Integrating the modes into a multimodal offering was a high priority and a MaaS option was close to launch. A new platform would support all services including a unified ticketing system. All services were designed to be easily accessible and developers of buildings and services linked to transport were required to comply with an accessibility guide.

Stephanie introduced the panellists together with the Impact Statements she had asked them to prepare. **Martin Huber** had commented that the wall between public and private transport was crumbling and in future the private sector would sell rides and perhaps even bus tickets – all enabled by public transport companies opening up their data. **Francisco Sánchez Pons** argued that more and more were living in urban areas which was creating unprecedented demand for mobility networks. Technology can turn this headache into an opportunity to use smarter management techniques that in turn will enable new services but we needed stakeholder cooperation to make it happen. **Guido Lemeire** proposed that the introduction of levels 4 & 5 autonomous vehicles would disrupt both urban and rural passenger transport eco-systems. **Peter Staelens** said that urban space and network management of the future would be based on a hierarchy of loads prioritising walking and cycling followed by public transport, shared mobility and then personal car use.

Stephanie asked **Francisco** what mobility suppliers should expect from cities under his proposed regime and what cities might look like. He said that the pressures on cities were present now and so were most of the technologies to counter them. Cities needed to manage the legal and regulatory frameworks to enable a smooth development but they should also take care to see that innovation was not suppressed. The vital role was creating a cooperative environment: bringing all stakeholders together. Cities also needed to put in place a range of KPIs to monitor activity and assess what was working less well.

Peter endorsed the need for collaborative working – cities were not always fully aware of what suppliers could deliver and suppliers often did not see the local factors behind purchasing plans or cities' visions and the associated concerns about equity, affordability, accessibility *etc*. **Guido** thought that a good MaaS platform would bring together a city's core requirements and combine them with what industry could supply as services. But the MaaS would also include cars both personally owned and shared as they were an essential element of the mobility provision for rural areas. Possibly the most difficult part of managing urban space was responding to changes in population movements as there were signs that the move away from rural areas to cities was reversing. **Martin** wanted to float the thought that cities were sometimes a part of a problem. If you lived in one country and wanted to move across it to another country and city then you did not want to learn a number of different transport user processes – you wanted, ideally, an interoperable solution that simplified your mobility but cities seemed not to see this. The key was national and international standards so that crossing borders was simple.

The moderator asked **Guido** who should be in charge of organising mobility network management. He believed a city needed to manage its own business but it was essential to do so within a national or regional standards framework so that cities could plan activities and users had a consistent experience when travelling across a country. This was key for public transport where exchange and sharing of data needed to go further and faster than it did at present but the issue also needed to be considered in the context of freight where movements across Europe from ports to hinterland required at minimum a regional approach. **Peter** noted the Commission's work on regulatory actions to accelerate the interconnection of sustainable mobility services in the 424 cities that comprised the EU Urban Mobility Framework. **Martin** was unsure that cities or regions would emerge as the lead mobility network managers as large international service companies were moving ahead far faster than cities and were delivering services that users liked.

Stephanie asked if cities could regulate the development of mobility networks without impeding innovation. **Peter** noted that an increasing number of cities were organising innovation hubs that embraced transport, energy, housing *etc* where new solutions were tested in "Living Labs" and designed and evaluated by users. These needed soft regulation to give freedom of action such as operational licences and cities were accumulating a lot of experience of how to steer activities without stopping promising new developments.

Guido commented that problems were likely if cities wanted to be very different and not use standards. It was noticeable that in the US level 5 was going ahead rapidly as cities were being involved in government moves to support the domestic EV producers so a loose regulatory regime had been allowed based on known behaviour. In Europe innovation was often the result of a subsidised programme whereas in the US it was mostly funded by industry so decision taking was much faster. However not all the panel agreed that the US level 5 work was proceeding as successfully as was claimed.

Stephanie moved the discussion to AI with a quick poll revealing that about a third of the audience had used ChatGPT. She had asked it for ideas on what 'Game Changer' meant in the context of urban mobility. The response was that the subject was complex with six elements that might contribute to game changing:

- **Internet of Things**
- **Big Data analytics**
- **Connected mobility solutions**
- **Citizen engagement**
- **Circular economy practices**
- **Resilience and safety**

She asked how the panel reacted to this? **Martin** was reassured that there had been no one-word answer as his experience from helping to organise the Hamburg World Congress was that game changing in urban mobility happened steadily all the time as lessons were learned from past practice and applied to new problems. **Peter** said that the key game changer was missing – climate change was driving developments in all sectors and was prompting acceleration of change. **Guido** thought that the game changer would be a group of actions but they would all be linked to data and in particular trusted data exchange. **Francisco** thought that connectivity was the most significant game changer not just in the technical sense of vehicle–vehicle and vehicle–infrastructure but also collaboration between the stakeholders. **Martin** agreed that the key point was opening data and the public and private sectors cooperating more closely.

Stephanie asked the audience for a show of hands to indicate what was the key game changer:

- **Climate change**
- **Greater Public Private cooperation**
- **Connectivity**
- **Data management**

The audience verdict was **Climate change**. **Stephanie** thanked the panellists for their hard work and also the audience for their participation.

PART 3

Discussion and Papers Sessions by Topic

Topic 1:

Cooperative, connected and automated mobility

Overall situation

Once again the topic of cooperative, connected and automated mobility attracted the highest number of papers and sessions in the congress. Both connectivity and automation related matters were presented and discussed from various angles by participants across Europe and also elsewhere.

Connectivity

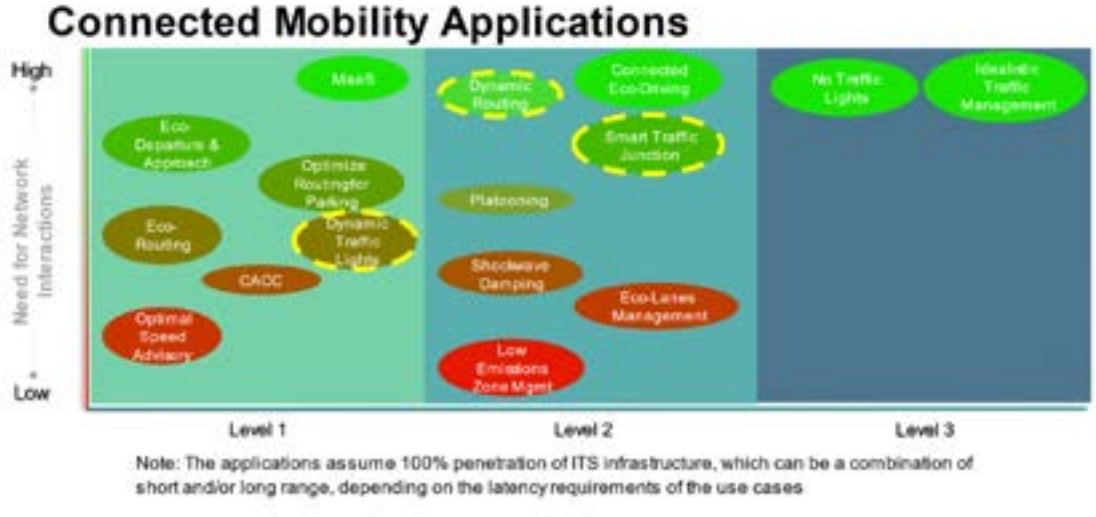
The Cooperative ITS (C-ITS) services had clearly moved close to deployment with a focus on implementation issues covering, among others, solutions to the familiar chicken-and-egg issue, experiences with cybersecurity solutions, impact evaluations, and provision of handbooks on how to deploy and operate the C-ITS services. Long-term operation of C-ITS services in a multi-stakeholder environment was the theme of the SFS on CCAM, and the focus was building on collaboration value between vehicle manufacturers, communications and infrastructure providers, and the European Commission to further this European success story. The services discussed included roadworks warning, GLOSA (Green Light Optimal Speed Advisory), speed limit information, travel routing, parking availability information (based on parking sensors from ADAS on cars), black spot recognition (based on detection of jaywalking, people in blind spots, speeding of surrounding traffic, all based on additional measurements from ADAS), railroad level crossing warnings, CACC, mobile tolling, and vulnerable road user services.

The 5G and edge technologies and applications attracted a lot of attention whereas also the short-range and satellite communications stood out in several papers. Space technologies were also the subject of multiple SIS, with a look at how ubiquitous connectivity can enable interference free CCAM services. It was generally agreed that satellite communications integrated with 5G and 6G terrestrial communications, complemented by Wi-Fi, Bluetooth *etc* provided the needed ubiquitous connectivity for the next 15 years. However, existing commercial 5G networks already provide sufficient service levels for a majority of connected services.

Integration of terrestrial and satellite connectivity. Angel Almeida, SIS 7

Connectivity was discussed as being vital for vehicles whether they are in automated mode or not, with its importance in updating accurate mapping applications and highway rules, to deter illegal manoeuvres, and its importance for automated lane keeping in tunnels, being two examples put forward.

A session on C-ITS deployment in Europe highlighted cooperation and connectivity between authorities, road operators, and the car industry as key enablers for successful large-scale C-ITS services. Defining how to use standards in an interlinked way to create the ability for legally binding services, for example Ultra Low Emission Zones, was hailed as a future goal, and there was discussion of CCAM's role in a green and sustainable digital society.



Accelerating Safe and Sustainable Transportation, Sanket Partani, SIS 5

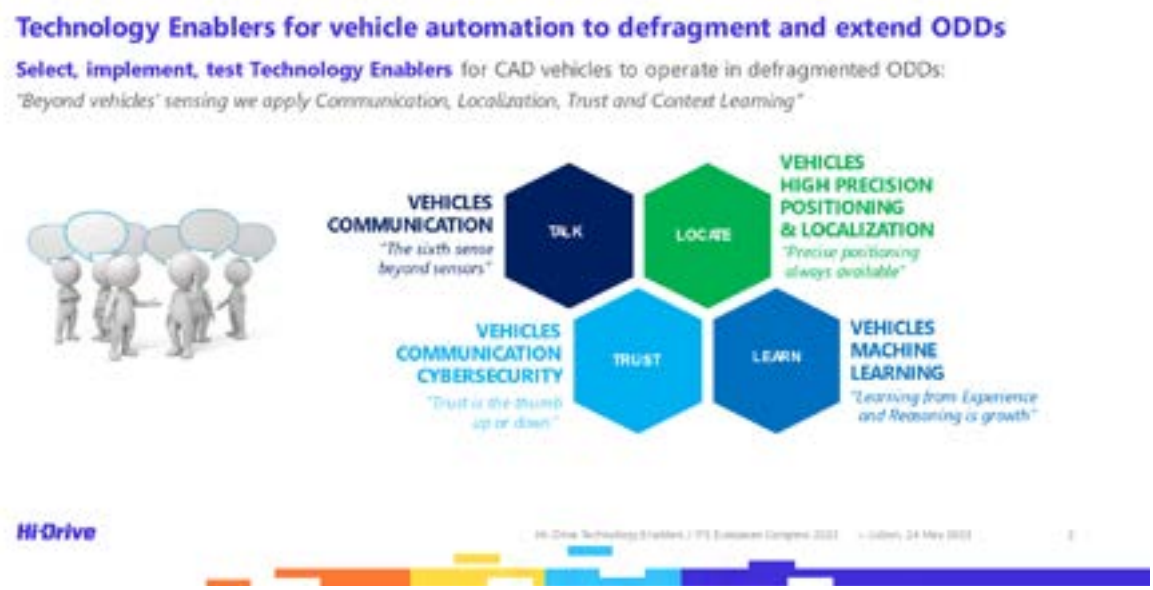
The use of Machine Learning models to extrapolate simulated vehicles to EU27 level representative scenarios used an interesting approach based on population size to classify cities into groups to model the uptake of connected mobility services across multiple use cases. One key general trend established was that the higher the level of connectivity penetration rate, the greater the reduction in CO_2 for all three population tiers, meaning 100% penetration may not be needed to achieve significant benefits.

There was a look at the progress of work to achieve interoperability for C-ITS services in Europe, with a breakdown of countries and work packages. The main message was day one services were now fairly mature, however we were still some way off fully integrating use cases into live traffic management applications, with the challenges being identified as mainly political and not technological. Joining OEMs and public authorities together was seen as the starting point to launch successful live deployments.

Automation

The orientation of automation was more focused on research and technology development with regard to sensors (camera, LIDAR, radar, *etc.*), occupant monitoring, machine vision, machine learning and AI as well as tracking and path following algorithms. Impact evaluation, user attitudes, experiences and acceptance, societal expectations, inclusivity, and an automated vehicle's driving performance assessment were among the topics addressed in the papers. Quite a few papers dealt with the legal frameworks including the German legislation interpreted as supporting automating public transport, need for enhanced type approval, working with extensive databases of scenarios, including the definition of acceptable risks, proposed new EU product liability directive, and the legal framework needs of multi-brand platooning.

Discussion on the accuracy, efficiency, and robustness of perception algorithms, like object tracking and scene recognition, greatly improved by advances in Machine Learning (ML) was featured, with consideration that developing a robust and certifiable perception system remains an open problem. ML methods employed for such tasks were particularly data-hungry so one important challenge was how to generate training data for the development, testing, and validation of such methods efficiently. Modern in-vehicle perception systems had shown promising results, based on processing complementary inputs such as LiDAR and image data, and awareness of the complementarity of using information from multiple sensors as well as using multi-modality for data generation for perception testing was examined.



Technology solutions for ODD defragmentation and extension. Francesco Bellotti, SIS 72

Several papers and sessions dealt with infrastructure support to facilitate automated driving. This discussed national support strategies, HD map updates, provision of ODD

awareness and electronic horizon to Automated Driving Systems (ADS), connected roadworks sites, integration of physical, digital and operational infrastructures, digitalisation of traffic management, provision of digital driving regulations, merging support, multi-object tracking, and impact of different physical road topologies. Emergency alerts and warnings for both ADS and human drivers of automated vehicles was another topic of focus, particularly how the ADS might function with reduced connectivity. The responsibility and liability gap was also discussed, since there are so many stakeholders involved in putting an AV on the road *eg* a city, software companies, hardware companies, OEMs, cities, road operators, *etc*. There were often so many stakeholders involved that it was hard to align and see who was responsible when things went wrong.

Safety demonstration of Automated Road Transport Systems (ARTS), Manel Brini, TP 3

Safety in automated road transport systems featured strongly, with a project examining a system of systems-based approach to risk analysis for last mile goods delivery, where the challenge of functional validation was found to be a complex task.

An intelligent speed assistance retrofit solution – to make existing vehicles compliant with EU regulations requiring this functionality in new vehicles from 2024 – was well received and generated interest, though challenges related to data accuracy and availability and physical traffic infrastructure were highlighted as challenges to overcome in further trials.

The challenges faced by highway operators in regard to enabling and facilitating deployment of connected and autonomous vehicles on their roads were discussed in a lively SIS on infrastructure supported automated driving. Strong cooperation with neighbouring authorities was highlighted as an important enabler in Europe, as was the issue of how to deal with the transition period from an infrastructure provision perspective when ADAS and full automation is expected to develop at different stages depending on vehicle type. Who pays the cost for roadside infrastructure was also a key discussion point, with one operator raising the point that, in terms of regulatory frameworks, "we may have to mandate, but we don't know how to!". A panellist remarked that "Most of the money goes to running the current traffic system, so it is difficult to find resources

for anything beyond that. When one is financially limited one has the tendency to only invest in the now, and not in the future."

Other domains

Experiences from co-creative innovation environments were regarded as positive for many transport related areas including CCAM. Multimodal Digital Mobility Services (MDMS) were assessed from a Mobility as a Service agent and end user point of view in order to create a cross border multimodal travel plan, booking, payment and navigation. A retrofit ISA system utilising both digital and physical infrastructure would be likely to accelerate ISA deployment in Europe.

There was a look at the role for connected, cooperative and automated mobility in helping the EU to achieve its climate objectives under the Green Deal. The potential of CCAM in reducing the emissions from road transport (*eg* by shifting towards shared on-demand mobility, by providing safer and more inclusive transport services, by optimising efficiency of the network, reducing energy consumption, *etc.*), was discussed, but also the policy options and framework conditions that need to be considered at local, regional, national and European level to maximise the benefits for the climate. It was argued that the effects of CCAM for sustainability are substantial, but that the potential is smallest where it is most needed, and that is cities. Also, many effects that are measured and prepared for pilots do not have a sustainable future and would not last in the long run for actual deployment. Besides all the advantages there are for CCAM for sustainability, reduced number of accidents and throughput, one important element is also the potential of CCAM for business, in which the innovations help the competitiveness for the European industry, with the number of patents on this topic increasing dramatically.

Data processing and sharing in a multi-vendor environment was discussed, in respect of the establishment of trust of data and entities. Driving on the road requires trust in others and the infrastructure, but in reality we never completely trust, so how can we be sure about the data integrity and level of trust in connected cars that need to cooperatively execute a safety-critical function? Trust was regarded as essential to the success of CCAM – "Trust is the thumbs up or down". If different stakeholders did not trust one another things would never work. This also meant that we needed objective information on the trustworthiness of data and we should explore new business models, since many stakeholders did not want to share data if their own business model was at stake, which related highly to trust. Individual companies did not want to take the first step but if the right incentives were offered, and it was also in their own benefit to share data or information (it was not always necessary to share the raw data), things might change. Trust needed to be arranged and organised; it did not just happen by itself. Trust was a human issue but also a technological one – for security and trustworthiness technology was needed; it is too complex to be done solely by people. We needed formal technological reasoning about this.

The studies on user needs and requirements in CCAM were found to not always cover all kinds of possible users with regard to gender, age, impairments and disabilities. This might result in making solutions either unattractive or unaffordable to citizens or operators limiting the commercial potential of CCAM applications for individual mobility or public/collective transport. The difficulties of fully understanding user needs still existed. Furthermore, we did not have agreement on what is the actual behavioural change that we hoped for, and how to accomplish that change. It was also important to realise that there was no such thing as "the user" – we needed to cater for all making sure that no specific group was excluded from data, from mobility, and from fulfilling their

needs. More and more projects included specific user groups with special needs, such as the elderly, migrants, users with physical or cognitive disabilities. Interestingly, it may be that if we design for vulnerable or special groups we would also benefit all road users.

Old vs New

Most of the papers dealt with trials and experience of well-known systems but some exciting new ideas were introduced in the congress papers, sessions and exhibition.

In CCAM technical performance and impact evaluation, modelling utilising the ITS Whole System Approach, microscopic energy consumption impact modelling, simulation of the performance of automated driving functions and the impact of physical road infrastructures in it provided new insights. For future cooperative and interactive traffic management, connected and predictive traffic light control algorithms for entire corridors, the integration of IoT technologies and vehicle as well as infrastructure sensors, and crowd-sourced machine learning models utilising connected vehicles *via* 5G and edge technologies showed promise. 5G had the potential to become a key connectivity technology also in maritime transport and would be the foundation of the Future Radio Mobile Communication System FRMCS to replace the outdated GSM-R solutions in European rail transport.

Interesting new ideas were operating vehicle platooning with the help of traffic management and collision alerts in complex urban road networks using 5G; the use of AI, 5G and 6G connectivity; cloud computing or IoT in last-mile electric automated shuttles; and monitoring of driver status and misbehaviour of drivers in 5G-enabled infrastructures and vehicles with specific sensing capabilities to serve AI driving training as well as targeted warnings. The concept presented of a self-evaluation of availability of the 10 sec vehicle control handover window based on physics and comfort considerations for a SAE level 3 Automated Driving System was seen as highly relevant for the safe operation of both Level 3 and 4 ADS.

New advances in the domain of infrastructure support for automated driving included distributed ODD attribute value awareness for ADS and road operators in general; ADS support at tunnel entrances and exits; and the use of machine vision and LiDAR as support technologies for navigation in Nordic conditions (bad weather, snow, tunnels, rural areas). The development of a Robot Operating System module based on common AI search algorithms which enhances path following on a self-driving vehicle, and the use of Principal Components Analysis (PCA) for perception of road users in microenvironments like bus terminals, gas stations, and similar environments finding optimal pathways with LiDAR data were also brought forward.

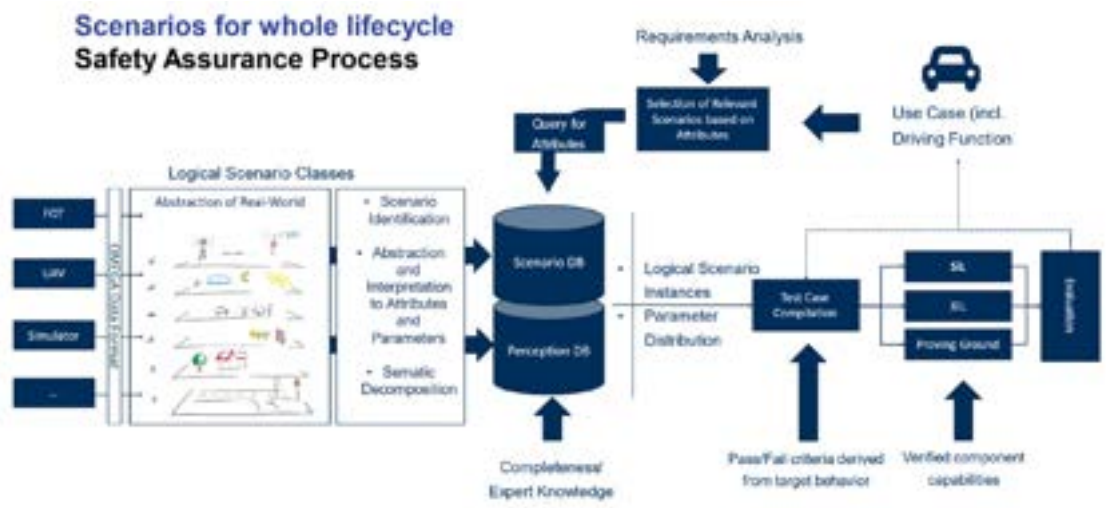
Road vehicle automation was advancing also for lighter vehicles, which was evident in the introduction of automated driving system design and preliminary testing of a reconfigurable light electrical vehicle.

For the Day 1 C-ITS services the congress provided numerous presentations on the experiences with solving the deployment related issues. With regard to automation several presentations provided additional evidence on the acceptance and user experience from pilot trials and demonstrations. The C-Roads platform was discussed as a shining example of what's possible in terms of real-world deployment, enabling cross-border cooperation, and also serving to highlight that pilot areas were open to the public, to be used by everyone.

CEF2 aiming for a seamlessly connected TEN-T network was presented as opening the opportunity to create international automated mobility services, with a focus on how to expedite the usage and deployment of seamless international mobility.

Policy took centre stage in a session on public-private partnerships for successful C-ITS deployment in the Nordic countries, with the main achievements, innovations and key challenges discussed. There was also a look at how National Road Administrations approach the challenges and barriers, like standardisation, communication, and technology readiness, and regulate and legislate while keeping safety and security in mind.

Safety assurance was discussed, with Scenario Based Validation (SBV) considered to be the most comprehensive, technically feasible and economically viable approach for the Safety Assurance of CCAM technologies. SBV shows the potential to overcome some shortcomings of traditional testing approaches such as the processes formerly used for type approval or consumer testing, as it may handle an increasing number of scenarios and can be extended to address continuous monitoring of the safety of deployed vehicles and evaluate socially responsible and comfortable driving performance. However it was also argued in discussions that true safety was a myth, we merely strive for the avoidance of foreseen and avoidable risks. This leaves the definition of unavoidable risks, and a common understanding of what the ground truth is. Only when we compared these systems to a human driver was there a ground truth, which helped to advance the roll-out of Automated Driving Systems. If you designed for the edge cases, ordinary driving scenarios were also included. There was a discussion on whether scenarios needed to be national in order to take national laws and driving habits into account or more universal. Scenario creation may follow several paths but its acquisition through pilots and/or Field Operational Tests showed the biggest potential as it included real world data and statistics. This also meant that a database of scenarios could never be fixed, it should evolve over time.



Safety Assurance by Nicolas Wagener, SIS 26

Safety was also discussed in a session framing the European data economy, looking at how safety data from vehicles and public authorities were being aggregated in real time in a stable European framework, the "SRTI Ecosystem". This was made possible by overcoming legal and operational challenges in innovative ways that could serve as an inspiration for the next steps in European real-time aggregation of many traffic data.

Also, a discussion was held regarding the fact that we also needed to educate and train people in understanding the potential of ADS, understanding that there would still be risks involved, and to try to avoid over-trust as well as under-trust. This in the end would also lead to higher public acceptance, although the term public embracement might be more appropriate.

Forwards vs Constrained

The topic was going forward quickly. With regard to connectivity 5G and edge technologies were more to the forefront than in the previous congresses. With regard to the topics, the focus on sensing was not as prominent as in the previous congresses but still considerable. Remote operation or rather supervision capabilities were discussed looking at how, together with automated driving systems, they could accelerate the deployment of highly automated vehicles (SAE 4) on public roads for smart mobility and ITS services. Experts had already developed smart procedures on handling the remote assistance in selected ODD departure cases. A new role of "technical supervisor" was proposed to deal with such situations in practice. In any case, much regulatory work needed to be done to ensure efficient remote assistance of highly automated driving systems. The concepts of remote assistance used in aviation were also usable and some companies were providing remote operation as a service. In aviation, the roles of the actors were quite clear: "The airplane does not determine what the airport does."

The constraints of connected services in the urban environment were given a platform in an SIS on CCAM in cities. The operational and safety benefits seem clear, but the road to scalability still seemed some distance away, and crowded roadways and unacceptable levels of injuries and fatalities remained the norm. A session focused on why significant advances in technology and system management were sometimes slow to happen, when contrasted with proposed benefits to the traveller, and how could we more effectively bring these technologies to scale to achieve the strong desire across the industry to deliver safety goals.

In automation and automated driving progress had occurred especially in the depth of the discussions as clearly the infrastructure sector stakeholders seemed to understand better the issues of the vehicle sector stakeholders, and *vice versa*. It was noteworthy that the fast forward moving robot taxi business was not addressed at all in the papers presented at the congress although several special interest sessions referred to them. Some saw the risk that driverless robot taxis would increase car use by attracting public transport users, cyclists and pedestrians to use them whereas others regarded them as means to reduce private car ownership. The question of shared rides remains a tricky one as sharing would be beneficial for transport policy goals but not attractive to the large part of the travellers.

Nordic Way demonstration on privacy respecting C-ITS based road user charging.

In connected services the service portfolio was clearly expanding with new services and use cases. The demonstration area cellular cloud-based service showed how privacy respecting dynamic road user charging can be realised on European C-Roads-oriented C-ITS foundation.

There was also a look at a reconfigurable light electric vehicle, that could be deployed in urban use cases, one of which was undertaking postal and courier services in the evening. However, it was clear there was a way to go to realise the full value of this type of solution, with testing of the wireless charging system proving inconsistent.

The importance of trust was highlighted by several speakers as it is crucial *eg* for the use of infrastructure support by automated driving systems. Trustable CCAM based on AI that was explainable (interpretability of model functioning), privacy preserving (exposure of sensitive data), ethical (bias and wanted/unwanted behaviour), and accountable (responsibilities of AI outputs) as presented at the congress was very worthwhile.

Some experts expressed frustration that stakeholders had not been honest about the lack of real cooperation in actual deployment. While the cooperation in the precompetitive research phase seemed to be quite productive the take-up and roll-out of both C-ITS services and Level 3-4 automated driving systems were suffering from the lack of real open cooperation. Some experts considered that the larger scale deployments of Level 4 automated systems in cities in the form of delivery robots, robot taxis, first/last mile

shuttles, and automated valet parking were chosen as they could be realised by single dominant actors without major cooperation issues.

A look at how we could qualify, collect and share data, scenarios, and services feeding safety assurance frameworks and test facilities with a methodological tooling framework and collaborative ecosystem of data, services and scenarios featured in discussion by automakers and test configuration experts.

Stakeholder cooperation was discussed as the mechanism that allows exchanges of knowledge and experience to be available for everyone, with a look at how to tackle challenges like cybersecurity and backwards compatibility and the crucial engagement of the general public, including their understanding and acceptance of the technology.

Lack of regulation as a barrier to large-scale commercialisation of CCAM was discussed, focussing on key challenges for the regulatory environment. The harmonised European type approval regulations from 2022 are today accompanied with unharmonised laws on operations throughout Europe. We needed regulations on liability, obligations of the various ADS operation related stakeholders, enforcement, *etc*.

Topic 2:

Digitalisation and the data value chain

Overall situation

Topic 2 attracted a very high number of Special Interest Sessions but a more modest number of technical papers; there was inevitable overlap with the other congress topics. The technical papers and sessions concentrated mainly on two subjects: Data for emission reduction; and Mobility data, especially urban data. The SIS sessions covered a much wider range. Common themes included:

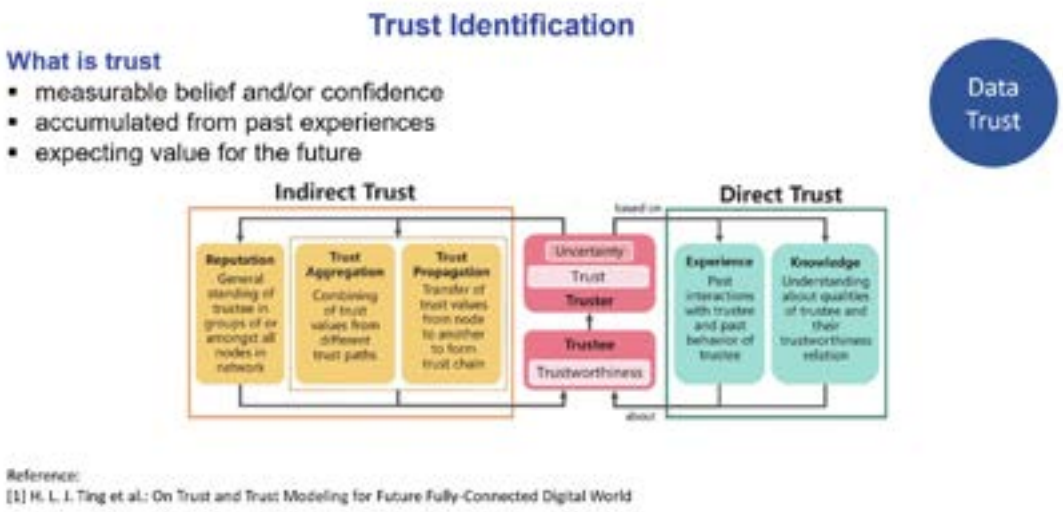
- "Data is at the heart of everything we do". Mobility data provision, data sharing and data exchange in Europe were core issues as these are key components of a successful mobility including useful and interoperable mobility services, ITS, C-ITS and CCAM. The FRAME system architecture description for ITS was promoted as a way to join up mobility data sets using metadata.

- NAPs and NAP ecosystems (*eg* through NAPCORE to ensure interoperability) were also part of several sessions and included discussion of a Common European Mobility Data Space (CEMDS). Whether a common vision could be established was still to be seen and will likely continue to be a hot topic in the future. There was also a key question on incentives for data sharing and how to strike the right balance between sharing data and information for the common good, without jeopardising the proper functioning of the market. Some argued that "All data is business data!". The challenges and role of standards to ensure market scaleup were also covered by many presenters.

- Common key actions identified were pan-European collaboration with a common road map and trust and commitment, focus on deployment of use cases and good quality data, accessible and findable.

- Digital Transport Infrastructure (DTI), where data is one key component, featured in several presentations. Many experiences were presented from projects, programmes, and demonstrations in relation to DTI. The congress showed a common understanding of the importance of commonly agreed definitions, harmonisation, and governance *etc*.

- Trust and more collaboration were mentioned as key success factors in most sessions and could be seen as a common factor throughout the congress. Cooperation among many stakeholders was always difficult and was still challenging. It required trust, resources, and experience from practice – which in many cases had been acquired through EU and ERTICO projects and public-private partnerships. A continued close cooperation between public and private actors was needed to establish a reliable high-quality service provision to end-users. The Smart Freight Centre in the Netherlands had produced guidance to show how trust could be improved using incentives in contracts.



Analysis of Trust, George Christou, SIS 21

- Innovations in data and service quality assessment were presented, *eg* for multi-modal ITS services, and European stakeholders from the ITS community were engaging even more solidly to agree on common indicators and methods on quality aspects, and (minimum) quality levels for ITS services and related data.

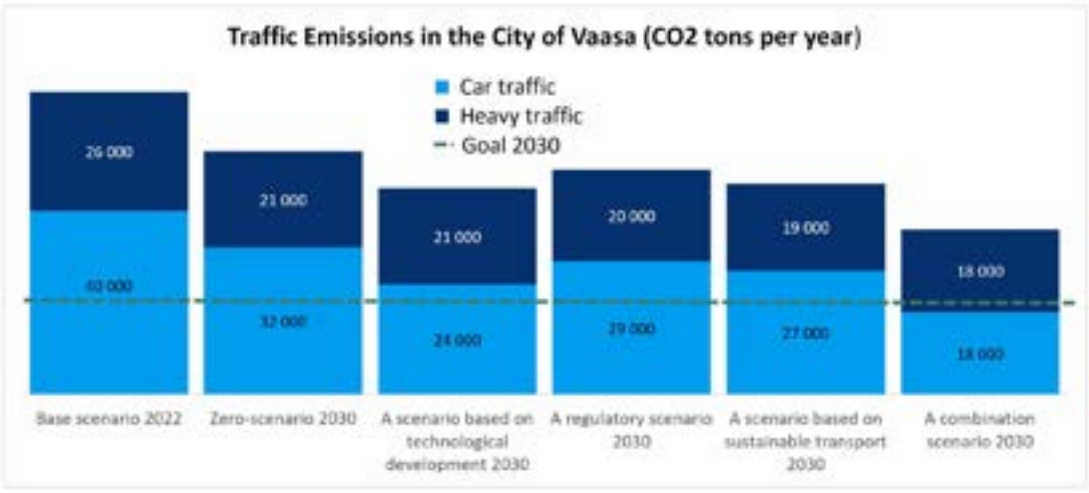
- Since the provision of a legal framework for making certain data accessible (the ITS Directive and derived Delegated Regulations), these data had become increasingly accessible throughout Europe *eg* through the NAPs. This situation held for the data within the ITS Directive but not for mobility data in general.

- Another common issue was the "Fitness for purpose" experience in relation to mobility data. Being able to specify purpose was crucial to defining data needs, types, density, quality *etc* and "one size doesn´t fit all". Harmonised metadata and data catalogues were identified as prerequisites.

- Flexible, easy, standardised, and secure data and information sharing was identified as crucial for successful interoperable mobility services, ITS, C-ITS and CCAM.

Carbon and emissions data and digitalisation were cited many times. EV charging infrastructure, charge point operator (CPO) data and data needed from public authorities seemed to be a popular topic. Public authorities had increased data needs for the use of public EV-infrastructure, mostly for planning purposes. The needs were expected to increase even more as EU legislation with ambitious targets for the rollout of EV charging infrastructures was underway.

Several papers mentioned the importance of reliably estimating emissions because they are difficult to measure in real time. Speed profiles can used for the estimation and one paper found a good correlation between driving style score and emissions. The use of vehicle data in transport models to perform scenario analysis for traffic management was another topic.

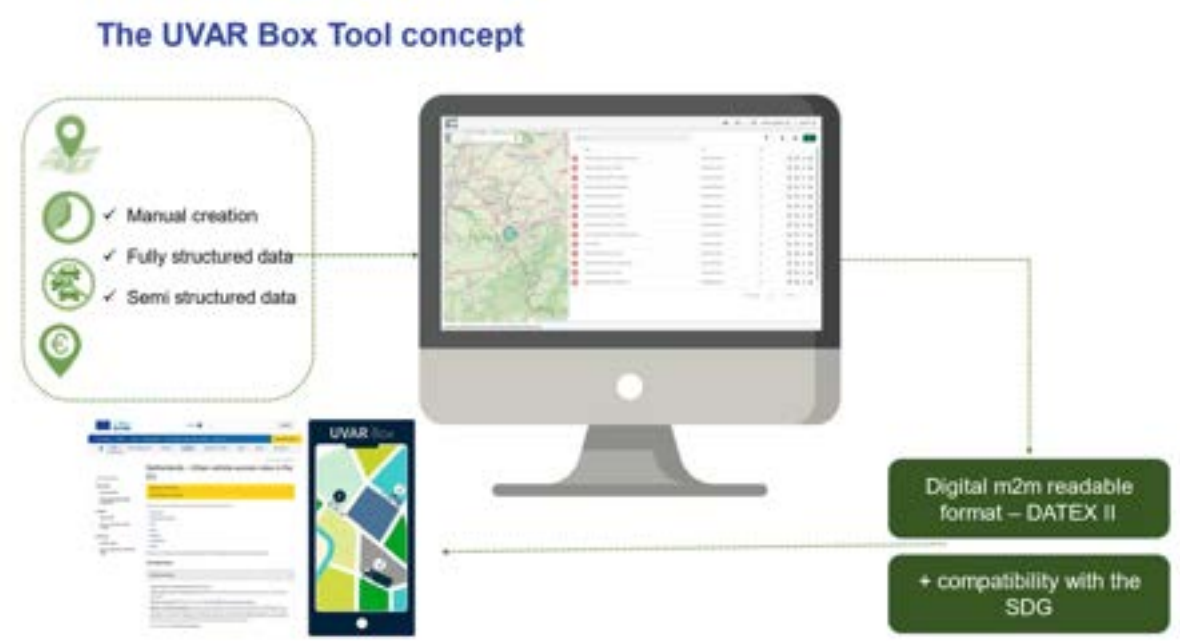


Results from 2030 forecast scenarios, Teemu Sihvola, TP 10

One interesting development was a system to compare actual measured emissions with manufacturers' expected values in order to identify where vehicle tampering had been used to avoid paying for costly repairs. Vehicle data tampering to manipulate measurements was very common and had to be dealt with. Many companies were offering tampering techniques, because although it was illegal to use this equipment or software it was not illegal to sell it. Many stakeholders did not recognise the threat caused by widespread data tampering.

Increased use of active travel (walking and cycling) was recognised as having a positive impact on vehicle emissions reduction, so several papers focused on better information on active travel. The potential to use Strava as a cycling data source was found to be only successful at a macro level, not for individual routes.

Several sessions looked at digitalisation of restrictions and regulations. Urban Vehicle Access Regulations (UVARs) were dealt with in several presentations and there were many initiatives aiming to support the development of EU-harmonised UVAR digitisation and data distribution (UVAR Box, UVAR Exchange, ReVeAL, and NAPCORE). The UVAR-box project was providing better and more easily accessible information to the public about urban vehicle access restrictions in European cities. It was estimated that there were 869 UVARs in Europe including low emissions zones, congestion and charging schemes; many with paper regulations.



Pedro Barradas. Aramis, SIS 46

Another issue discussed intensively was the widespread variation of UVAR information signs between countries making it difficult for visitors to know what they needed to do. Signs were invariably text-based which was not helpful for other languages. It was important to avoid penalising foreign drivers who had not been able to understand the rules! Recommendations about harmonised signs for LEZ / ZEZ had been made and would be adopted by the UNECE; this would be helpful as most countries followed these conventions. There was also the potential to the expand legal basis to allow countries to share data for UVAR enforcement.

Electronic Traffic Regulations attracted a lot of attention with sessions and papers looking at the road authorities' efforts to digitise their national traffic rules and regulations including the general rules not visible at the roadside.

Electronic traffic regulation orders (TROs) were essential for AVs and need international standardisation. The data can then be disseminated to vehicles using DATEXII, TPEG *etc*. TROs are still often stored on paper across EU. Several member states are investigating TROs so collaboration is needed to avoid duplication of efforts. But the view is that digitisation needs to be mandatory for operators to get the benefits, so legislation may be required – recognising the big effort involved in digitising paper records. Sweden had made good progress with a national database, and a successful trial in Gothenberg of mandatory publication of electronic data at the same time as the legally binding PDF.

There were particular challenges with temporary TROs, which would also need to be disseminated in international standard format. For variable speed limits we needed data not just on the designated speed limit but also on any infrastructure faults – could you display a speed limit in a vehicle when the infrastructure (VMS, gantry *etc* was not showing it due to fault?) TROs for roadworks were straightforward when they were in place, however setting up / taking down was a very dynamic situation and consequently extremely difficult to digitise. One speaker in a session said that he could guarantee that

it was impossible to make TROs 100% accurate all the time! This prompted the thought – what does that mean for AVs?

More generally continued EU/US cooperation was required on standards where international interoperability was important. There had been extensive collaboration since 2012 in many areas, including probe vehicle standards. Current priorities were telecoms, cyber and TROs.

Example of signs easy for a human to understand but needing convertion to machine language for Avs, Onno Tool, SIS 58

Maritime data and stakeholder challenges were only presented in one session and the congress had not really attracted the players and stakeholders within maritime data. The session showed that although maritime was a niche area compared to land ITS, it faced the same challenges such as collaboration, trust and funding. Data sharing was essential for optimal shipping; there were multiple stakeholders with different interests. A key difficulty sharing was the very competitive market. Disruption was on the way due to the move to alternative fuels; the IMO had committed to cut GHG emissions from international shipping by at least 50% by 2050. Integration between land and sea ITS was urgently needed; there was a plan to build a common architecture on IMO platform.

Old vs New

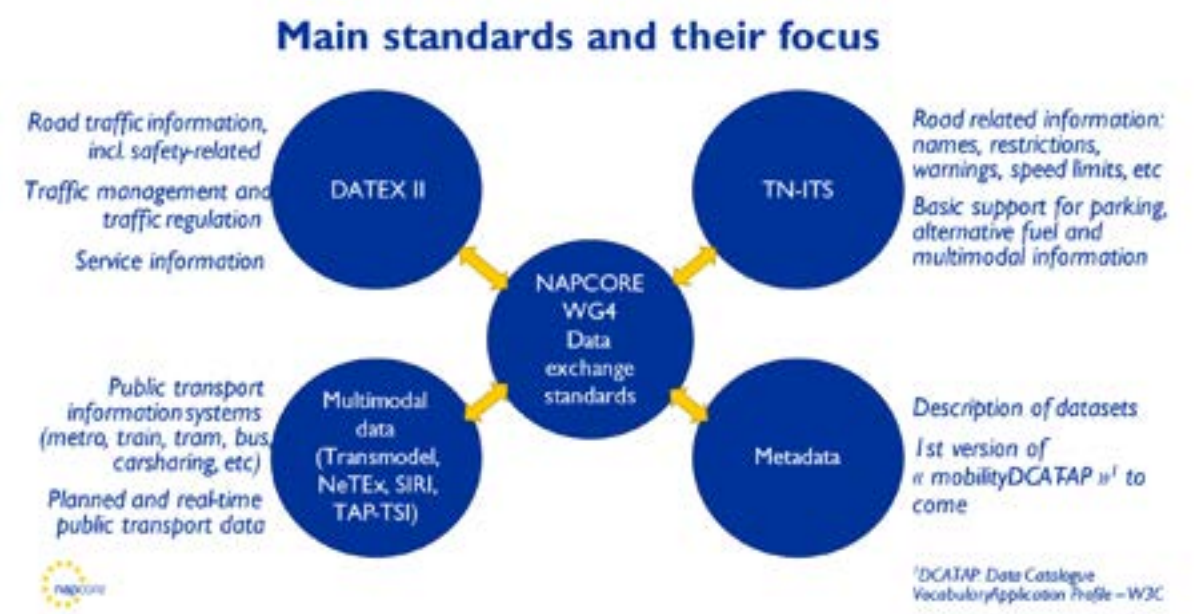
The presentations, the exhibition and demonstrations showed that the topic was progressing with multiple deployments and more scale than earlier. Several scalable solutions from deployed information sharing and data exchange were presented and were working at large scale, *eg* in the Netherlands (Talking traffic) and in the EU the NordicWay project representing key advances compared to earlier congresses. In particular federation of C-ITS data exchange was becoming increasingly interesting for all stakeholders.

Deployment of C-ITS, Menno Malta, SIS 28

The discussion of a common European Mobility Data Space (CEMDS) was advancing with a first step to map and identify gaps and overlaps of existing initiatives. There was a clear need for trusted actors to take responsibility for the interchange nodes and federated data spaces. OEMs and service providers were urging countries to commit to ensure pan-European (or worldwide) solutions. Commitment was therefore needed from road authorities/national road administrations to keep the data exchange and platforms running in a longer term, otherwise the industry stakeholders would be reluctant to make the necessary large-scale investments.

Gilles Carabin, European Commission, SIS 2

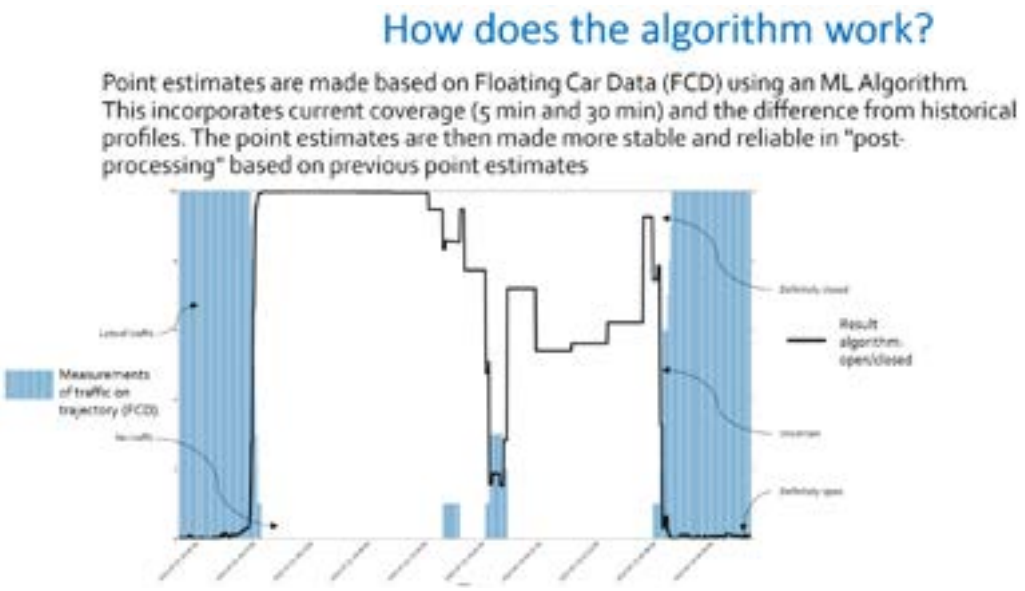
The NAPCORE project was seen as essential to facilitate EU-wide coordination of NAPs, and included all member states plus Norway & Switzerland. Although NAPs had been introduced each country provided them in a different way, making interoperability impossible. They used different architectures, access methods and quality requirements. Harmonisation activities included a data dictionary, data quality criteria and standards (DATEXII and TN-ITS fusion). An alignment of DATEX and TN-ITS standards was announced at the congress to meet changing market demands, and a cooperation agreement was signed at the ERTICO stand. The goal is one integrated set of road traffic data standards.



From SIS 2 and SIS 8, by Sylvain Belloche, French Ministry of Transport.

A stepwise approach was planned, and deployments would be done *via* use case specific profiles. NAPCORE was seen as a basis for EU Member State and road authority engagement. However, NAPCORE would be enhancing data exchange standards to multimodal data to contribute to the harmonisation and alignment of standardisation work with the aim of establishing interoperability of EU multimodal data standards.

An interesting development presented in sessions was the Dutch IDEA project. It was using floating car data to validate actual (rather than planned) roadworks. Assembling high quality roadworks data was a huge challenge for many operators because the works might be present for only a small amount of the planned window, or they might be quite dynamic within a significantly larger window. The system identified in real-time that no vehicles were on the road and cross-referenced with the planned works data. A list of FCD-validated roadworks data could then be sent to information service providers. A 2-month trial had been very successful and showed a further benefit – the ability to use the results to see how bad the planned data was and work with stakeholders to improve data quality. The project was working with NAPCORE to expand from the Netherlands.



Roadworks validation by the Dutch Intelligent Data Exchange Alliance, SIS 29

A major challenge for many stakeholders was that public transport data availability in a standardised, secure, and interoperable way was lacking. Political commitment and funding were needed if the sustainable and public transport modes (including walking and cycling) were to be taken into account and the vision of EU multimodal standardised data sharing was to be delivered.

Sessions discussed a great deal of other work on standardisation. A possible new standard to apply to cities' infrastructure data (CityGML 3.0 Transport) was discussed. Helsinki had been conducting the first pilots with the standard to gain insight add experience of its potential as base for mobility data management.

In June 2022, a new standard had been published: ISO 23795-1:2022, *"Intelligent transport systems – Extracting trip data using nomadic and mobile devices for estimating CO2 emissions – Part 1: Fuel consumption determination for fleet management".* The standard showed how to use speed profiles per second relative to the speed profiles of the Worldwide Harmonised Light Vehicle Test Procedure (WLTP) to quantify real-life CO_2 emissions reliably. In the EU-Project 5G-Loginnov it was found that indirect %-WLTP measurements also allowed other pollutants such as NO_x and PM10 / PM2.5 to be calculated. This method was used to show the emissions reduction due to Green Light Optimal Speed Advisory (GLOSA). The standard had resulted in field trials showing a strong low emission potential when guiding drivers for optimum emission driving style.

The role and use of AI was more in focus, and was regarded as critical in some contexts such as providing an ergonomic HMI and helping to prevent driver distraction when presenting a wide range of real time data. AI was expected to play a key role in processing the data and controlling the many different and complex applications needed to deliver safe driving.

We did not see evidence of radically new innovative suggestions at this congress. Rather, continued development of existing ideas and research. The themes of improved data to support evaluation and policy, and trying to address emissions through behaviour change, had progressed much further since last year's congress.

Forwards vs Constrained

The topic was moving forward very quickly. The infrastructure owners, authorities and road operators seemed to be more actively involved and with much better understanding of the value (and necessity) of data provision and data management. This included the requirements for changes in organisations, staff, and work processes. Digitalisation was regularly agreed and accepted by all stakeholders to be a fundamental part of mobility provision.

Few constraints were mentioned, the key one being difficulty achieving collaboration and trust. Mechanisms to establish trust between data-using and data-producing actors in mobility were highlighted more at this congress than in previous years and enhanced with new ideas, concepts, and tools thereby demonstrating that progress was being made.

Data quality was – and remains – a hot topic. The foremost critical action was to enhance trust and data quality in order to share and use data at a larger scale. This could be done by establishing an ISO or CEN standard including an organisation to ensure data quality continuously and mobility data processes, *ie* "Certified Quality according to CEN-xxx or ISO-xxx". There was a clear need for a commonly agreed quality framework: Terminology, exact and harmonised metadata descriptions, common elements, requirements, quality levels, parameters *etc ie* a high quality architecture framework.

The area of road traffic data had moved forward. Road traffic data was shown to exist in many areas or countries and to a large extent the "four key questions" (1. What data is available? 2. Where is it? 3. Who has it? and 4. How can I get it?) had been answered by several projects for example NordicWay, NAPs, and national data warehouses *etc*. But there remained the key fifth question on "How good is the data?"

For road traffic data the largest remaining challenge was the data quality description framework. Working groups in NAPCORE were working on the issue; however, for mobility data in general there was an expressed need for harmonised metadata, *ie* a mobility DCAT-AP: a metadata specification for mobility data portals. Future congresses were likely to see interesting work within this topic.

Another constraint mentioned often was the continued lack of good quality data for active travel movement (cycling and walking), which made it hard to make policy decisions and evaluate the success of interventions and measures. This remained an unsolved issue, but research and development were ongoing. The increasing demand for active travel data was likely to push this agenda. Platforms were needed to share the scattered cycling and walking data, and actions and policies were needed to motivate sharing of the data.

Strategies towards **data-as-a-service** had progressed with more in depth discussion. A strong business ecosystem had developed around connected vehicle data access and sharing and also developing digital services. A similar trend was observed in the context of public transport data, although these two ecosystems seemed to be divided into two groups with interests in different business models. However it was underlined that convergence of underlying platforms was possible, at least from a technical point of view, towards the concepts of cloud service federation, data-as-a-service, and data spaces for mobility.

Topic 3:

Freight and Logistics

Overall situation

The topic of freight and logistics spanned two core themes for the papers sessions; digital logistics platforms and reducing delivery chain costs. As the sector increasingly turned to digitalisation to improve efficiency and customer experience it was clear that there was also a strong emphasis on decarbonisation and enabling electrification of freight transportation. The benefits of connectivity and data sharing platforms were also front and centre at the congress, with a seamlessly integrated freight and traffic cooperative network being hailed as the dream, whilst acknowledging recognition that there needed to be incentivisation to share data and create new services.

Digitalisation

There was interesting discussion of digital twins for last-mile logistics and the benefits that can be achieved by utilising them for balancing all the city stakeholders' needs, by using living labs to test use cases and scenarios. Insights and experiences from various digitalisation projects and demonstrations were presented, with a heavy focus on understanding how practical implementations can be speeded up, and how business scenarios can be scaled up. Sustainability and greening of urban freight featured in presentations of several research projects focused on innovation for logistics.

Future priorities for research and innovation in freight and logistics Torsten Klimke, SIS 41

Novel approaches to routing and tracking of freight for commercial deliveries were featured with a pilot that utilises telematics data in place of satellite positioning information in a very interesting technique. The use of multi-operator real-time data for continuous, cross-modal exchange of information including a stable prediction of ETA, was also covered, and enhancement of data accuracy and its application to user-based problems was a recurring theme.

Reducing delivery chain costs

Delivery chain cost efficiencies was a prominent topic, and it was clear that ITS was already playing a key role in achieving savings as the freight sector revolutionised through digitalisation and decarbonisation. Delivery chain value was created by multiple organisations, and this point was accentuated in relation to port value chains in a session on sharing data for maritime applications. Ports could be seen as a catalysing hub, essential for optimising freight shipping services sustainably, by slowing speed at sea and then moving rapidly through the port to ensure maximum optimisation benefits. Sustainability could show how to change the game.

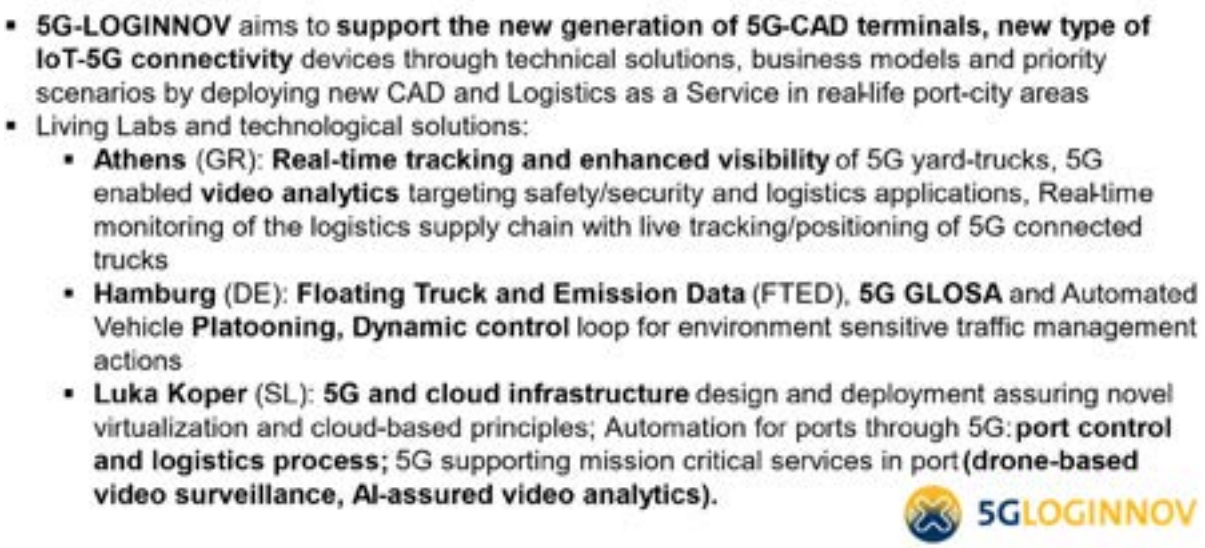
Future Research and innovation priorities for Freight and Logistics, SIS 41

Sharing is caring, Ornulf Jan Rodseth, SIS 40

Cost effectiveness was discussed in the context of FENIX, a Connecting Europe Facility project dedicated to the development of several services and innovations though nine Trans-European Transport Network corridors, with a methodology for assessing efficiency presented. A gap analysis assessment, comparing logistics operations pre and post implementation of FENIX, was another topic covered aiming to highlight priority areas for further intervention. Another interesting topic was a look at how the fulfilment of customer demands depended on various aspects of goods delivery, *eg* timely pickup and delivery of goods, delivery fees, customer support, *etc.* As a result the idea of a unified platform for both the deliverers and the customers that could act as a broker and facilitate delivery management was an important but also challenging task. i-Deliver was one solution discussed – a platform that provided a delivery management system which collected orders and available resources in one place, and then orchestrated and audited the service of all requests in real-time,.

Other domains

Communications for logistics was explored with a look at the role of 5G communication networks in the 5G-LOGGINOV project, which aimed to optimise freight and traffic operations at ports and logistics hubs by using new innovative concepts, enabling applications and devices supported by 5G. Discussion centred on facilitating the collection, integration, and sharing of large amounts of data from different sources, and the importance of stakeholders' expectations and needs in the development process of business models and future exploitation of the solutions implemented. Safe and secure truck parking was an issue of common concern for logistics operators and their drivers, and there was a look at how ITS applications can support road users, operators, and decision makers.



Data sharing and 5G-enabled technologies in logistics: new opportunities and collaboration ideas, SIS 33, Michela Apruzzese

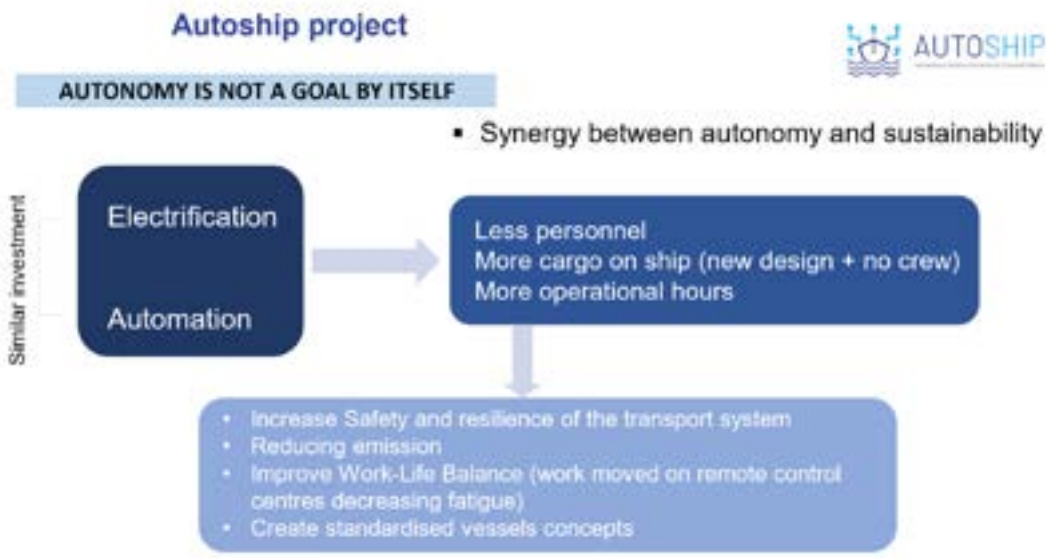
Old vs New

There was much innovation to observe in the freight and logistics ITS theme, but equally, improvements to existing technologies and solutions were also on display. Autonomous trucking was clearly becoming more advanced, and there was discussion of connected truck convoy concepts. These systems still required a human operator in the lead vehicle;

however, it was suggested greater economic benefits could be realised for truck platoons than are achievable with single, fully autonomous vehicles.

The application of ITS to intermodal freight featured in a presentation of cross-border solutions, with starting points in the Netherlands, Estonia, Finland and Norway, and a focus on maritime and rail freight that delivered environmental, monetary and quality of life value. Small autonomous cargo ships were discussed in an interesting session focused on European projects, with attention drawn to the benefits rather than the act of automating the vessels purely for technological gain.

A look at ITS amid the war in Ukraine was a solemn but positive example of unique resilience. Hearing how the city of Kyiv transformed and operated its public transport app into a trusted source of information showing the locations of bomb shelters was truly astonishing. Uber gave an extremely passionate speech about how the company kept their ride hailing service running, which helped evacuate more than 100,000 people out the country. TomTom talked about wider critical public emergency events flagging that road closures related to extreme flooding, wildfires and snowstorms had seen a gigantic increase in recent years and if this trend continued a coordinated road operation response would be needed.



Comparison of external costs between trucks and autonomous ships, Anastasiya Azarko, SIS 25

The use of small vessel transport to move goods from port to the city centre and small rural destinations was another interesting look at the value that can be achieved through marine autonomy for the wider logistics transportation network. Multiple use cases were demonstrated to validate the potential of their transferability for both small-rural ports and ports located within busy city centres.

Small vessel transport from port to city centre and small rural destinations, Alexandros Rammos, SIS 25

Forwards vs Constrained

While it was clear that there had been advances in the topic of freight and logistics it was also clear that there was work to do to uncover and develop the value from scaling the use cases of today and addressing the challenges of tomorrow. One session highlighted the message that a step-by-step approach to development was key; the path was evolution not revolution. How to bridging the gaps in a long logistics chain was identified as a key challenge, with the suggestion regulation was needed to support digitalisation, and National Access Points could be the answer in this respect.

Automation and its value in reducing climate change and driving digitalisation were explored with a look at a methodology for assessing the efficiency of mobile robots in a warehouse environment. In another interesting look at automation in the freight sector there was a focus on autonomous waterborne transport for freight in the form of small, uncrewed vessels, controlled by ITS, for automated cargo handling. It will be interesting to see how this topic develops at future congresses.

Intelligent truck parking was a prominent topic, with a look at the optimum information provided to drivers, the method of delivering the information, and how the driver utilises it when received. Also related to parking was an examination of how digitalisation and artificial intelligence, along with electrification, would impact a brand-new approach to truck parking. Digitalisation impacts many aspects of freight logistics, from choosing routes to optimal scheduling based on customer needs, driver availability and congestion levels. Truck electrification was a hot topic but for it to succeed allowable payloads must be realised, minimal driving distances on a single charge must be achieved, and charging facilities must be cost effective, strategically located, and available at the point of need. Of course until trucks are all operated autonomously, there can be no avoiding the need to park. It was noted that truck parking planning and finding available spaces wasn't just limited to overnight parking on long haul deliveries, it also included shorter regional trips that required a driver to find a place to park and wait until the customer was ready to accept the delivery. Truck parking was also about essentials such as finding a safe place for a female driver to use the rest room or take a shower.

The use of public transport for freight transport featured strongly at the congress, with a focus on low-carbon footprints for last-mile deliveries and bringing together major logistics and public transport stakeholders to create shared value. One of the key messages was how to make users part of the story; with the suggestion we needed to start by listening to citizen stories to enable effective freight digitalisation. Time can be essential for collaboration, integration and cooperation to take effect, and trust in data provided by the data owner can be a requirement to open it up. Smart intermodal freight was the topic of an interesting session, with a focus on port and maritime based solutions. Electric ferries for wholesale grocery transport were presented as an opportunity of moving freight from road to sea, and CCAM solutions for improving logistics operations demonstrated various use cases in different EU countries as part of the MODI project.

Single windows facilitating data exchange for all transport modes featured in a project being run in Estonia, with the message that though transport modes may change, the data stays the same, so we should be better at sharing between modal operators more effectively. Maritime Single Windows will be a hot topic over the next year, with the requirement for countries to introduce them in 2024, and this could be an area where maritime can act as a catalyst for integrated data exchange between logistics operators.

There was much discussion of identifying future trends and analysing the needs for freight transport in the EU, and important areas were identified where developments, information and insights were lacking and hindering the practical innovations. One future development of the horizon was the obligation, from 2025, that EU member state authorities would be obliged to accept freight information provided electronically *via* dedicated electronic Freight Transport Information (eFTI) platforms. The implementation specifications and regulations were described, along with a look at what the implications will be for the private sector. This was another topic where we are sure to see more at future congresses. A useful message that may help engagement with eFTI was the importance of bringing together public authorities and all freight stakeholders into use cases to make them viable; moving from simply use cases to really useful cases.

It was really positive to see such a strong set of technical papers and special interest sessions for ITS related to freight and logistics at the Lisbon European Congress. It was clear that this topic is gaining more and more momentum, and there are definite lessons the rest of the ITS sector can take from developments in smart and digital freight to drive forward integrated solutions for all transport modes.

Topic 4:

Future traffic management

Overall situation

Future Traffic Management attracted a good number of papers and sessions reflecting the growing interest in the ways in which technology and data could be harnessed to better manage traffic and transport. A high proportion of the papers and Special Interest Sessions considered the areas of future traffic management in a multi-modal world (particularly active travel), and last mile improvements in traffic flow, or transitioning drivers from cars to other forms of transport. This debate appeared to be at an early stage and clearly issues were emerging around driver behaviour prediction and actual behaviours observed during trials. The three priority subjects were Active Travel; Data; Wider Traffic Management.

Many papers had a green perspective, mostly driven by the challenges of attaining EU targets, local need and wider societal need and consideration has also been widely given to the need to reduce electricity grid loading. A core theme with many of the papers and sessions was data, whether from vehicles, future sensor data or multi-modal data and this certainly reflected the planned EU legislation that supported data for public sector organisations. The data was seen increasingly as central to better service provision and a valuable outcome of other systems and activities. In addition to data, there was a strong theme of equity of non vehicle users within the road space, with a recognition that vulnerable road users required particular attention.

Old vs New

Despite the number of Topic sessions on newer mobility forms the overwhelming challenges were existing driver behaviour and encouraging car users out of their vehicles into other forms. Future traffic management was seen as a major opportunity to mitigate climate change and reduce pollution with a focus on impacts and quick wins tied to EU legislation on GHG reductions.

Active Travel

Over the past few years cycling and walking had gained a key role in urban mobility, proving to be a solution for many issues like last-mile freight and service delivery, air quality, noise, sustainability, health, congestion, equitable access and efficiency. A number of SISs analysed lessons learnt and best practices from connected cycling solutions. Recognising cycling as a fully-fledged mode of transport and integrating it in the transport network was key to a multi-modal approach. Cycling is already a reliable alternative to cars for short-term trips. A theme of a number of sessions has been ways in which ITS can take this and scale up efficiency and convenience, bringing cycling to the next level along with integration into existing ITS systems, VMS and forms of ITS that favour other modal transport such as cycling

There is a strong desire to increase active travel in towns and cities, to improve health and reduce the environmental impacts of transport, but this in turn increases the potential for

conflict between vulnerable road users and powered vehicles. Stakeholders in the road transport sector were taking action towards climate change adaptation and mitigation at the global level while European cities and regions were also leading action towards zero or ultra-low emission transport, not only to reduce Green House Gas emissions but also to reduce pollution, improving air quality.

Wider Traffic Management

The question of what needed to be done to make traffic management, both nationally and regionally, ready for tomorrow at a practical level was considered in a number of sessions and papers. The day-to-day operation of road traffic management across Europe was increasingly powered by traffic data, enabling accurate insights, better decision making and cost efficiency. A session bringing together pioneers in data driven traffic management revealed the latest trends, product developments and market insights.

Cooperative intelligent transport systems delivered high quality information to road users and road authorities to help them make transport smoother and safer. To make the most of this more data needed to become available and more services needed to be brought to every road user. By going beyond traditional ITS data and intelligence sources and combining ITS data with fleet and logistics management, driving and rest times and data from other modes, a truly multi-modal approach to traffic and mobility management was possible. Such enhanced traffic management would enable a better use of the full multi-modal transport network and more efficient and sustainable planning of travelling choices.

Delivering this vision was a key challenge. Knowing that in data in siloes could be difficult to successfully aggregate was a challenge, as was opening up a lot of the data that needed to be made available. A session considered this by discussing a strengthened role of public-private cooperation for enhancing traffic management through increased interaction between road authorities, traffic managers, service providers, fleet managers, vehicle manufacturers and the physical and digital Infrastructure operators.

Project ORCHESTRA was exploring maritime ITS as well as road, as it was important to understand the full travel chain. This large EU project examined how transport could be more efficient across the travel / transport chain and help address the challenge of “More transport but less resources”. Manufacturers, transporters and companies had to be willing to share data to ensure transport was efficient and optimised for the full length of the journeys that goods or people make, irrespective of the modes used within the whole journey. Fundamentally, this was a data problem around the interfaces needed to share data between modes. With this open exchange in place, the task of examining and refining options for journeys across multiple modes became simpler and possibly commercially viable.

The project was now incorporating lessons learned to go further and scale up. Collaboration started in the Safety Priority Services, by asking parties to have an open dialogue with the service providers to contribute data to the Netherlands Nation Access Point or NAP. Jam Tail Warning to provide live alerts for the location of queuing traffic was an early example of this principle, but assuring data quality was a problem; there was little trust in data quality between data and service providers. An open, circular dialogue between data providers had led to the delivery of good, trusted services and speaking to end users also and ensuring their views were incorporated had also been essential.

A circular feed-back loop between data providers, Annet van Veenendaal, SIS 14

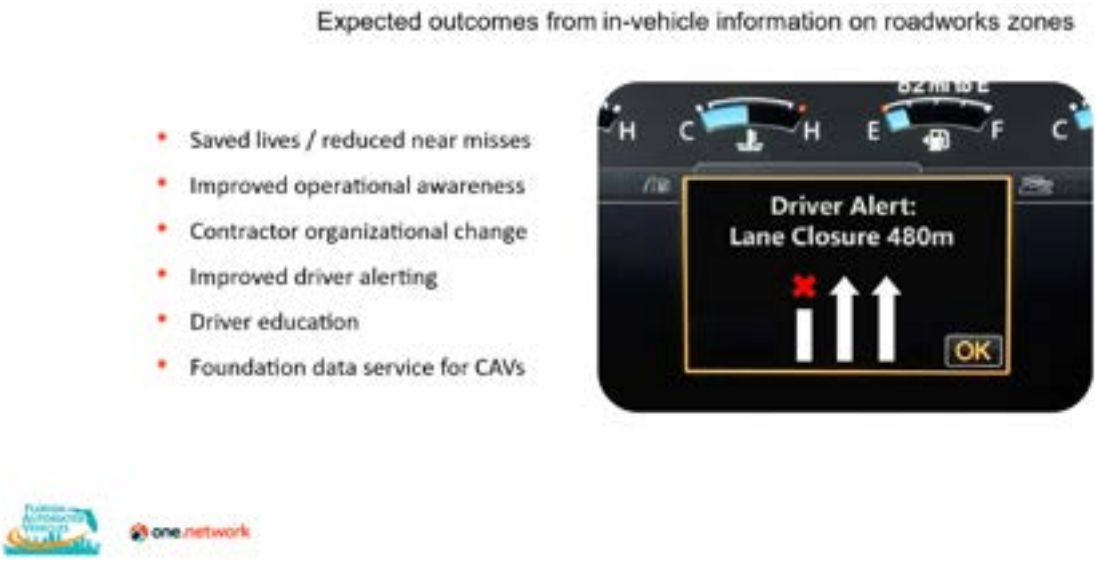
Congestion charging was a dynamic form of road user charging and potentially an effective means to fund road-maintenance, decrease congestion and increase the quality of life within a city. It was also becoming an increasingly important source of revenue as EV take-up impacted the sale of petrochemical fuels and taxation income diminished. A session looked at the major objectives of a smart city or region and considered if they could be reached through the introduction of congestion charging. It focused on the key challenges and best practices to successfully implement a congestion charging scheme in a city, considering the differences in congestion charging in the different continents, how this form of taxation or income can be established with equity in mind, whether congestion charging was a fair way of increasing taxation and what were the best practices to successfully implement a scheme.

The session also explored how congestion charging could be used in the implementation of "total traffic management" and the costs to run an intelligent congestion charging system compared to the income it would generate. This led to wider issues and an examination of the digitalisation of traffic management on a national scale and what needed to be done to make this ready for the future. The session considered best-practice examples of national traffic management today and tomorrow showing how enhanced coordination optimised traffic flows. The challenges of dynamic routing and traffic management in the light of increasing vehicle automation and ways in which digitalisation could enhance current traffic management were presented by projects that bridged public authorities for traffic management at a city, region and state level, and private service providers such as navigation services.

Achieving 'Vision Zero' fatalities and emissions levels on road infrastructure was a key challenge for the coming years that future traffic management could address. Digital technologies were already intensively used for the future-focused vision of improved road safety, efficiency, travel experience, environmental protection and contribute to the social and economic development. The increasing prominence of the climate change agenda as a vital outcome challenged all social and economic sectors to mitigate their footprint on the planet's resources. The transport sector is one of the toughest in which to make meaningful change but decarbonising infrastructure, operations, and fleet electrification were effective actions that should be adopted. The huge cost of accidents and the resulting casualties placed an obligation on all involved to take effective action

and the growing use of automatic mechanisms such as eCall for monitoring, detection and warning, information and traffic control would contribute to the success of the road infrastructure sector in meeting its goals.

Using data in the One.Network system had been demonstrated to be capable of driving warnings and providing information to support increased safety for road workers. This could include live alerts in vehicles to warn of the activation and commencement of road works. Links to OEMs had started to get this information into vehicles showing road works alerts from the data activated by the on-road workers. This could provide live warnings and increased safety, but roll out of the service in the US had shown work zone management frameworks were variable and even though there was a federal standard (WZDx) not many road authorities use it – a common challenge around data that needed to be addressed.



In-vehicle application of aggregated roadworks zone data, James Harris, SIS 14

Equally, full integration with the rapidly developing automotive technologies, particularly autonomous and connected vehicles, created unique opportunities for all. The whole ecosystem faced challenges in adjusting and adapting to better interact with, and include, all stakeholders. A session discussed ways in which our roads were becoming less like independent assets even though they constituted discrete physical corridors between points. They formed part of wider topological networks of complex and varying mobility services and had the potential to make a decisive contribution to improving efficient and clean accessibility. Digital technologies were key to facilitating the building and improving of the roads of the future and this session presented and discussed ideas and initiatives that leverage this vision and set out the goals that were achievable.

A Technical Paper considered stopped vehicles on the highway network, which presented a significant safety hazard. There were many kinds of stopped vehicle detection methods each with its own performance characteristics, which suggested that there could be potential in data fusion from multiple sources. Various methods of fusion were possible. With data characterising the performance of individual alert sources the performance characteristics of a stopped vehicle data fusion system could be derived using probability theory. This paper emphasised the need for data science to be at the core of future traffic management.

Electric Vehicles or EVs were quickly becoming a popular solution for car drivers looking at making the switch from the Internal Combustion Engine vehicles to a greener alternative. A significant amount of the energy demand in transport was moving from fossil fuels to the electricity network. A technical Paper described the development of a forecasting model and methodology to determine the charging infrastructure demand associated with transitioning ICE vehicles to EV. The model enabled analysis of EV charge infrastructure demand and provided insight to Local Authorities and other Stakeholders under several scenarios, applying assumptions, including EV uptake, charging schemes/ incentives and user behaviour. When deploying charge points, having a strategy in place maximised charge point investment benefits, and it was believed that undertaking current and future demand modeling would better inform wider strategy.

Conversely, an SIS examined whether technology was 'Over Hyped' and asked the question *why are innovative solutions not becoming reality*? In the last decade transport had witnessed the introduction of an array of innovative technologies designed to reduce congestion and improve road safety but widespread deployment had often been slow to occur. Even though crowded roads and unacceptable levels of injuries and fatalities remained the norm, and connected and automated transport and multi-modal solutions had taken centre stage in recent years, significant advances in technology and system management were sometimes slow to happen. Why?

Future operating models and ways in which cost effective and efficient services could be delivered were also a key area for consideration. Another session discussed public / private co-operation for future traffic management and the impact, benefits and lessons learned from outsourcing traffic management centre operations. This concept should also be an important enabler for establishing the ideal operation control centre, suitable for multi-domain operation.

The Dutch iCentre programme explored the options for greater cost efficiency in traffic management of several provinces and municipalities and served as a starting point for discussion. The three solutions considered to enable more efficient traffic management were; combining and integrating individual, single domain-specific control centres into one multi-domain control centre; using one single control centre serving several local authorities, instead of having separate control centres; and purchasing part of the service from specialist companies, where the province or municipality had a coordinating role with clear policy goals.

A session looked at two case studies of data driven traffic management. The Port of Rotterdam uses traffic data to measure delays that represented significant cost truck drivers and operators. The Port had access to real-time information on live queues in all parts of the enormous harbour, that allows it to gain insights into the surrounding traffic situation and manage it more efficiently. They know where traffic is slowing down but also unearth the cause of these delays. The Port also had a customised alert system which informed of potential traffic breakdowns in real time. This helped to detect problems while they were still developing and so enable a faster response.

Data Driven Traffic Management – the scale of data availability – Kristina Vuletic, SIS 14

For both of these case studies, the use of large-scale floating car data (FCD – often also referred to as floating vehicle data or FVD), had been used to build wider traffic management systems and provide previously unavailable levels of intelligence;

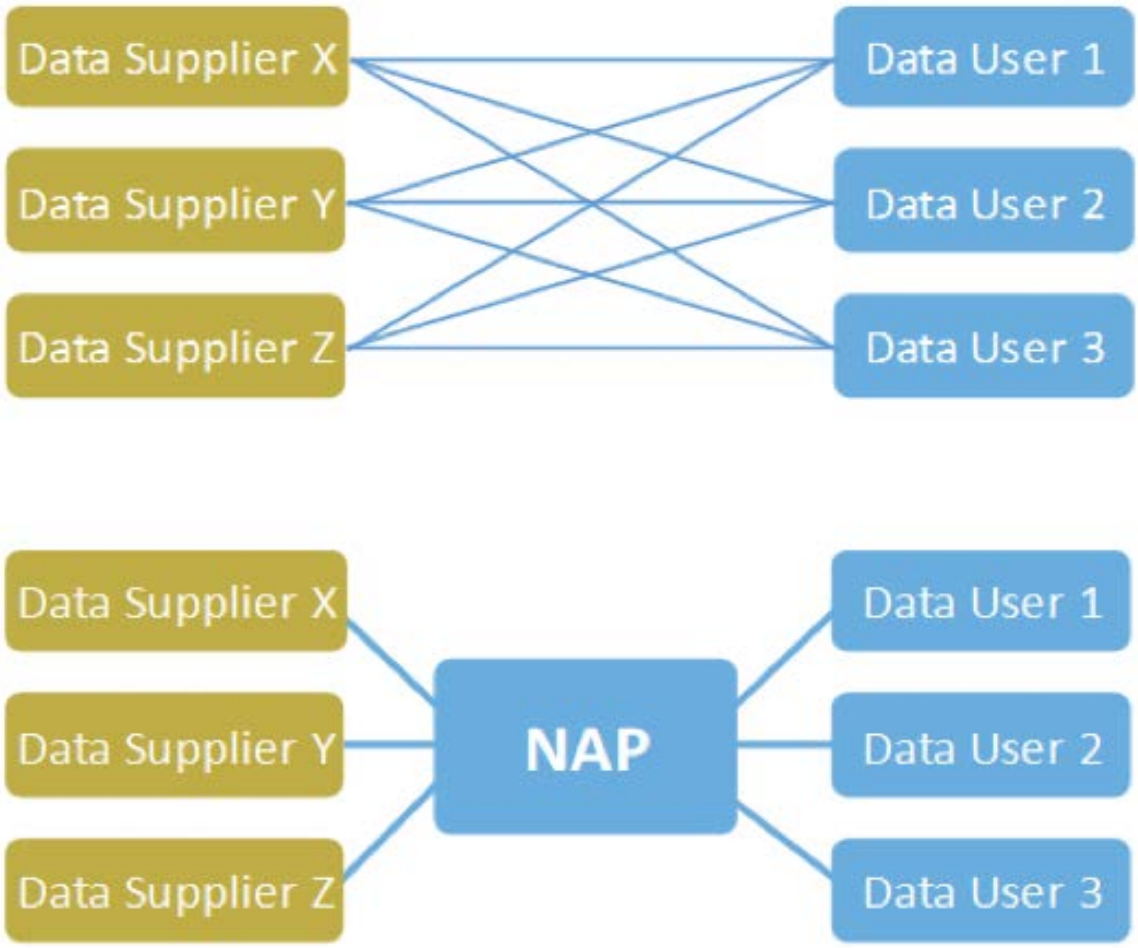
In Switzerland Cantonal or local authorities were responsible for managing traffic within their respective regions, while the Federal Roads Office (FEDRO) was responsible for national traffic management. Traffic management for three areas (Zurich, Geneva and Lausanne) was fully delegated to regional Traffic Management Centres (TMCs). National and cantonal traffic management systems (TMS) were increasingly integrated through data sharing and communication technologies. Traffic counters on national roads were managed centrally by FEDRO. TMC Zurich was working with a selection of 63 traffic counters on national roads within and around the Zurich canton to exchange data (real-time only) in Datex II format *via* XML SOAP interface around minute aggregates, numbers of vehicles in two vehicle categories, and average speed (only real-time / no historical data). For Traffic counters on cantonal roads about 250 traffic counters within Canton Zurich were capable of single vehicle data (real-time and historical), measurement of vehicle category SWISS 10, vehicle length, and speed, and connection from traffic counters to server via mobile network.

The challenges in traffic management were similar everywhere and included data exchange and collaboration across organisation boundaries. However each organisation had to do its own homework (architecture, data (standards) and process management) as a basis for system integration. Interface management was the key success factor for integrated traffic management and rrelevant data of reliable quality had to be made available and used. The National open transport data platform would be extended to (one of) the National Access Points (NAP) of Switzerland for traffic data.

Data

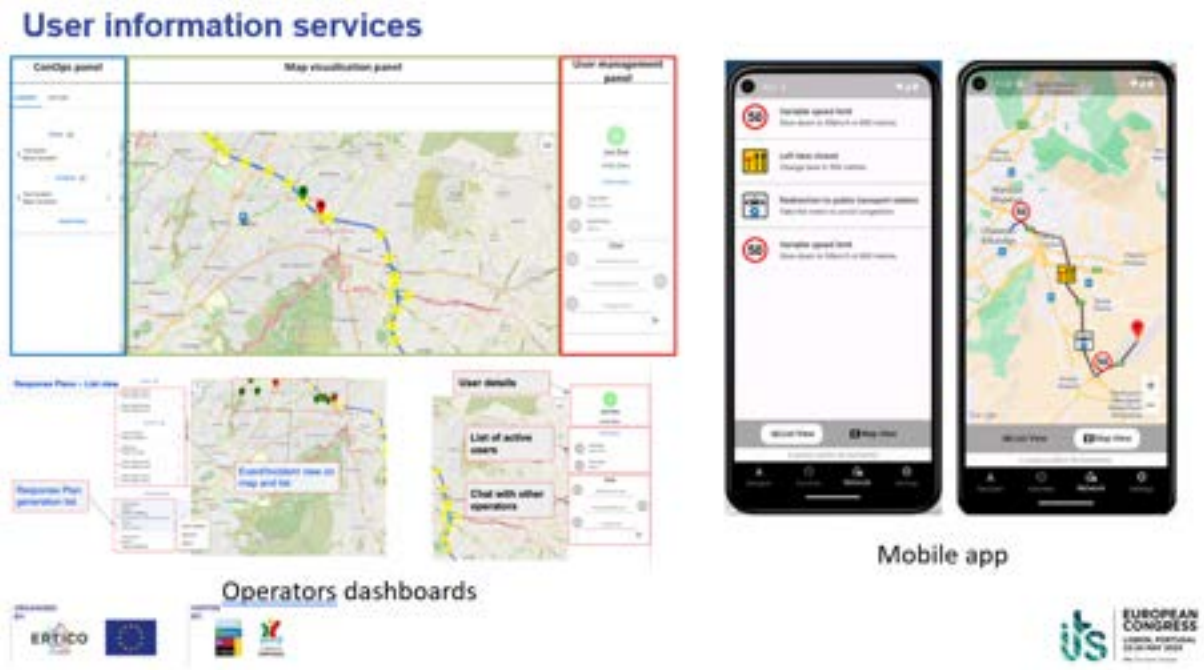
At this European Congress there was strong interest in the use of data, and data science technologies for enhancing traffic management. Increasingly we have been seeing the employment of pure data techniques, often developed in other sectors in the pursuit of better solutions and services.

At the highest level, discussion centered around the need for widescale open data sharing and the need to develop data sharing services through National Access Points (NAPs) across Europe. BASt, the German Federal Highway Research Organisation, outlined the need for NAPs and current progress across Europe towards their deployment;



How NAPs allow for simplified access, exchange and reuse of data, connect data suppliers and users and support EU-wide interoperable ITS services, Peter Lubrich, SIS 3

The EU FRONTIER Project was using AI and data analytics for advanced situation detection and traffic state estimation and prediction. Building a modular architecture for fast processing from high numbers of sensors allowed the development of a simulation framework for urban, motorway, and potentially waterway, modelling and prediction services.



FRONTIER allows the Development of interfaces to high quality operator and public user information services – Panos Goergakis, SIS 9

The development of an Autonomous Network and Traffic Management Engine, (ANTME), allowed the AI and data analytics used for situation detection to be harnessed for real-world purposes including response plan generation, recommendation and propagation, demonstrating ways in which the previously highly theoretical worlds of AI and data were starting to be used more commonly for actual traffic management services.

Front-end applications and apps for situational awareness, reporting and management, for road operators and for information services for users were also possible using the architecture developed by FRONTIER. This allowed highly developed and self-learning AI to be placed into applications users, (both operators and the public) are familiar with and enhances the quality of information that is provided.

The FRONTIER architecture also allows for a development loop to be implemented to ensure system learnings were reused to train the system for the future. A model that supported the loop described below is possible;

- develop action,
- recommend,
- monitor,
- learning,
- refine,
- reimplement.

An examination was made in a session into how far 'High Risk' Artificial Intelligence or AI was being used in traffic management. The European Commission's legislative proposal on Artificial Intelligence, the 'AI Act', intended to control how AI was used and developed within the EU to ensure its use did not jeopardise citizens' safety and security. The use of AI in the operation and management of road traffic management was identified as a 'high

risk' AI system, meaning its use could have an impact on the health, safety and wellbeing of citizens. Such high-risk AI systems must follow strict conformity requirements to be allowed on the EU market. This special interest session explored how far AI was already used in traffic management systems.

The issue of the collection, reuse and re-purposing of data was explored in a technical paper, in relation to harvesting stopped vehicle alerts from eCall data. Voice calls initiated by the automated eCall service were accompanied by a data packet with attributes describing the context of the emergency. Although eCall was used throughout Europe for emergency response the use of eCall data by road authorities was not common ever though the use of automated eCall data processing could increase the speed of alerting road operators by an order of magnitude compared to voice eCall. It was considered that eCall could complement infrastructure-based methods of stopped vehicle detection to provide a service with better coverage and richer information content.

A case study was presented in a technical paper by the BMW Group describing multimodal urban mobility in Rotterdam showing that even with good data integration, able to deliver innovative traffic management, it was not always possible to affect actual behavioural change. This outlined pilot tests of how car drivers could be motivated to leave cars in a park-and-ride facility and use other means of transport for the last mile. Participants on their way to Rotterdam received a recommendation to park for free at a park-and-ride facility and to choose between three alternative modes of transport to continue their journey. Many unique trips to the city centre of Rotterdam received a recommendation to switch; in a small number of cases drivers accepted the recommendation but ultimately none of them changed to one of the transport alternatives. This work was awarded "Best Technical Paper".

The operator of motorway concessions in Portugal discussed the use of centralised video analytics for automated incident detection, and in doing so provided a strong 'real world' study into the use of AI and analytics to assist with the issues faced by road operators. Traditional human monitoring of CCTV was considered to be inefficient and ineffective as an incident detection tool and so automated incident detection was being trialled as a way forward. The traditional infrastructure relies on fixed CCTV and a dedicated network and offered the following characteristics;

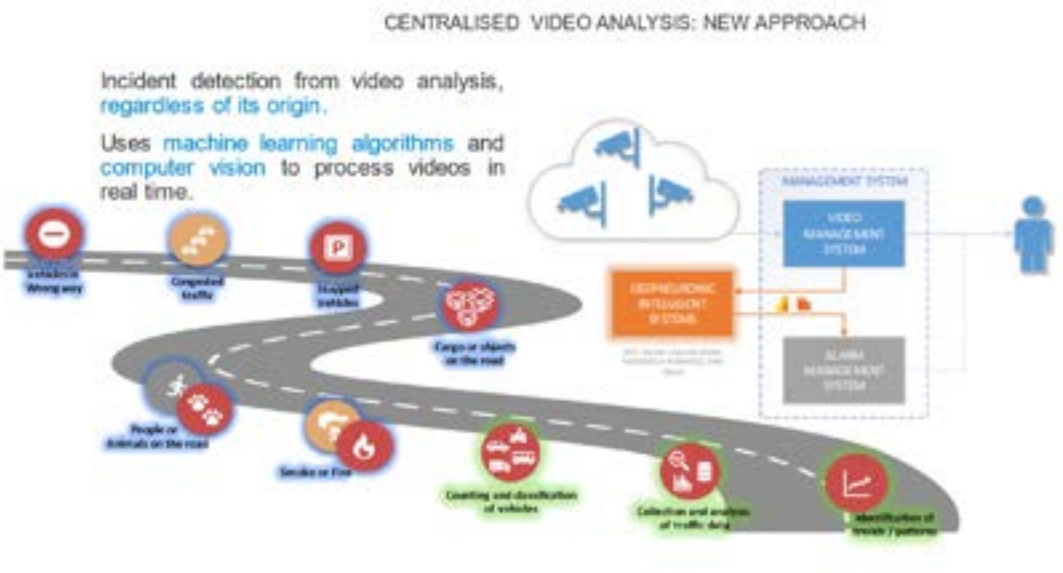
- Good 'real-time' detection
- Poor scalability
- Dedicated and expensive infrastructure
- No self-learning capabilities
- Frequent false alarms, false negatives and false positives.

Centralised video analytics for automated incident detection; Traditional human video monitoring has severe limitations - Vasco Corte-Real, SIS 30

Use of machine learning and computer vision allowed learning and training of the system based on experience scenarios and behaviour. It uses neural networking to do this that is not hardware specific and is now showing very high levels of accuracy in detecting incidents. For the defined use cases the following performance figures had been observed;

- Wrong way driving – 99%
- Smoke and fire – 91%
- People – 91%
- Vehicle classification counting – 97%
- Vehicle volume counting – 94%

The new approach to generating incident detection from automated video analytics was not only capable of self-learning and delivering better incident detection reliability – but could use video feeds regardless of image origin, and so required less expensive or dedicated infrastructure.



Centralised video analytics for automated incident detection; Potential Use Cases - Vasco Corte-Real, SIS 30

Future vs Constrained

The Future traffic management Topic covered a wide range of technologies and initiatives and explored high level data science principles down to pragmatic solutions for traffic management problems. Along with the other topics covered in the Congress, subjects presented in technical papers and discussed in special interest sessions had been heavily influenced by the need to reduce carbon, better manage urban travel and address issues of road safety and the vulnerability of active travel users. It was encouraging to see the breadth of research and product and service development that was underway to assist in tackling these issues, whose outcomes had been thoroughly and honestly reported to this Congress, and the number of actual, real-world trials of new technology solutions that were underway and yielding results across Europe.

A particular area of interest that was covered in sessions that was not especially technical but was crucially important to all was that of skills and workforce provision. A special interest session reported on a future-ready workforce in mobility and transport and examined the challenges and opportunities presented by digitalisation, electrification, automation, cooperation, and new business models. It looked at showcases of all future road mobility concepts, solutions, technologies, and innovations and determined that without a greater emphasis on reskilling and upskilling the delivery of mobility and transport future would be very difficult. Training, education and outreach programs needed to be offered at levels that were geared towards existing transport professionals, supporting the development of future transport professionals at schools and Universities, and supporting appointed public officials.

Topic 5
New Mobility Services

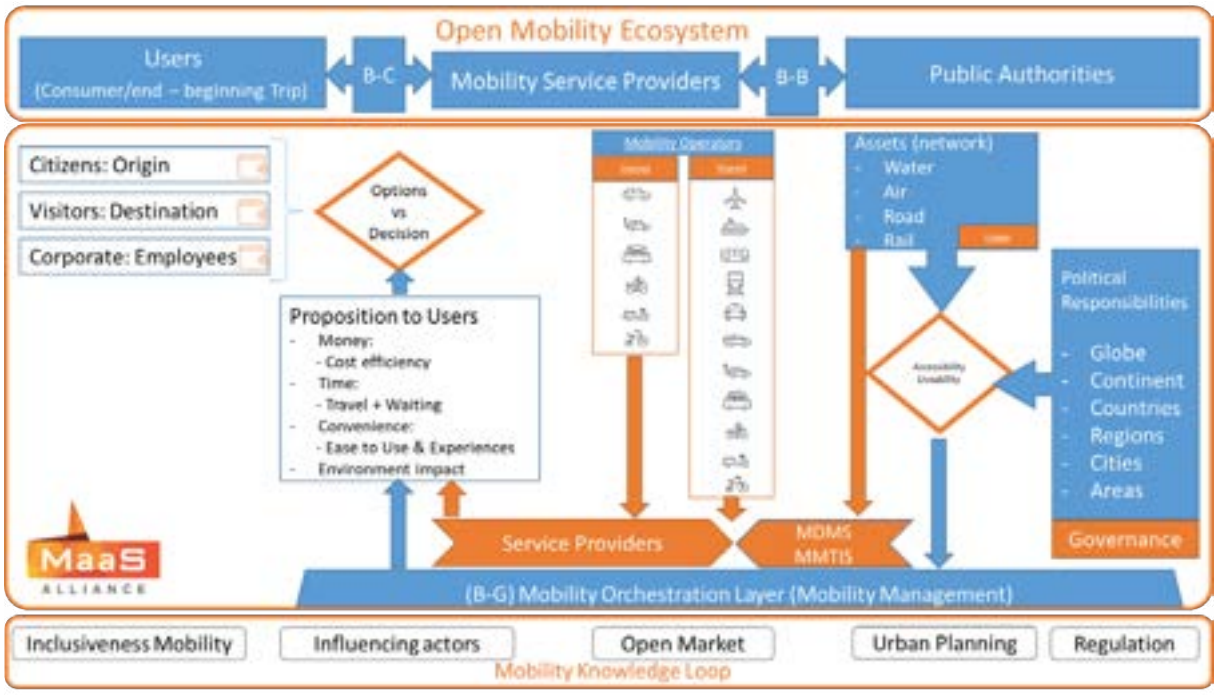
Overall situation

There was much activity in three distinct areas – Mobility data sharing/exchange; Mobility as a Service (MaaS), and Human Factors (inclusivity, behaviour change, public perception influencing). Lisbon saw a much higher emphasis on Human Factors in the new mobility area than earlier congresses, with many papers and sessions focusing on putting a person at the centre. We saw more papers looking at how to encourage more people to take up various new mobility solutions, what needs to happen and can it be used elsewhere. In contrast we saw little on using ITS technology for safety and security particularly for in active travel/new mobility.

Less popular themes at this congress were around using ITS in technologies supporting bike lanes and bike safety itself. This was a little surprising considering the more human centric "fashion". Equally, safety for other forms of micromobility/active travel were less prevalent. Security was also only covered in a few areas with regards to cyber security in new mobility. It was an expectation that there would be more discussion on other forms of new mobility other than e-scooters but this was only briefly touched on by one or two panels – E-scooters and E-bikes remain the key new mobility focus areas.

With current and significant discussions about artificial intelligence (AI), it was surprising that the role of AI in mobility management was hardly mentioned. Hamburg's #transmove project was noted, a smart and sustainable congestion forecast based on an agent-based approach under AI algorithm programming. An examination of how digitalisation and artificial intelligence, along with electrification, would impact a new approach to truck parking also featured but overall, the impact of AI on mobility management was not well understood.

MaaS was a popular item still on the agenda with a slightly different nuance – a greater realisation that MaaS was not a panacea. There seemed to have been a shift over the past few years from human factors in MaaS to shiny technology but it now appeared to be getting more person centric again. However the original challenge remained – that organisations did not appear to know how to do mobility as a service and do it justice. The MaaS Alliance had modified slightly its view of MaaS since the 2022 ITS European Congress – see below:



MaaS Vision, Roelof Hellemans, SIS 56

There were still questions to answer with ongoing debate regarding to who were the key people in MaaS and what the pricing or incentive mechanisms should be. In bringing TM 2.0 and MaaS together there appeared to be 3 key touchpoints: (1) Put mobility services (supply) and people (demand) first in traffic management; (2) Electric mobility but the charging infrastructure needed to come together with transport infrastructure; and (3) Active mobility - what could we provide to make active mobility more attractive and safer. There were several aspects of MaaS discussed at the Congress that were new – these appear in the new section of this report.

Another popular topic was E-scooters. There were clearly differences between different countries for example in the UK it was legal to buy a personal scooter but it could not be used on public roads but you could use a hired scooter; whereas in Paris you could buy and use a personal scooter but could not hire a scooter. E-scooters generated policy challenges *eg* where should scooters scoot? This had many implications for different groups including pedestrians, those with children, those with accessibility challenges, road users, logistics and other actively travelling people. An SIS discussed how E-mobility could meet different use cases, particularly for small traders, women, and families, who were often neglected in discussions on mobility; and how these needs varied around the world.

Bicycles and ITS were mentioned many times throughout the Congress particularly regarding the use of ITS in bicycling, data collection and the need to standardise bicycling data beyond the General Bicycle Feed Specification (GBFS). Many cycling ITS projects and implementations throughout Europe were described and lessons learned from various implementations highlighted not only information services that would be helpful to cyclists, but also the creation of European cycling standards, especially for counting, parking, infrastructure and real-time information.

Another recurring theme was the lack of standards for charging micromobility devices. Whose role was it to standardise this? What was the role of governments in micromobility? The role of parking was also an ongoing debate. Should public spaces be used for electric vehicle charging and micro mobility charging? How would this work and who had the control? Also, could parking reduction be used as an incentive to use mobility services that did not involve single-occupant automobiles? These questions were very relevant to the popular discussion around mobility data sharing and exchange.

Micromobility Definition John Paddington, SIS 42

On mobility data sharing and exchange, the key points discussed during the Congress included the challenges and opportunities. Challenges included existing digitalisation gaps in ticketing at local, regional and national levels; different data formats and standards, proprietary systems and legacy software that require technical integration and compatibility; lack of understanding of mobility stakeholders' needs and roles, and collaboration among all stakeholders involved; data privacy issues; and lack of regulation. However, EU-wide Multi-Modal Travel Information Services (MMTIS) and Multimodal Digital Mobility Services (MDMS) will set the framework for addressing these issues.

A clear message was the need to consider more than just the vehicles – meaning that human factors needed to be central to this debate. Discussions were heard about inclusivity; behaviour change and how we influence public perception with regards to new mobility methods of transport.

Old vs New

Although EV charging was not a very popular topic a new angle appeared to be the recognition that E-charging points needed to consider modes of electric transport other than only cars (*eg* electric micromobility vehicles). It was also pointed out that the topic had implications for fire hazards. Both New York and London were cited for struggling to deal with sharp increases in the numbers of e-scooter and e-bike fires.

There were a few other critical items related to EVs. Currently, there were no standards for charging. Enabling conditions were needed so that all EVs could be charged safely. It wasn't always clear what was a "safe place" (*eg*, safe from a hazard perspective and secure location) to charge electric 2-wheelers? Integrated infrastructure was needed to handle the use of all EVs (*eg*, creating EV parking areas next to public transport stations). Moreover batteries for electric micromobility vehicles were not interchangeable consequently there were many different sizes of batteries.

Battery rental was being considered to reduce upfront costs in purchasing electric bikes – you would buy the electric bike without the battery. In Europe a battery regulation was being reviewed. Part of this regulation was asking for individual battery cells to be replaceable, but that was not a current market requirement. So there might be a mandate on companies producing batteries to produce modifiable cells – a technology expected to be available in around two years. There were start-ups known to be developing this type of battery technology. Specific types of batteries had their own challenges; the industry needed a more sustainable product that matched the technology that was currently available.

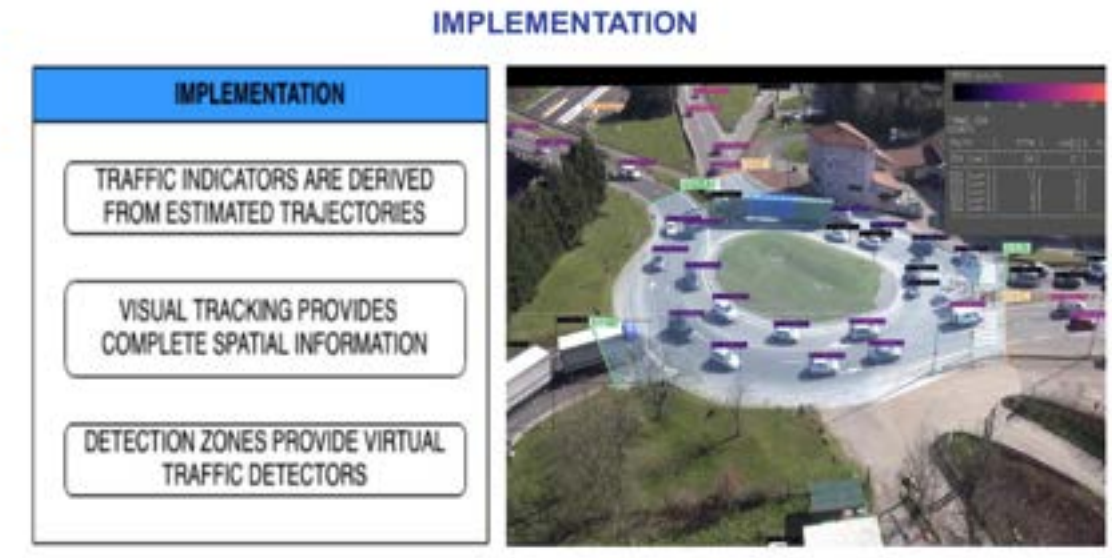
In terms of micromobility vehicle origin and destination data, there is still much work to be done for that data to be collected and understood.

Another new topic was the how regions were relating Clean Air Zone (CAZ) compliance to MaaS. It was argued that eventually the [CAZ] compliance system would become a core part of tomorrow's multi modal mobility system allowing a completely different approach and enabling mobility choices to be made easily. This would deliver the freedom to select the most appropriate mode of travel without barriers between payment providers and all wrapped in an overall compliance solution that enabled cities to genuinely offer mobility as a service. To maximise the climate benefits intelligent mobility must be strategically and thoughtfully deployed and leveraged within transport systems around the world.

While the ITS industry had always said that one key element of MaaS was the partnerships among the mobility services providers and MaaS operator(s), the Lisbon Congress said that a key success factor was the creation of an alliance to push a mobility revolution away from owned and single-occupant vehicles. For example a part of the alliance in Berlin included the companies and people who owned city real estate. Including people who owned space in a city was not typical for MaaS stakeholders.

As noted earlier a popular topic was mobility data but a new aspect of this was how a Horizon Europe project nuMIDAS was being used. This project involves Spain, Italy, Belgium and Greece. New Mobility Data and Solutions Toolkit (nuMIDAS) was established to provide insights into the methodological tools, databases, and models that are required for technology-enabled mobility services, and how existing tools, databases and models needed to be adapted with new data.

A new concept at the congress was using overhead video acquisition of complex traffic junctions or roundabouts *via* drones with deep learning and computer vision methods for vehicle detection, classification and tracking to improve traffic planning. Key planning parameters could be determined through this "airnalytics" process using image analytics algorithms applied to the captured video. These parameters included completed origin/destination matrices, vehicle counting, the most desired O/D pairs and vehicle classification. This work was awarded "Best Research Paper".



Real-Time traffic monitoring and management based on tethered drones' videos, Nour-Eddin El Faouzi et al in RP 3

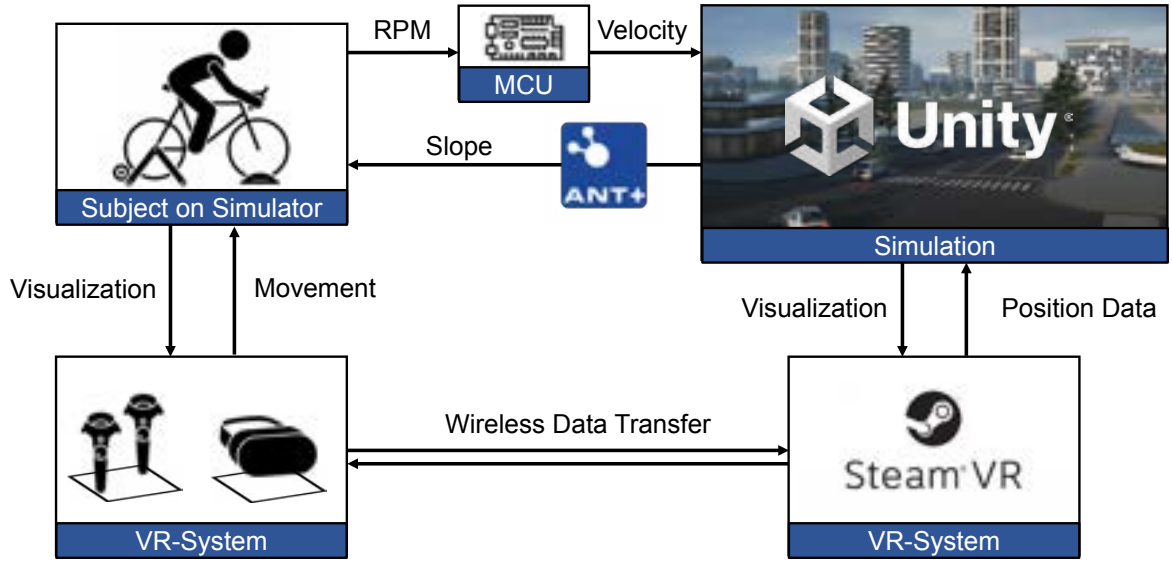
Using decentralised stakeholder collaboration to develop new cross-border mobility services in an Open Journey Planning (OJP) ecosystem based on the newly developed open application programming interface (API) for Distributed Journey Planning was a new topic. Implementing OJP at the European level by developing transnational mobility information services could be based on a decentralised network of linked journey planners.

The novel use of a framework to introduce MaaS in Belgium was presented. It consisted of an economic, technological and data models, awareness raising and communication to the population, and multimodal infrastructures (*eg* mobility hubs). In September 2022 it was approved as the "interfederal vision for Mobility as a Service." In addition, a pseudo-data sharing MaaS environment had been created by training a machine learning model using data from different transport providers without the need to share the data or collect it in a central server. This could solve the continuing barrier of data sharing in MaaS. It had the potential to better predict the demand for mobility under different circumstances, allocate transport resources in a MaaS environment, determine the logistics demands of shippers under different conditions, and collect data about driving behaviour.

New approaches and technologies for road pricing were discussed based on balancing different policy objectives and sharing lessons learned from recent pilot/implementation projects from across the globe. Also, the potential decarbonisation benefits from CAV were discussed but this was still at an early stage; we would expect this to be a theme in future congresses. Decarbonisation based on using ITS was discussed but more work was needed. It was recognised that Operation as a Service/Tolling as a Service was the future but this meant that the road pricing industry would have to change the way it works – competitiveness and readiness were the main challenges.

A virtual reality bicycle simulator was presented to research factors such as visualisation, longitudinal and lateral dynamics, and hardware and software interfaces, for the parameterisation of vulnerable road user behaviour models. Behavioural models enabled the actions of cyclists in potentially dangerous scenarios to be better understood and

predicted. The data could also be used to eliminate a key barrier preventing many from opting to walk or cycle to their destination: fears around safety. Developing an array of datasets to design reactive and proactive tools to plan safer routes for navigating cities, and to prioritise investment in improving the safety of active travel, could reduce real and perceived concerns around safety.



Overview of Bicycle Simulator, Fabian Russ, RP 1

There was a lively discussion about the synergies between energy, water and transport that debated the lessons learned between sectors but also the benefits/disbenefits of siloes. The key points from the exchanges included the need for cross-modal learning; the way that governments were established and operated could create challenges; the ways we consumed transport and the ways we consumed water/energy were different since we have elements of freedom in transport; transport people did not typically talk to energy or water people but it was data that drew these groups together; the right people were not being recruited for the future (*eg*, there were not enough data scientists); and it was the job of government to provide open data standards to allow different siloes to interoperate/come together. Overall, decarbonisation was a common objective across these three sectors but there was no one entity responsible for decarbonisation.

ITS semantics appeared to be changing. Quite a few speakers suggested that "Vulnerable Road Users" should be replaced by "Valuable Road Users". The phrase "traffic flows" appeared to be changing to the more holistic "mobility flows" and Transport 2.0 appeared to be being gradually replaced by Transport 4.0.

There were surprises that some "old" challenges remained a discussion item such as data challenges, parking, MaaS pricing and EV charging. We will unpack some of these in this section.

In the various discussions about MaaS at the Congress, several old issues were raised again. This included saying that "We needed more than just than an app to change people's behaviour." Another old favourite was who should "own" the MaaS proposition, but a key was focusing on public entities needing to own the proposition to ensure that MaaS user expectations were met and realising that there were multiple "users" in the MaaS ecosystem. Yet another repeat was that bundles must be developed to make it

more attractive for car users to change their habits and use public transport through MaaS. Perhaps the most important old MaaS issue mentioned was that just providing the mobility alternatives was not enough – the alternative services need to be integrated.

The roles of key stakeholders in MaaS and how the roles contributed to MaaS' survival had been discussed in prior Congresses and had been studied in the DOMINO project in Austria which was nearly complete. A pilot app had been implemented between March and September 2022 during which time detailed user data was collected and was being evaluated. A preliminary look produced three user-related points: (1) there must be clear incentives (such as company parking spaces) or regulations, such as the possibility of only receiving the commuter allowance if trips were offered in the app; (2) one barrier for users was needing to take detours so a good network of transfer points could be seen as a lever; and (3) reliability – it had to be a given that a traveller returned back home, such as a guaranteed ride home.

The importance of living labs was discussed through the Lyyli Living Lab project and the importance of real world testing. Lyyli was a testbed and living lab built in the operative urban tram environment of Tampere, Finland. It allowed developing, testing, validating and promoting products in a real-world environment and also gathered actors from all sectors including citizens to co-create new innovations for city mobility. Key benefits were accelerated development helped by feedback received from users and co-operative parties. It supports innovation ecosystems with concrete tools binding stakeholders from different sectors, including citizens, to the development work and it is a publicly visible development and product allowing effective marketing.

The potential for MaaS is still being discussed and has been since 2014: is the concept viable? What were the expectations of citizens/travellers, governments and the private sector? Was MaaS a tool for a more sustainable mobility and how should we measure its impact? Was the technology ready to enable a seamless and complete journey when switching from one mode of transport to another?

Data standards remained tricky. Where standards were needed the requirements and potential overlaps between standardisation organisations promised to be a topic theme at future congresses.

There were continued predictions that autonomous vehicles would be a significant portion of vehicles by 2030. For example Hamburg expected that up to 10,000 autonomous vehicles would be on the road by 2030,. The variety between predictions remained a constant from previous congresses.

Another challenging issue which remained a discussion topic was ticketing with regional variations again especially with regards to seamless ticketing and travel options. Some countries were finding this easier than others depending on the legacy situation.

Regional challenges also remained for EV Charging and infrastructure although we saw some new proposals *eg* utilisation modelling. Some countries were making headway, but urban areas remained a challenge where on-street parking existed – which was much of Europe. Doing this effectively and safely remains a problem along with the challenge of increasing public uptake of EVs.

Whilst the concept of 15-minute cities with regards to technology, policy, communities and services was not new we did hear how some of the new technology was being used to progress this notion.

Use of bus lanes and using simulation to test various configurations was familiar, however simulation for demand-response transport (DRT) was relatively new and had much promise to assess the feasibility of providing DRT services, to design and redesign them based on specific performance metrics, and to optimise the services in terms of scheduling and routing.

Forward vs Constrained

There appeared to be few ground-breaking futuristic concepts presented but many papers and presentations on forward-thinking progressions of existing innovations.

Forward – An issue that came up numerous times in MaaS discussions throughout the Congress was that while the car was always going to be a mobility alternative (particularly in rural areas), how could we make cars less attractive and convenient? Some potential solutions were providing less parking, charging higher parking fees, and changing travel lanes to shared mobility and buses, rather than cars. There was discussion on looking at solving "traffic congestion" more as "managing mobility flows," coupled with the creation and use of mobility hubs and digital mobility management tools to ensure better flows of travellers and goods. However many cities faced challenges in obtaining or collecting the data needed to make mobility flows efficient.

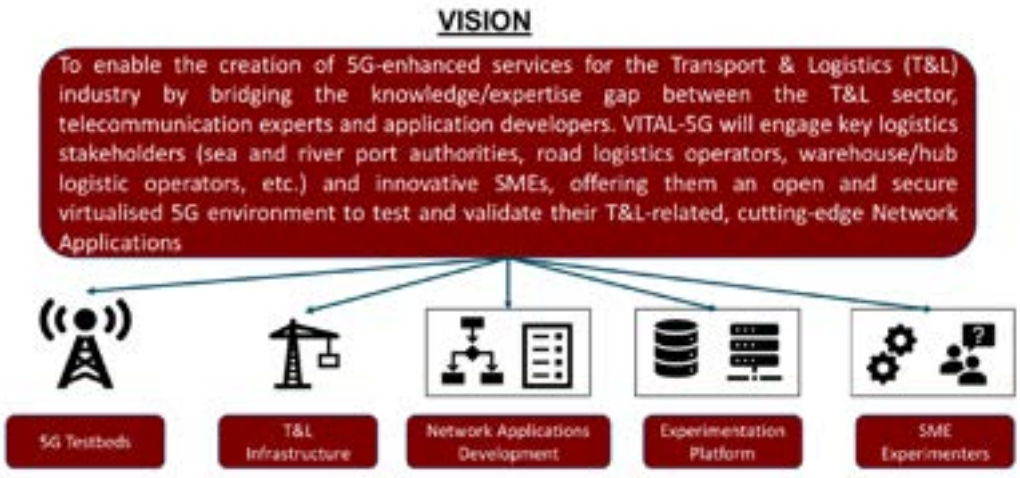
There was a sketch of the ultimate accessible mobility concept: a hyper-personalised fully accessible mobility experience using AI-based environment sensing and situational awareness applications for navigating complex environments assisted by sensor data, wall cameras, Bluetooth beacons, AI-updated maps, Lidar 3D environment mapping technology and simultaneous localisation and mapping (SLAM) for indoor navigation; and embedded assistive devices for in wheelchairs and white canes. These and other technological innovations could lead to mobility independence and greatly improve personal safety, a key element of mobility independence.

The Congress discussed the fact that we still have a way to go to identify the most appropriate metrics to assess how we are incorporating equity, diversity, accessibility and inclusion (EDAI) in ITS. We have certainly started to recognise that just mentioning that

EDAI issues exist will not reflect how well we are addressing these issues. Presentations reviewed the use of equity assessment tools, such as the UK Department for Transport's (DfT's) Equality Impact Assessment (EIA); the Gender Equality Toolkit In Transport (GET-IT) and the Sustainable Mobility for All (SuM4All) Initiative to ensure that technology-enabled mobility accounts for (EDAI).

There had been an effort to include cycling in the National Access Point Coordination Organisation in Europe (NAPCORE) and DATEX II, as well as standardising cycling and active mobility datasets. The types of cycling data that should be covered included data on infrastructure (network, physical attributes, road sign, access restrictions, road closures, speed, volume *etc*); bike sharing and bike hire (location, availability, booking *etc*.); secure bike parking (location, availability *etc*.); and real information for cycling (road works, disruptions *etc*.).

5G was being used to pilot seamless automated cross-border mobility. Several examples of Connected and Automated Mobility (CAM) pilot deployments that used 5G were described including three CAM projects that have specific geographical characteristics representative of the diversity of European corridors, including tunnels, urban and rural areas, toll zones, rivers, bridges, and mountainous areas. Another set of pilots focused on maritime and rail cross-border mobility. Lessons learned in these cross-border mobility pilots concluded that 5G was not necessarily ready for full deployment in this situation due to non-compliance with current standards, 5G roaming mechanisms/optimisations had not been implemented in most 5G systems, and mountainous geography in some corridors required complex transport networks (*eg* multi-hop microwave links).



The VITAL-5G Project, Andreas Gavrielides, SIS 68

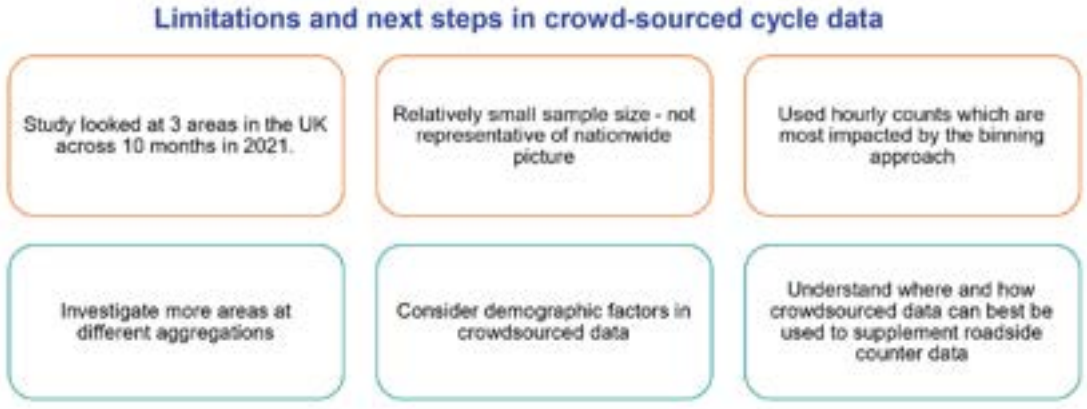
A number of active mobility datasets were identified: active travel patterns and behaviours; active travel infrastructure; crime data; traffic data; route topography; crash/accident data; road and junction layout; and historic and forecast weather conditions.

Other "future gazing" topics included video tolling which had been introduced as an improvement over typical toll collection. There also appears to be broader thinking on how activities could be used as blueprints and then tried elsewhere by adapted adoption. For example how could proven ways to influence tourists to use shared mobility in a Greek Island be used elsewhere?

Constrained – Decarbonisation driven by intelligent mobility was discussed and it was concluded that while it was very promising, much more work needed to be done for it to be effective. In the future, ITS interventions should continue to be deployed to support decarbonisation and 'the need to travel' should be redefined.

Walking and cycling did not get the same political attention as car driving and public transport. It was important for cities to set goals and targets, create the policies needed to reach these goals, and to track progress and make decisions. Without these actions walking and cycling were often missing or overlooked in the transport and mobility ecosystem. The lack of walking and cycling data meant a poor foundation for policy making and planning for these key active modes. The lack of standardisation resulted in challenges related to quality, validity, and comparability for both walking and cycling. Walking and cycling were connecting the dots of modern complex travel chains and shared mobility to contribute to a more sustainable mobility system. It is important to get data related to the amount of walking and cycling activity, as well as the safety, satisfaction, and characteristics of individual pedestrians and cyclists. GDPR and privacy concerns could be observed while making the invisible visible through data collection and analysis. Knowing who was not walking and cycling, and why they were not, was vital to understanding mobility gaps.

In terms of crowdsourced cycling data, there were limitations as were identified in a UK project: the data might not be fully representative of a wider cycling population; privacy protection policies impacted on data granularity; and roadside sensors could go offline or require maintenance.



Crowdsourced cycle data review for correlation determination, Niamh Trinci, TP 10

And a final word from Portugal – a regular point in this report has been the need to consider more than just the vehicles and how human factors needed to be central to this debate. Porto's Dots are a great example of this in practice with an explanation of not only how the dots can be used to provide information on mobility, points of interest *etc* but also the effort in design and how people were kept at the centre of the project.

Data as a key ingredient for efficient service development in a city, Ana Carneiro et al, SIS 16

PART 4

The Smart Mobility Summit of Cities and Regions

ERTICO had organised Summits in six previous Congresses but the clear feedback we received from our public authority partners pointed to the need for an event more focused on supporting the local and regional authorities' agenda of driving innovation and implementing smart and sustainable mobility solutions for public benefit. The Lisbon Summit therefore became the Smart Mobility Summit of Cities and Regions and on Monday 22 May senior representatives from over 30 cities and regions from across Europe, the Middle East and Africa met to discuss how intelligent and green mobility can contribute to sustainable growth and a better quality of life for all citizens.

The Smart Mobility Summit of Cities and Regions was one of the key highlights of the 15th ITS European Congress, 'ITS: The Game Changer', offering a unique opportunity to meet with peers, alongside a select group of industry technology representatives, to discuss challenges, possible solutions and future opportunities. Cities and regions of the Summit benefitted from a very candid briefing by the European Commission on the significance of the Sustainable Urban Mobility Plans (SUMPs) and the related Sustainable Urban Mobility Indicators (SUMIs). Emerging issues were identified in which closer collaboration and wider knowledge sharing could benefit all parties. Overall, the Smart Mobility Summit highlighted that the transition towards sustainable mobility requires a multifaceted approach, including education, infrastructure development, and policy changes. By learning from each other and sharing best practices cities can work towards achieving a more sustainable and liveable future for all.

In his keynote, Mr Torsten Klimke, Head of Unit Innovation & Research, DG MOVE, emphasised the importance of supporting cities across Europe and beyond as they played a key role in developing future mobility. The Commission was keen to learn from all cities and regions in order to understand what was needed to facilitate the uptake of frameworks in addition to the Trans-European Networks for Transport (TEN-T), the SUMP and the new Urban Mobility Expert Group. The Commission was working on regulatory actions to accelerate the availability of sustainable mobility services given the need to connect urban and rural mobility ecosystems, focusing on flexibility, user-friendly and demand-based solutions. Within the EU Urban Mobility Framework, 424 cities with over 100,000 inhabitants would develop Sustainable Urban Mobility Plans (SUMP). The Sustainable Urban Mobility Indicators[1] were being finalised to monitor the progress of their implementation by collecting data for seven sustainable mobility-related areas such as climate effects, safety, inclusiveness and affordability.

ERTICO – ITS Europe's Chairman, Dr Angelos Amditis, and CEO, Mr Joost Vantomme, noted ERTICO's commitment to continue facilitating and promoting networks to support local and regional authorities' agendas of driving innovation and implementing smart and sustainable mobility solutions for public benefit. Summits provided productive ways to gather the views of all stakeholders and decision-makers to guide the development of strategies for providing smarter and integrated mobility. The following round table discussions considered four aspects:

[1] The indicators included greenhouse gas emissions, congestion, deaths and serious injuries caused by road crashes, modal share for all modes, access to mobility services, and air and noise pollution

City Road Space Allocation

The challenges of allocating city road space centred on assessing the overall capacity for a road and deciding priorities for each class of use while anticipating future developments. The dialogue provided an opportunity to exchange ideas and solutions to meet the challenges of allocating city road space and to learn from their counterparts. One of the major difficulties discussed was getting political decisions on allocating the physical space. This was not just between private and public passenger vehicles and freight but also active modes including cycling and walking. Processes for analysing and quantifying the costs and benefits of different solutions were urgently needed. The participants noted that most cities aimed to strengthen parking space management in anticipation of the deployment of automated vehicles. However, there was a growing demand for more guidance on best practices and how to (re)design and install technologies to enable dynamic reallocation of road space. A final important note that emerged from the discussion highlighted the need to communicate with citizens from a strategic perspective. This included co-benefits for citizens and the need to reduce air pollution whilst facilitating more active mobility modes to cater to different user needs.

Setting and using mobility indicators

Summit participants at the second table discussion noted the importance of monitoring and evaluating the performance of local delivery systems by setting and using Sustainable Urban Mobility Indicators (SUMIs). Many cities were already using some form of metric, with several using the set of practical and reliable indicators developed by the European Commission to provide a standardised evaluation of mobility. There were many benefits from maintaining a set of indicators: They gave politicians and regulators continual feedback on the impact of policies; and infrastructure managers could get a direct view of their systems' performance. Both factors helped to inform overall city planning and encourage cooperation between different administrative sectors. However, it was also highlighted that there were challenges in adapting and developing indicators to address qualitative factors such as accessibility, equity, inclusivity and quality of life. Participants recognized the need for a mechanism to share know-how.

Collecting and using mobility data

Another table discussion focused on the need to increase public awareness and trust regarding the collection and use of mobility data. The past few years had shown how digitalising transport improved service delivery and enabled the creation of new services. However it was important for cities to understand how they intended to use the collected data, not just for immediate purposes but also for possible future applications. This required using published standards and identifying privacy and security concerns as soon as possible. The delegates highlighted the need for a storehouse of guidance learned from cities' experience collecting and using mobility data. Key topics were improving data quality; deploying open data practices to encourage innovation; making wider use of National Access Points (NAPs), and mobility data spaces; and forming private-public partnerships combining data from public sources with the private sector. The concluding remarks of this discussion presented questions on how we drive knowledge sharing, including standards, but also experimenting together.

Transitioning to sustainable mobility

Transitioning to sustainable mobility was seen as an important step for cities to achieve

their environmental goals and ensure better quality of life for their citizens. Developing a Sustainable Mobility Plan was an excellent way for cities of all sizes to focus on key issues locally. The policies required to achieve this goal were likely to be a mix of high-level objectives set by the national government and smaller local initiatives, but a common thread was a need for all classes of stakeholders to work together on both planning and delivery issues. Cities also needed to recognise that many policies would rely on improving or extending infrastructure for public transport and active mobility modes including cycling, and walking. Citizens needed to understand the arguments for seeking behavioural change, and education campaigns should be put in place to inform them of the benefits of sustainable mobility and get their support. One fundamental point was the need for pre and post-evaluation of transition strategies, which should be cross-linked to mobility indicators.

Although the four topics were discussed separately, it was clear that they overlapped. For example, a key element in sustainable mobility was changing the patterns of road traffic and the use of city space which in turn rested on understanding the best tools for last-mile logistics. These included micro-distribution hubs, urban vehicle access regulations, dynamic road space allocation, and achieving change through incentives or penalties. Each tool had its own advantages and disadvantages, and finding the right combination of tools was crucial for successful implementation. A major question in nearly all discussions was the role of automated transport in sustainable mobility. While there were potential positive impacts, such as increased efficiency and reduced emissions, there were also potential negative societal impacts, such as job loss and increased traffic congestion. It was therefore important to consider the potential impacts of automated transport carefully and incorporate them in planning.

The Summit delegates were pleased to have the opportunity for a full and frank exchange of views on sensitive and complex issues. They noted that addressing the issues discussed under each topic required a multi-stakeholder approach, constantly focusing on user consultation. They also noted the need for more research to analyse and quantify the costs and benefits of different configurations of city space and the need for mobility indicators that assess qualitative factors such as accessibility and equity. More work was needed on understanding behavioural issues – particularly important when seeking to achieve a modal shift – and the impact on mobility demand and supply of an ageing population. Finally, there was a common need for an open-access storehouse of guidance derived from cities' experience of collecting and using mobility data. The participants were keen to continue working together on addressing city mobility challenges through the deployment of efficient and sustainable ITS solutions.

In his concluding remarks Professor Eric Sampson, Master of Ceremonies and Chief Rapporteur, commented on how cities frequently experienced the same types of policy problems but mechanisms for discussing and sharing solutions at the city level, such as the Summit,were scarce. Common problems discussed included:

- Deciding the target balance between better accessibility to a city, both passenger and freight, for economic reasons; and devoting space to trees/green infrastructure, traffic calming, and controlled emission zones for better liveability;

- Developing greater cooperation between the private and public sectors regarding collecting and using data in mobility services;

- Ensuring that energy demand and supply issues were always integrated into ITS planning;

- Getting the public and private sectors to recognise that the other side had different objectives and obligations regarding the availability of data and sharing it and that the two requirements could co-exist;
- Improving trust between all stakeholders; it was the cornerstone of the mobility eco-system and essential for data sharing;
- Putting in place a long-term skills and training plan for the mobility sector;
- Understanding the impact of Artificial Intelligence on mobility services.