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Executive Summary

The European Commission, with the support of the EC-funded projects CARTRE and SCOUT, have hosted the first European conference on connected and automated driving. The high-level conference was held in Brussels on the 3rd and 4th April 2017. Major road transport stakeholders – automotive and telecom industry, users, road operators, public transport operators, regulators, research centres, universities and representatives of both the EC and EU Member States were present. The four main themes at the conference were transport policy issues, technological challenges, legal and regulatory frameworks and digital transformation.

The programme was organised by the four European Commission DGs RTD, MOVE, CNECT, and GROW with the support of the CARTRE coordination action. The plenary sessions equally covered European Commission's initiatives: DG RTD's Strategic Road Transport Innovation Agenda (STRIA), DG CONNECT's Connected and Automated Driving Round Table, DG MOVE's C-ITS platform and DG GROW's GEAR2030.

The high-level conference provided a platform for open communication and for two days, EU leaders, CEOs and representatives from major road transport stakeholders discussed interactively on the role of Research & Innovation and policy making to accelerate roll-out in Europe.

The conference focussed on the significant progress made in developing automated road transport technologies, such as advanced vehicle control, vehicle localisation systems, data processing, artificial intelligence or user interfaces, fostered by Horizon 2020, the EU research and innovation programme.

Carlos Moedas, Commissioner for Research, Science and Innovation, said: Automated road transport is such a fast-moving and important area that it requires a coordinated and a collaborative approach within and between the public and the private sphere. A vast range of sectors, from the automotive industry and road infrastructure to IT and telecoms, have a role to play in exploring this new frontier. That's why this first European event is so important.

Violeta Bulc, European Commissioner for Mobility and Transport (MOVE) reaffirmed Europe's worldwide lead affirming that; Europe needs to lead and shape the future of

connected and automated driving and collaboration is the keyword for the deployment of connected vehicles.

In addition, CARTRE organised a large networking event at the AutoWorld with the opportunity to experience a couple of CAD demonstrations outside the venue from the EC projects AdaptIVe and AUTOPILOT.

The venue also accommodated for a series of exhibitions displaying the currently active EC-funded projects.

With more than 580 participants, this first conference can be qualified as a real success. This is thanks to the good cooperation between the projects and the European Commission services. CARTRE is proud to have actively contributed to make it a success.

Discussions for the second edition, probably in 2019, are ongoing.

Table of Content

1. Overview

The European Commission, with the support of the EC-funded projects CARTRE and SCOUT, have hosted the first European conference on connected and automated driving. The high-level conference was held in Brussels on 3-4 April 2017. Major road transport stakeholders – automotive and telecom industry, users, road operators, public transport operators, regulators, research centres, universities and representatives of both the EC and EU Member States were present. The four main themes at the conference were transport policy issues, technological challenges, legal and regulatory frameworks and digital transformation.

The high-level conference provided a platform for open communication and for two days, EU leaders, CEOs, industry executives and representatives from major road transport stakeholders discussed interactively on the role of Research & Innovation and policy making to accelerate roll-out in Europe.

The conference focussed on the significant progress made in developing automated road transport technologies, such as advanced vehicle control, vehicle localisation systems, data processing, artificial intelligence or user interfaces, fostered by Horizon 2020, the EU research and innovation programme. It looked forward to the next 20 years of Connected and Automated Driving.

Carlos Moedas, Commissioner for Research, Science and Innovation, captured the needs as follows: “Automated road transport is such a fast-moving and important area that it requires a coordinated and a collaborative approach within and between the public and the private sphere. A vast range of sectors, from the automotive industry and road infrastructure to IT and telecoms, have a role to play in exploring this new frontier. That is why this first European event is so important.”

Violeta Bulc, European Commissioner for Mobility and Transport (MOVE) reaffirmed Europe’s worldwide lead affirming that Europe needs to lead and shape the future of connected and automated driving and collaboration is the keyword for the deployment of connected vehicles.”

1.1.Motivation

Increased connectivity and automation are major trends that are expected to shape the future of road transport and mobility. They hold the promise of addressing many of the major challenges facing today's transport system, such as user safety, energy efficiency, air quality and traffic congestion, and to enhance the drivers' comfort and convenience.

For many years huge Research & Innovation efforts have been invested in developing and demonstrating systems for connected and automated driving. Significant progress has been made in key technologies for innovative connected and automated driving functions and applications (e.g. advanced vehicle control, systems to detect vehicle location and environment, data processing, artificial intelligence, human-machine interaction, etc.). To make the next step towards roll out, large-scale pilots are necessary to test and improve the performance and safety of innovative connected and automated driving systems and to study market potentials and risks.

The combination of advanced connectivity systems and automated vehicles could disrupt the entire automotive ecosystem. Connected and automated vehicles will enable higher level of safety and the emergence of new "mobility-on-demand" services and innovative digital services in the area of entertainment, commerce, vehicle management, etc.

Connectivity and automation represent a critical testing ground to support the international competitiveness of the European automotive industry. Car manufacturers are part of a worldwide race towards connectivity and automation which includes new entrants from the global IT sector.

All relevant services of the European Commission (DG RTD, DG CONNECT, DG MOVE, DG GROW) are contributing to the development of connectivity and automation with actions ranging from R&I funding to policy guidance. In addition, trilateral cooperation between the EU, US and Japan has been established under the framework of the ITS (Intelligent Transport Systems) cooperation agreement in 2013. This cooperation has been extended to other countries such as South Korea and Australia, recently.

Over the past years, a series of events have been organised in the US and Japan to substantiate the progress in the field of Connected and Automated Driving. These events have been attracting large international audiences – the recent Automated Vehicles Symposium in San Francisco was attended by more than 1200 participants. Europe is still lacking a similar central meeting place for its research, industry and policy community. Therefore, the time is ripe to organise a Conference on Connected and Automated Road Transport in Europe.

1.2. Objectives

This conference was considered as a very good opportunity for European Commissioners Moedas, Oettinger, Bulc, and Bieńkowska to present jointly the recent European Commission policies on Connected and Automated Road Transport. Commissioners Oettinger, Bulc and Bieńkowska could present their initiatives (e.g. Round Tables on Connected and Automated Driving, C-ITS Platform and GEAR 2030) and show their commitment to support a fast deployment of Connected and Automated Driving technologies. Commissioner Moedas could outline aspects of the new R&I agenda on Connected and Automated Driving and present recently funded EU projects as well as the Call for proposals on "Automated Road Transport".

The main objectives of the conference were:

- To discuss key challenges in terms of, policy, legal and regulatory framework, research and innovation, standardisation, digital issues, infrastructure, cyber-security, use and sharing of data, etc. on the way to the deployment of Connected and Automated Driving technologies on our roads,
- To show where policy and research and innovation are coming together on these new technologies,
- To create an understanding of innovation needs across the various sectors (automotive, ICT and telecom),
- To include the perspectives of all road users, transport service providers and road operators,

- To reflect the EU Member States' activities and initiate a forum for collaboration and exchange within the EU,
- To include an international dimension beyond Europe for benchmarking and outreach, covering current international activities, especially in the US, Japan, South Korea, Australia, China and Singapore,
- To provide opportunities for networking between EC officials, policy makers, key academics, industry and societal stakeholders.

The long term ambition is still to establish this conference as an annual event beyond the duration of the supporting projects. Exhibit space, sponsors and participants fees may eventually be required in order to continue organization of the conference without funding support.

1.3.Format

The first Conference was organised over two full days with the motto "*Bringing real-life connected and automated road transport to the heart of Europe*" in the EC Charlemagne conference centre in Brussels with more than 700 participants. The two newly EU-funded Coordination and Support actions CARTRE and SCOUT have cooperated to prepare this conference. No additional sponsors are planned for this first edition.

The conference consisted of a series of plenary morning sessions complemented with nine afternoon thematic breakout discussions with 3 parallel tracks (see figure 1). The Conference was concluded with a wrap-up of each of the break out session by the nominated rapporteur before the closing session.

Limited Exhibition spaces were organised outside the plenary room in order to display active European and National activities.

2. Overall programme of the conference

Day 1 - 09:15-17:10

09:15 - 09:35 *(20 min)*	**Opening** • ***Carlos Moedas***, European Commissioner for Research, Science and Innovation (RTD) • ***Violeta Bulc***, European Commissioner for Mobility and Transport (MOVE)
09:35 - 10:45 *(70 min)*	**Plenary panel discussion** • ***Violeta Bulc***, European Commissioner for Mobility and Transport (MOVE) • ***Håkan Samuelsson***, President & CEO, Volvo Cars • ***Roberto Vavassori***, President, CLEPA • ***Uwe Janßen***, Vice President Innovation and Research, Deutsche Telekom
10:45 - 11:30 *(45 min)*	**Research and Innovation Challenges of Connected and Automated Driving** • ***Clara de la Torre***, DG Research and Innovation (RTD), Transport Directorate, European Commission • ***Dr. Carlo JT van de Weijer***, Director Smart Mobility, Technical University of Eindhoven, The Netherlands • ***José Manuel Viegas***, Secretary-General, International Transport Forum, OECD • ***Jean-Luc di Paola-Galloni***, Vice-President for Sustainability and External Affairs, Valeo Group & Vice-Chairman of ERTRAC (European Road Transport Research Advisory Council)
11:30 - 12:00	Break
12:00- 13:15 *(75 min)*	***Shared and automated mobility services for our cities*** / ***Physical and Digital Infrastructure*** / ***In-vehicle technology enabler***
13:15 - 14:45	Lunch
14:45 – 16:00 *(75 min)*	***Vehicle Validation/certification Roadworthiness testing*** / ***Big Data, IoT, AI, Deep Learning*** / ***Human Factors &User awareness***
16:10 – 16:25	**Introductory speech** • ***Roberto Viola***, Director General, DG CONNECT, European Commission
16:25 – 17:10 *(45 min)*	**Digital technologies enabling Connected and Automated Driving** • ***Despina Spanou***, Director, DG Communication Networks, Content and Technology (CNECT), European Commission • ***Nadine Leclair***, Senior Vice President Global Expertise Management & Member of the Board of Directors, Renault • ***Prof. Ralf Herrtwich***, Head of Automotive Business Group, HERE • ***Matteo Gatta***, Director Tech Strategy & Innovation, PROXIMUS
	Change of venue
17:30 – 20:00	Social networking event at AutoWorld

Day 2 - 09:00-16:30

09:00 - 09:15	**Opening** • ***Melanie Schultz van Haegen-Maas Geesteranus***, Ministry of Infrastructure and the Environment, The Netherlands (to be confirmed)
09:15 - 10:15 *(60 min)*	**EU MS programmes on Connected and Automated Driving** • ***Antti Vehviläinen,*** Director General, Finnish Transport Agency, Finland • ***Jean-François Sencerin,*** Program Director, Autonomous Vehicle PFA/NFI, France • ***Hamid Zarghampour***, Programme Officer, Swedish Transport Administration, Sweden • ***Ian Forbes***, Head of the Centre for Connected and Autonomous Vehicles, Department for Transport, The United Kingdom • ***Henriette Spyra***, Strategic Coordinator Mobility Transformation & Transport, Austria • ***Jaime Moreno García-Cano***, Deputy-Director General for Mobility, Directorate General for Traffic, Spain • ***Dr. Tobias Miethaner***, Director General Digital Society, Federal Ministry of Transport and Digital Infrastructure (BMVI) , Germany
10:15 - 11:00 *(45 min)*	**Cooperative systems deployment towards Connected and Automated Driving** • ***Claire Depré***, Head of Unit, DG Mobility and Transport (MOVE), European Commission • ***Dr. Teodor Buburuzan***, Leading Communication Engineer, Volkswagen AG • ***Joël Valmain***, Adviser for European and International Affairs, Ministry of Interior, France • ***Martin Böhm***, Head of Mobility Systems & ITS Deployment, Austriatech
11:00- 11:30	Break
11:30 - 12:15 *(45 min)*	**Which policy and regulatory EU frameworks for CAD** • ***Gwenole Cozigou***, Director, Industrial Transformation and Advanced Value Chains, DG Internal Market, Industry, Entrepreneurship and SMEs (GROW), European Commission • ***Edwin Nas***, Dep. Project Leader Connected and Automated Driving, Ministry of Infrastructure and the Environment, The Netherlands • ***Jos Vantomme***, Smart Mobility Director, European Automobile Manufacturers' Association (ACEA) • ***Ferry Smith***, Director Public Affairs, ANWB
12:15 – 13:00 *(45 min)*	**International Cooperation** • ***Dr. Gereon Meyer***, Dept. Future Technologies and Europe, VDI/VDE-I&T, Germany • ***Seigo Kuzumaki***, Program Director of SIP-adus, Chief Safety Technology Officer Secretary, Chief Professional Engineer - Safety, R&D and Engineering Management Div., Toyota Motor Corporation, Japan • ***Lam Wee Shann***, Group Director, Technology and Industry Development, Land Transport Authority, Ministry of Transport, Singapore • ***Dr. Steven Shladover***, California PATH Program Manager, University of California Berkeley, USA
13:00 – 14:15	Lunch (75 min)
14:15 – 15:30 *(75 min)*	***Digital IT Infrastructure & Connectivity*** | ***Socio-economic Impact of CAD*** | ***Shared economy – automation and electro-mobility***
15:30 – 16:15 *(45 min)*	Breakout wrap-up session (45 min)
16:15 - 16:30	**Closing** • **Paraskevi Michou,** *Deputy Secretary-General, European Commission*

3. Plenary sessions

The plenary programme was organised by the four European Commission DGs RTD, MOVE, CNECT, and GROW with the support of the CARTRE coordination action. The plenary sessions equally covered European Commission's initiatives: DG RTD's Strategic Road Transport Innovation Agenda (STRIA), DG CONNECT's Connected and Automated Driving Round Table, DG MOVE's C-ITS platform and DG GROW's GEAR2030.

3.1.Opening session and high level panel discussion

The opening session and following panel discussion addressed a number of open topics. Each panellist represented a part of the sector directly concerned by the development of CAD. The panellists gave details about:

- *What are the driving forces for your sector to deploy connected and automated driving systems and technologies? What are the potential benefits for users?*
- *How can we best support the deployment of connected and automated driving systems to keep the global competitive position of the EU automotive industry?*
- *Are existing international, European and national rules sufficient to facilitate the introduction of connected and automated vehicles on the market and enable their cross-border use?*

Speakers

Opening
- ***Carlos Moedas,*** European Commissioner for Research, Science and Innovation (RTD)
- ***Violeta Bulc,*** European Commissioner for Mobility and Transport (MOVE)

Plenary panel discussion
- ***Violeta Bulc,*** European Commissioner for Mobility and Transport (MOVE)
- ***Håkan Samuelsson,*** President & CEO, Volvo Cars
- ***Roberto Vavassori,*** President, CLEPA
- ***Uwe Janßen,*** Vice President Innovation and Research, Deutsche Telekom

Highlights

Carlos Moedas, Commissioner for Research, Science and Innovation, said: Automated road transport is such a fast-moving and important area that it requires a coordinated and a collaborative approach within and between the public and the private sphere. A vast range of sectors, from the automotive industry and road infrastructure to IT and telecoms, have a role to play in exploring this new frontier. That's why this first European event is so important.

Violeta Bulc, European Commissioner for Mobility and Transport (MOVE) reaffirmed Europe's worldwide lead affirming that; Europe needs to lead and shape the future of connected and automated driving and collaboration is the keyword for the deployment of connected vehicles.

Roberto Vavassori, President of CLEPA said; we welcome the fact that four DG's have prepared this conference. Additionally in the last months the

automotive and telecommunications industry have worked together to deploy the connected and automated driving applications. President Vavassori also stressed that data is at the core of connected and automated driving and that data will need to be differentiated for effective use and regulation.

Volvo Cars believes governments and car makers should join hands in sharing traffic data in order to improve global traffic safety - Håkan Samuelsson, president and chief executive

Dr. Bruno Jacobfeuerborn, CTO of Deutsche Telekom, expressed its deep support to the automotive industry to engage in various trials and pre-deployment activities, such as the activities taking place on the A9 in Germany. He also mentioned the role of the round table on CAD to bring these two industries closer to each other.

The following discussions rotated around the role of digital technologies for CAD, how to cooperate between public and private sectors, what actions are needed to make data available, and how CAD will look like in 2030.

3.2.Research and Innovation challenges of CAD

For several years huge R&I efforts are being invested in developing and demonstrating systems for connected and automated driving (CAD). Significant progress has been made in key technologies for innovative CAD functions and applications (e.g. advanced vehicle control, systems to detect vehicle location and environment, data processing, artificial intelligence, human-machine interaction, etc.). To make the next step towards roll out, large-scale pilots are necessary to test and improve the performance and safety of innovative CAD systems and to study market potentials and risks.

There are still many challenges to overcome before automated driving will be widely available on the market for use in many different environments and conditions. More research work is needed in areas such as automated driving in mixed conditions and complex environments, data collection and management, security and privacy aspects of sensitive data, communication technologies for higher levels of automation, design of fail-operational systems, safety validation methodologies, etc.

CAD systems will not become available only by integrating more and better technologies. In order to identify promising use cases that have social and economic benefits, we have to better understand how users perceive and value future use of CAD for specific purposes. For making decisions on investments related to CAD systems, it is necessary to assess the short, medium and long term impacts, benefits and costs of the deployment of CAD vehicles.

This plenary session brought together the academic research community and automated driving industry to outline the research challenges of future transport systems, where connected and automated driving can bring its added value to different use cases, for urban environments or for long-haul transport. The focus of this session was to discuss R&I priorities for the next 10 to 20 years and key policy actions to support R&I towards deployment of connected and highly automated driving systems in Europe.

Speakers

Research and Innovation Challenges of Connected and Automated Driving

- ***Clara de la Torre***, DG Research and Innovation (RTD), Transport Directorate, European Commission
- ***Dr. Carlo JT van de Weijer***, Director Smart Mobility, Technical University of Eindhoven, The Netherlands
- ***José Manuel Viegas***, Secretary-General, International Transport Forum, OECD
- ***Jean-Luc di Paola-Galloni,*** Vice-President for Sustainability and External Affairs, Valeo Group & Vice-Chairman of ERTRAC (European Road Transport Research Advisory Council)

Highlights

Clara de la Torre, Director, DG Research & Innovation (RTD), Transport Directorate, European Commission said; we must seriously consider autonomous vehicles role in the transport system. Connected and automated driving will address the needs of users in particular and society in general.

Dr Carlo JT van de Weijer, Director of Smart Mobility at the Technical University of Eindhoven said; we need to put the human at the centre of connected and automated driving. Dr Weijer demonstrated the challenges for connected and automated using bike traffic in Amsterdam as an example. ‘‘The urban space is the major left over challenge for mobility. Driverless cars, faced with indecisive, distracted humans, may just park and start carrying. Smart mobility is more than just automation.’’

José Manuel Viegas, Secretary-General of the International Transport Forum (OECD) called Europe to be social ready and for a fair distribution of automated vehicles among EU member states. ‘‘European standers will be crucial for the effective deployment of connected and automated vehicles.’’

3.3. Digital Technologies enabling CAD

Cooperative, Connected and Automated Mobility (CCAM) holds the promise to help addressing many of the major challenges of today's transport system. CCAM has the potential to increase safety and energy efficiency, improve air quality, reduce congestion and enhance user comfort and convenience. An even bigger impact is expected from shifting value chains: connectivity and high levels of automation enable innovative services as well as third parties "accessing the dashboard" and providing the driver new choices.

Car manufactures around the world are unanimous in predicting the emergence of higher level of automation on our roads sometime in the near future.

Digital technologies are enablers for convergence of connectivity and automation in vehicles. To make CCAM commercially viable, a pan-European enabling digital framework is needed, focusing on connectivity, 5G and wise use of data. Well-promising solutions focusing on interoperability needs and secure and unhampered communication will pave the way for quick and efficient deployment of CCAM.

The European automotive and the telecom sectors joined forces last year to jointly overcome the remaining barriers to the roll-out of increasing levels of automation on Europe's roads.

These joint efforts will at the same time help European industries to preserve and consolidate its global leadership in Connected and Automated Driving.

Speakers

Introductory speech
- ***Roberto Viola***, Director General, DG CONNECT, European Commission

Digital technologies enabling Connected and Automated Driving
- ***Despina Spanou***, Director, DG Communication Networks, Content and Technology (CNECT), European Commission
- ***Nadine Leclair***, Senior Vice President Global Expertise Management & Member of the Board of Directors, Renault
- ***Prof. Ralf Herrtwich***, Head of Automotive Business Group, HERE
- ***Matteo Gatta***, Director Tech Strategy & Innovation, PROXIMUS

Highlights

This session examined the current status and possible future scenarios of CCAM, and discussed the emerging issues from the perspectives of different stakeholder groups. We focused on core opportunities and challenges, such as those related to seamless connectivity, 5G, security, safety, liability and consumer acceptance.

Main questions addressed during the session were:

- What is the added value of connectivity in terms of automation?
- What could the telecom industry do more to make the cellular connectivity more appealing to the car industry?
- Which areas you think are the easiest ones to strike an agreement among all stakeholders on the openness/use of data and which are the most difficult ones and how could the recent Commission initiative on Data Economy help in this respect?
- What do you see as main strengths/opportunities/risks for Europe (vis-à-vis our international competitors) in the race to connected and automated driving?

Roberto Viola opened the topic by highlighting the recent signature of a Letter of Intent between 29 ministers (27 MS signed and Norway and Switzerland) at the digital day of the 60th anniversary of the EU in Rome. This was an important signal to support that all MS want to work together to enable the realisation of cross-border connected driving solutions supporting automation. As a next step, EC will identify these corridors over the whole Europe. Additionally, spectrum allocation is needed for the future 5G mobile networks. The role of the EC is to facilitate the process and put the financial means to realise these ambitious goals.

Despina Spanou (DG CNECT) introduced CAD as a major real-life experiment for the overall accomplishment of the digital economy; three areas emerged as fundamental: seamless Connectivity of CAD with the roll out of 5G, Cybersecurity integrated in automated vehicles and infrastructure, and Trust to enable acceptance of data exchange (including liability issues).

Nadine Leclair (Renault) introduced the Platform for connected cars which includes essential technology building blocks: integrated communication using anything available to transfer data, large data collection and processing in cars and outside, life-cycle continuous improvement with over-the-air updates, and

operational performance.

Prof. Ralf Herrtwich (HERE) insisted on importance of the backend challenges for enabling CAD. Beyond location and guidance, self-learning high-definition maps for CAD will become a reality index that are collected by vehicles, aggregated in the cloud and fed back to all others. For this to happen, connectivity, coverage, bandwidth and cost will be keys to success. Give-and-get models will trigger more willingness to share data.

Matteo Gatta (PROXIMUS) presented the evolution towards 5G as an important building block to enable CAD passing by 4G+ and 4.5G gradual evolution of the mobile communication networks. This will offer new opportunities in coverage, capacity, latency and QoS.

3.4.Ministerial speech and European Member States panel

Since last year Connected and Automated Driving (CAD) is put high on the agenda of the EU and national governments. There is increasing awareness amongst decision makers that action from public authorities is needed to create the right conditions for safe deployment of CAD. Several national and regional plans have been launched in Europe and a number of European Member States have started to prepare and implement large scale testing of CAD functions on public roads.

This session will provide an overview of current policy measures adopted by European Member States including available funding programmes and support to large-scale testing facilities.

National activities regarding pilots and testing of CAD will be illustrated by elaborating on objectives, scale, type of tests, and levels of automation.

In particular, aspects related to required modification of road infrastructure and types of infrastructure (e.g. physical, ITS communication) will be considered.

The main objective of the session is to support mutual understanding of current initiatives, to discuss alignment between national and EU initiatives and to identify possible areas of cooperation.

Speakers

Opening
- ***Melanie Schultz van Haegen-Maas Geesteranus***, Ministry of Infrastructure and the Environment, The Netherlands (to be confirmed)

EU MS programmes on Connected and Automated Driving
- ***Antti Vehviläinen,*** Director General, Finnish Transport Agency, Finland
- ***Jean-François Sencerin,*** Program Director, Autonomous Vehicle PFA/NFI, France
- ***Hamid Zarghampour***, Programme Officer, Swedish Transport Administration, Sweden
- ***Ian Forbes***, Head of the Centre for Connected and Autonomous Vehicles, Department for Transport, The United Kingdom
- ***Henriette Spyra***, Strategic Coordinator Mobility Transformation & Transport, Austria
- ***Jaime Moreno García-Cano***, Deputy-Director General for Mobility, Directorate General for Traffic, Spain
- ***Dr. Tobias Miethaner***, Director General Digital Society, Federal Ministry of Transport and Digital Infrastructure (BMVI) , Germany

Highlights

The opening speech on the second day of the conference was given by the Dutch Minister of Infrastructure and the Environment Melanie Schultz van Haegen. The minister's core message was for national member states to work together on cross border testing and trials for self-driving cars. The Minister further stated that regulations should be forward looking and stressed the importance of learning by doing.

The session on the EU Member States programmes on connected and automated driving regrouped representatives from Finland, France, Sweden, UK, Austria, Spain, Germany and Netherlands. It provided an overview of current policy measures adopted by the European Member States including available funding programmes and support to large-scale testing facilities. The session supported mutual understanding of current initiatives and encouraged alignment between national and EU initiatives. Possible areas of cooperation at European level were still unclear.

Antti Vehviläinen presented the Finish National Action Plan 2016-2020 focussing on Infrastructure, Roads, Services, Vehicles, and Drivers. Testing on open roads has been facilitated and different pilots have started on allocated infrastructure e.g. the Aurora Test Ecosystem offering a test bed for CAD in real Arctic weather conditions. Additionally, Finland is investing in their "road 2.0" programme to improve the exchange of relevant data across the public-private clouds.

Jean-François Sencerin introduced the Autonomous Vehicle French national programme (PFA) part of the "Nouvelle France Industrielle (NFI)". France has the intention to be a place for automated vehicle experimentation with access to a center of excellence for embedded intelligence and a great expertise in critical system safety. During the last year, the French programme has more than doubled the number of authorised CAD prototypes on public roads. VEDECOM and SystemX are mentioned as major centres of excellence for CAD.

Hamid Zarghampour spoke about their Strategic Innovation Programme called Drive Sweden which includes a large variety of partners (56) from different sectors to work on next generation mobility solutions. Among other, it includes the Drive Me Volvo Car project making L4 Volvo's available to 100 families around Gothenburg. Other activities are mentioned: Truck Platooning, off-road truck in mining environment, commuter shuttles, 5G cloud and AstaZero, a collaborative test ground for CAD.

Ian Forbes talked about the work of the UK DfT Centre for Connected and Autonomous Vehicles (CCAV). CCAV is jointly funding a CAD programme of more than 100 m£ which is matched funded by the industry; it has also worked on regulatory reform actions such as the UK code of practice for testing CAD, the sales and use of CAD vehicles, the vehicle insurance bill. Finally, CCAV is investing in building up an integrated suite of testing environments for CAD.

Henriette Spyra emphasised the involvement of Austria in C-ITS activities building up their digital infrastructure with the automotive, IT and robotic industry. Austria has established a legal framework for testing with a single point of contact at AustriaTech. In Addition, Austria is investing in research and testing environment with more than 20m€. Finally, the ministry looks at the combination of electrification, automation, digitalisation towards societal goals especially decarbonisation.

Finally, Jaime Moreno presented DGT's proactive work on CAD. Spain is one of the countries with little legal barriers for higher levels of automation: all road network is open for CAD testing. Spain is a leader in automotive environment for CAD with high engagement of the industry, research and innovation and policy support. DGT promoted their connected platform offering anonymous free data hubs especially for road safety data using the cellular network.

Dr. Tobias Miethaner, Director General Digital Society at the Federal Ministry of Transport and Digital Infrastructure (BMVI) could unfortunately not attend the conference and present the progress in Germany.

3.5.Cooperative systems deployment towards CAD

As outlined in the European Commission's strategy on Cooperative Intelligent Transport Systems in many respects today's vehicles are already connected devices. However, in the very near future they will also interact directly with each other and with road infrastructure.

This interaction is the domain of Cooperative Intelligent Transport Systems (C-ITS), which will allow road users and traffic managers to share and use information previously not available and to coordinate their actions. This cooperative element – enabled by digital connectivity – is expected to significantly improve road safety, traffic efficiency and comfort of driving, by

supporting the driver.

Cooperation, connectivity, and automation are not only complementary technologies; they reinforce each other and over time will merge completely. Truck platooning (trucks communicating automatically and safely following each other at very short distance) is a good example: connectivity, cooperation and automation must all come together to make it work.

To ensure coordinated deployment of C-ITS services in 2019, an unprecedented level of cooperation across many sectors is required to make Connected Automated Driving (CAD) a success.

Since November 2014, the Commission has hosted the C-ITS platform to identify remaining barriers and propose solutions for C-ITS deployment in Europe. In 2016, Member States and the Commission launched the C-Roads Platform to link C-ITS deployment activities, jointly develop and share technical specifications and to verify interoperability through cross-site and cross-border testing.

This plenary session on C-ITS brought together experts from both the public and private sector. They will expand on what Cooperative ITS brings to them, what they get out of the work being done within the C-ITS platform and why they felt the need to get involved in this platform. On the C-Roads Platform, we heard about who is involved in this project, what services it is deploying and what are the expected outcomes and feedback into the C-ITS policy work.

Speakers

Cooperative systems deployment towards Connected and Automated Driving

- ***Claire Depré***, Head of Unit, DG Mobility and Transport (MOVE), European Commission
- ***Dr. Teodor Buburuzan***, Leading Communication Engineer, Volkswagen AG
- ***Joël Valmain***, Adviser for European and International Affairs, Ministry of Interior, France
- ***Martin Böhm***, Head of Mobility Systems & ITS Deployment, Austriatech

Highlights

Claire Depré talked about C-ITS on the European roads. Thanks to the joint efforts of the public and private sector, the date of 2019 has been set for deployment of C-ITS over Europe. Interoperability is seen as a key for success and all EU Member States are working towards this goal.

Joël Valmain reframed the discussion around road safety and the work done at the UNECE. The “ITS/AD” informal group of experts on automated driving (IGEAD) has been formed in 2015. Driver engagement in secondary tasks is being considered in a forthcoming amendment. Also, a non-binding advisory article for CAD may be proposed. Remote parking is the subject of a discussion paper.

Dr. Teodor Buburuzan talks about electric mobility and digitalisation including connectivity. VW sees connectivity as the combination of cellular based and 802.11p technologies. VW considers 5G as an evolution path to improve scalability unlocking

new user centric services. ITS-G5 is seen as an additional connectivity which will evolve from information delivered to drivers towards machine-to-machine data. As an OEM, VW is asking more clarity on some essential elements before deployment of C-ITS: Certificate policy to prepare for broad deployment, data protection clarity on CAM/DENM messages, spectrum clarity, and transparency on IPRs.

Martin Böhm presented C-ROADS as a platform grouping many European Member States deployment activities facilitated by the CEF programme. C-ROADS prepares the MS for the 2019 deployment of C-ITS. The focus is to enable interoperability with handover of services across borders. C-ROADS puts together the experts working on national pilots and feeding the working groups so that they deliver practical recommendations to facilitate EU-wide deployment. Martin invited to the TRA2018 conference.

3.6.European Policy and regulatory framework for CAD

Policy expectations are high on Connected and Automated Driving (CAD): offering new transport services, improving traffic management, saving fuel, reducing road fatalities, creating a new area for jobs and competitiveness in the EU to mention just a few of the potential benefits.

Policy and regulatory actions in favour of CAD are already taking place within the Commission and the Member States. But automated and connected vehicles raise cross-cutting issues (traffic law, liability, vehicle certification, connectivity infrastructure, etc.) involving different departments within the Commission or within the Member States which require working together in a coherent manner.

This is the reason why the Commission launched at the beginning of 2016 the GEAR 2030 High level group launched by the Commission gathering the relevant Commissioners, Member States and stakeholders representing various industries: automotive, telecoms, IT, insurance. The High Level Group will assist the Commission in developing a long-term EU strategy for highly automated and connected vehicles by the end of 2017. The Group will build on complementary EU initiatives (e.g. C-ITS Platform, 5G Action Plan, etc.) and will in particular make recommendations to ensure that the relevant policy, legal framework and public support are in place for the roll-out of highly automated and connected vehicles by 2030. The Group has delivered its first recommendations for automated and connected vehicles up to 2020 and will deliver by the end of summer 2017 recommendations for automated and connected vehicles up to 2030.

The main objective of this Plenary Session is to give an overview of the GEAR 2030 work and discuss the first recommendations for CAD.

Speakers

Which policy and regulatory EU frameworks for CAD

- ***Gwenole Cozigou***, Director, Industrial Transformation and Advanced Value Chains, DG Internal Market, Industry, Entrepreneurship and SMEs (GROW), European Commission
- ***Edwin Nas***, Dep. Project Leader Connected and Automated Driving, Ministry of Infrastructure and the Environment, The Netherlands
- ***Jos Vantomme***, Smart Mobility Director, European Automobile Manufacturers' Association (ACEA)
- ***Ferry Smith***, Director Public Affairs, ANWB

Highlights

Gwenole Cozigou presented CAD deployment from a point of view of industry policy. Policy and regulatory actions in favour of connected and automated driving are already taking place within the Commission and the Member States. But automated and connected vehicles raise cross-cutting issues (traffic law, liability, vehicle certification, connectivity infrastructure, etc.) involving different departments within the Commission or within the Member States which require working together in a coherent manner. This is the reason why the Commission launched at the beginning of 2016 the GEAR 2030 High-level group. The work on CAD consisted of two phases: actions up to 2020 and until 2030. It was confirmed that pilots of automated vehicles is widely needed and exchange of data is important. Eventually, data generated by cars may require specific regulations if we compare to the mobile phone. A EU strategy on CAD policy will be published by the end of 2017.

Edwin Nas claims that many automated vehicles functions are already on the roads. So the work in GEAR2030 WG on CAD is very timely. First, at UNECE WP1, the revision of the role of the driver gives room to higher levels of automation. For the short term introduction of 2020 CAD, the WG issued recommendations on cross-border testing, HMI, connectivity, data and liability. Especially, the role of data recorders was emphasised to solve the liability bottlenecks. The future of type approval is under consideration. Additionally, for the longer term, the WG added issues on road safety.

Jos Vantomme enumerated electrification, connectivity, shared mobility and automation as a combined set of disruptive technology trends. These will change the industry as we know it towards new alliances with non-automotive actors such as ICT sector. The role of regulations should be to create a level playing field where needed, provide legal certainty for stable investment opportunities and only intervene where market forces fail. Two approaches are ongoing at the moment to regulate the CAD deployment: vertically (vehicles, road and ICT infrastructure), and horizontally (data economy, enabling technologies, and international dialogue). The industry's priority is to go beyond products towards services, collect and access large amount of data while fostering trust and confidence, facilitate higher levels of automation, and ensure continued and coherent cooperation with all stakeholders.

Ferry Smith talked about the challenges from a consumer point of view: Simple systems with intuitive interactions and similarities between brands, Driver training needs even for non-

automated vehicle drivers in mixed traffic, Clarity during a transition period to avoid mode confusions and distraction, Access to data generated by vehicle and from event data recorder, and finally, the conclusion raised the question on "what is safe enough"?

The panel concluded that it is crucial that the European Union provides the right legal and regulatory framework, innovation-friendly conditions and support to research projects as well as large-scale trials. This includes support through Horizon 2020.

3.7.International Cooperation

Many of the challenges on the way towards deployment of CAD systems can be better addressed in cooperation with international partners. It is essential to develop and maintain close cooperation with other regions of the world to exchange knowledge, expertise and best practises and to work towards a global framework and international standards for connectivity and automation technologies. Close international cooperation will also help to reduce duplication of efforts, and encourage sharing of knowledge and data collected in research projects and large-scale pilots. Cooperation is also needed on complementary research in areas, such as human-machine interface, social acceptances of CAD and ITS technologies.

International cooperation in the field of intelligent transport systems, road safety and road automation is already ongoing for several years, in particular between EU, US and Japan. In 2012 a tri-lateral working group (EU, US, JPN) on road automation has been established. The European Commission and the US Department of Transport support "twinning arrangements" of road automation projects funded by the EU and the US to expand the breadth of learning, optimize the use of mutual resources, and improve outcomes in both regions.

The objective of this session is to present policies and actions of different regions of the world to support the development and deployment of connected and automated driving systems and to discuss main benefits and future priorities for International Cooperation in the area of connected and automated driving.

Speakers

International Cooperation

- ***Dr. Gereon Meyer***, Dept. Future Technologies and Europe, VDI/VDE-I&T, Germany
- ***Seigo Kuzumaki***, Program Director of SIP-adus, Chief Safety Technology Officer Secretary, Chief Professional Engineer - Safety, R&D and Engineering Management Div., Toyota Motor Corporation, Japan
- ***Lam Wee Shann***, Group Director, Technology and Industry Development, Land Transport Authority, Ministry of Transport, Singapore
- ***Dr. Steven Shladover***, California PATH Program Manager, University of California Berkeley, USA

Highlights

Dr. Gereon Meyer presented the results of a study assessing the degree of the transport system maturity in a number of countries around the world and across all modes. Specific attention was on Automation and Connectivity. A series of best practices were identified from which lessons learned were

extracted. US California Regulatory exercise, Japan's SIP-adus and Singapore's Electrified Automated Shared Mobilty emerged as good use cases to learn from international activities; which is the reason they are represented in this panel.

Seigo Kuzumaki presented SIP-adus, a 5 year R&D effort with cross ministerial cooperation. The programme integrates all technologies which needs common concepts: Sensors, Maps, actuators, HMI, Cyber-security, Simulation, Connectivity, next generation transport, etc… the programme is now entering an intensive Field operational testing phase including industry, research and government. The tests will take place around the Tokyo area on expressway, on arterial roads and at the JARI new test facility. The FOTs will help to validate the concepts developed in SIP-adus. SIP-adus will use a common platform as a basis to enable the data exchange while the OEMs will be allowed retain their proprietary data. Foreign industries are also invited to test.

Lam Wee Shann presented a concept for future urban mobility integrating CAD for people and goods mobility. The Committee on Autonomous Road Transport for Singapore (CARTS) covers both public and private stakeholders and works on planning, regulations and industry development. Several trials are taking place with fixed schedule services on small shuttles and larger busses, on-demand self-driving eTaxis, truck platoons, and autonomous utility vehicles (cleaning and waste collection). The Centre of Excellence of Testing & Research of AVs-NTU (CETRAN) builds up technical knowledge for testing and certifying AVs. Invitation to the forthcoming 2019 ITS World Congress in Singapore.

Dr. Steven Shladover promoted the benefits of mutual exchange. He provided an extensive list of research cooperation topics which could be addressed internationally: fundamental technological research, testing methods, impact assessment, Safety assurance, Human interaction from inside and outside the vehicles, and cyber-attack protection. On the other hand a few examples of topics which are less interesting for cooperation are linked to either competitive aspects and/or national peculiarities (public education, regulatory process, political engagement).

4. Thematic Breakout sessions

The breakout sessions were organised in order to encourage expert discussions on technical or non-technical ART topics. The thematic sessions will present the SoA in research, identify possible cooperation areas, identify gaps in research or policy, and outline the next steps. The thematic breakouts consisted of 75 minutes presentations and discussions with three sessions running in parallel in the three available conference rooms.

The list of the thematic areas (9 themes) addressed is:

- Shared and automated mobility services for our cities
- Physical and Digital Infrastructure
- In-vehicle Technology enablers
- Vehicle Validation/Certification and Roadworthiness testing
- Big data, IoT, AI/Deep Learning
- Human Factors & User awareness
- Digital IT Infrastructure and Connectivity (ITS G5, LTE-V2X, LTE-advanced, 5G)
- Socio-Economic Impact Assessment
- Shared economy – automation and electro-mobility

The thematic breakouts were organised by recognised experts in the thematic field. The organisers were in charge of selecting the panellist for their breakout as well as listing a series of questions to be debated. The organiser reported their findings during the plenary at the end of the second day.

Each session is reported in this conference report.

4.1.BO 01 - Shared and automated mobility services for our cities

Organiser/s: Vincent Blervaque (VEDECOM), Patrick Mercier-Handisyde (EC – DG RTD)

Moderator/s: *Siegfried Rupprecht*, RUPPRECHT CONSULT - Forschung & Beratung Gmb

Speakers:

- Koen De Broeck, Manager mobility & market research, De Lijn, Belgium
- Kawamoto Masayuki, SIP-adus Next Generation Transport WG Co-Chair, University of Tsukuba, Japan
- Yann Leriche, Chief Performance Officer, TRANSDEV, France
- Mikael Ivari, Senior Advisor, Development & International, City of Gothenburg, Sweden
- Dennis Potter, senior advisor, Program Manager Rivium-Campus, Gemeente Capelle aan den IJssel, The Netherlands
- David O'Neil, Head of the Political Service Department at Syndicat des Transports d'Île-de-France (STIF), France

Introduction

Shared and automated mobility services are a unique opportunity to bridge the gap between individual mobility needs and community interests by delivering complementary mobility offer integrated with existing high capacity multimodal public transport. They can contribute to make public transport more attractive, support modal shift and reduce pressure from the use of private vehicles by offering a well-integrated and cost-effective public transport service with a high frequency and short waiting times, at peak and off-peak periods. Introduction of on-demand and door-to-door services will improve accessibility of public transport services

to all users and sustain development of public transport as urban mobility backbone with complementary line services offering viable business models and service flexibility.

Main topics addressed

Mobility in urban and suburban areas faces significant challenges with respect to accessibility, safety, security, environment, service quality of public transport and financing. Shared and automated mobility services have the potential to address these challenges and to offer concrete solutions which are not technically or economically feasible with conventional public transport systems. This session will report on expectations from local authorities to meet policy goals in cities, strategies developed by transport authorities to facilitate integration of automated vehicles and associated shared mobility services in existing public transport systems, and lessons learnt from trials and commercial operations by public transport operators and mobility service providers.

Main topics addressed during this session are:

- How to provide efficient and flexible 24/7 mobility services in all urban / sub-urban areas including those with medium/low demand, that are with accessibility to all, including persons with reduced mobility capabilities?
- How to reduce negative environmental and health impacts in cities from transport such as congestion, air pollution, noise?
- How to improve road safety in urban and sub-urban environments, especially for vulnerable road users?
- How to offer high-quality mobility services and to make public transport a more attractive option in a way that is both affordable to users and economically viable for operators and service providers?
- How shared and automated mobility services can be a game changer for sustainable urban mobility?

Main outcomes and open issues identified

This session brought together local authorities, transport authorities and public transport operators who have already gained deep knowledge on shared and automated mobility services. This session was not about what technology can deliver but what policy makers and decision makers need to improve and sustain urban mobility for all users. Based on their past experiences of shared mobility services, speakers expressed their views on how to benefit from the next evolution towards shared and automated mobility services. All speakers made similar statement on the need to fully integrate to the existing public transport systems to complement them with new mobility services that are not feasible or not economically viable with conventional vehicles (e.g. night service, door-to-door, on-demand). When talking about automated driving, cities give preference to shared automated driving vehicle scenario in order to make better use of public space (expected reduction of parking spaces) and mitigate risk of increasing congestion linked to private automated driving vehicles.

Beyond technology, first experiences of shared and automated mobility services have raised the issue about human presence in vehicles. Because public transport vehicle drivers are doing more than just driving, it is important to learn about the impact of driverless vehicle with respect to user acceptance, passengers' safety and security and ticketing.

All speakers agreed that public and private stakeholders representing demand and supply sectors need to gain more knowledge to get ready for full scale deployment through pilots

and demonstrations of shared and automated mobility services in real-life conditions in different urban environments and with different categories of shared automated vehicles.

4.2.BO 02 - Physical and Digital Infrastructure

Organiser/s: Risto Kulmala, Finnish Transport Agency & Geert van der Linden, EC DG MOVE

Moderator/s: Risto Kulmala, Finnish Transport Agency

Speakers:

- Stephen T'Siobbel, Sr. Partner Development Manager, Tom Tom Maps
- Manfred Harrer, Austrian national operator of the highways and motorways (ASFINAG)
- Armin Gräter, Driver Assistance Development, BMW Group
- Frank Försterling, Head of Advanced Dev and Innovations Infotainment Solutions, Continental AG
- Tom Alkim, Senior Advisor Connected & Automated Driving , Ministry of Infrastructure and the Environment, The Netherlands

Introduction

The adaptation of physical infrastructure and its link with the digital infrastructure is a key issue for the deployment of connected and automated vehicles. Physical infrastructure, from roads and bridges to traffic signals and lamp posts, may need to be updated with regard to its planning, building, maintenance and operation processes, guidelines and practices. The "Digital Road infrastructure" may be defined as "the digital representation of road environment required by Automated Driving Systems, C-ITS and Advanced Road/Traffic Management System". It can be understood as the integration of multiple geo-located information layers containing:

- Static - Basic Map Database (e.g. Digital cartographic data, Topological data, Road Facilities)
- Semi-static - Planned activities and forecast (e.g. traffic regulations, road works, weather forecast)
- Semi-dynamic - Traffic Information (e.g. accidents, congestion, local weather)
- Dynamic - Information through V2X (vehicle to anything communication, e.g. surrounding vehicles, pedestrians, timing of traffic signals)

In addition, it contains the infrastructures for integrating the afore-mentioned elements, i.e. the positioning infrastructures (e.g. satellite positioning, cellular and LAN positioning, roadside landmarks), communication infrastructures, and the back-office processes (e.g. information management centres, servers and databases, data interchange servers).

Main topics addressed

The session discussed the main issues related to the deployment, operation and maintenance of the physical and digital infrastructures for connected and automated driving and transport. The roles and responsibilities of the different stakeholders, the likely deployment scenarios and the time plans were discussed by representatives of stakeholders

from both the demand and supply side of the infrastructure. The speakers shared their views on the needs of connected and automated vehicles and transport towards physical and digital infrastructure as well as the objectives and plans of the infrastructure providers and operators. The session addressed issues such as real-time infrastructure maintenance, security, economic feasibility, business models, differences in operating environments ranging from rural roads in remote areas to busy interurban motorways and from residential areas to central business districts, and the specific problems in the transition phase towards full connectivity and automation. The session brought up many needs for actions on the European, national and local scale with regard to accelerating the deployment, coverage and quality of the physical and digital infrastructure to facilitate connected and automated driving. These actions covered the domains of research, innovation, deployment, maintenance, operation and service provision.

Main outcomes and open issues identified

The session brought up the fact that road operators must deal with challenges first to the profit of only a few drivers but gets the benefits later for the community, providing a business case and public investment model issue. Managing mixed traffic of both highly automated and non-automated vehicles is the major challenge in the near and medium term.

The issue of adding elements or leaving out elements of the infrastructure due to automation was also highlighted. Leaving out elements is only possible if there is no mixed traffic. Full benefits from higher automation will be reached only when all vehicles using the road in question are highly automated. This was seen as one driver for allocating specific roads, lanes and areas for highly automated vehicles.

Good road markings and signs as well as well-marked shoulders are important in the start to support the operation of the in-vehicle sensors of automated vehicles; this would also be beneficial to all road users with or without automation. Landmarks and roadside reflectors may turn out to be important as well.

Digital map stakeholders are pushing the innovation mostly towards high-definition real-time maps. The solution of using crowd souring techniques for building up digital infrastructure via interpretation of sensor data is showing good promise.

Maintaining real-time eHorizon based cloud data and reliable hybrid communications with low latency and good security and privacy protection was regarded as essential for safe automated driving.

4.3.BO 03 - In-vehicle Technology Enablers

Organisers: Alessandro Coda (CLEPA), Patrick Pype (NXP)

Moderator: Alessandro Coda (CLEPA)

Speakers:

- Eckard Steiger, Director Chassis Systems Control, Robert Bosch GmbH
- Mark Mages, Manager Legal Regulations & Public Affairs, Division Chassis & Safety Systems, Continental
- Maurice Geraets, New Business / Board Member NXP Netherlands, NXP Semiconductors
- Jochen Langheim, VP Advanced Systems R&D Programs, STMicroelectronics
- Dominique Bolignano, CEO and Founder, Prove&run

Introduction

Enhanced vehicle automation functions have been implemented in the past years and more will come in the short future to improve road safety and reduce emissions and congestion.

Improvement of understanding of areas in the context of the vehicles could help to better perform vehicle functions. Connectivity, in-vehicle networks, Vehicle-to-everything (V2X) functions and Internet of Things (IoT), play a fundamental role in increasing the levels of automation in different environment: motorways, urban, inter-urban, rural, different traffic conditions, critical whether situations.

In-vehicle technology is today ready to implement at affordable cost in Connected and Automated - CAD and this is where, the suppliers of these system, devices and components are becoming an essential part of the evolution.

Main topics addressed and outcomes

The session focused on how suppliers are contributing to build the different elements of the improved layers and platforms towards the full CAD vehicle.

Vehicles integrating Internet of Things technology interact with each other and with personal devices, wearables, the cloud to deliver innovative services and applications.

This will require a revised view on what the future electronics platform in the car will look like and will consist of secure and reliable communication gateways and networks, data links among vehicles as well as between humans, vehicles and infrastructure.

New sensors and very high-speed multi-gigabit wireless communication networks need to be installed.

Drivers will have optimal guidance, avoiding traffic jams, respecting the vulnerable road users or find the most rational route to points of interest (e.g. electrical charging stations).

Smart sensors and accurate positioning methods will need to be able to detect potholes in the road and send a signal to road infrastructure operators to repair them.

Software engineering and sensor fusion are becoming vital disciplines in the automotive industry due to the increasing amount and complexity of automotive control systems.

Security and privacy protection are becoming high relevant factors to avoid hacking and leakage of private data.

4.4. BO 04 - Vehicle validation/certification and Roadworthiness testing

Organiser/s: IDIADA (Álvaro Arrúe), TNO (Bastiaan Krosse)

Moderator/s: Margriet van Schijndel, Secretary General, European Automotive Research Partners Association (EARPA)

Speakers:

- Dr. Adrian Zlocki, Senior Manager Driver Assistance, IKA
- Richard Schram, Technical Manager, EuroNCAP
- Arjan Van Vliet, Senior Advisor Corperate Strategy, RDW
- Takahiko Uchimura, Senior Vice President, ITS Japan

Introduction

Safety verification/validation and roadworthiness testing of automated vehicles involve the definition of a comprehensive set of methodologies and tools aiming to verify whether they comply with regulatory and technological requirements. This verification/validation of higher levels of automation is difficult to achieve with the existing technology but is one of the building blocks for the safe deployment of automated road transport on public roads. Strong challenges must be addressed to create complete, reliable and continuously evolving procedures that cover the whole vehicle lifecycle.

Main topics addressed

Safety validation and roadworthiness testing must cover different types of testing (compliance, commercial and up to type approval) but should also include different levels of granularity, the interaction with all road users (including the vehicle occupants) and with the environment (large amount of highly dynamic and highly variable scenarios) during the whole development process and beyond. Simulation and virtual testing will play an increasingly relevant role as it provides the way to deal with the high number of scenarios CAD will encounter. Verification/validation of CAD is a very complex process which is not solved yet.

For SAE level 4/5 systems, verification and validation can still not be fully achieved with current knowledge. Further research in the area is fundamental to build up from the existing regulatory framework while promoting a European wide approach. Exhaustive (safety) validation and trustful roadworthiness testing of increasingly complex systems are key elements to both guarantee and promote the successful deployment of safe, socially accepted automated road transport in our roads. This session provided further insight on the current status of the topic with special focus legal and technical requirements through the presence of worldwide key experts on the topic.

Several questions arise and should be answered in order to define a harmonized approach to the challenge:

- How to prove completeness of AD validation?
- How to speed up time to road test exemption?
- How to make test results more comparable?
- How to create a common benchmark for automated driving?
- How to identify the minimum performance requirements for automated driving?
- How can we develop and maintain a common safety methodology?
- How to handle an exploding number of validation tests?

Main outcomes and open issues identified

The panellists had the chance to present to the audience some of the worldwide initiatives that are trying to give an answer to these questions:

- RDW overviewed some of the challenges and needs for testing on public roads with two of its latest initiatives: the Dutch license exemption procedure and the European Truck Platoon Challenge as practical case.
- Euro NCAP highlighted its commitment to inform the users of the market situation, also for future AD functions. Their approach to introduce AD rating is based in functions and some defined use cases and they also informed about the importance and differences of how each OEM decides to implement these functions.
- IKA presented the German national project PEGASUS which is dealing with the topic. Among some of its activities a common scenario database is being created as a repository of (shared) scenarios and data that may be used for testing in the whole development process of an AD function.
- ITS Japan introduced the SIP-adus initiative, its topic areas, and the planned FOTs (2017-2019) that are going to test AD technologies on public roads and to improve user acceptance. Japan considers that roadworthiness testing and impact assessment should be considered together as a way to identify benefits and risks.

During the presentations and also during the discussion that followed, the importance of (international) cooperation was raised. This cooperation could take the following next steps:

- Harmonisation of regulation between Member States and regions or at least mutual recognition. This is critical for cross-border testing scenarios.
- Cooperation to develop cost efficient, harmonised vehicle validation
- Japan invited the audience to participate in Japanese open roads FOTs and SIP-adus (November 2017)
- Euro NCAP explained its cooperation activities on active safety with other NCAPs They explained how their activities may complement regulation that may set (not very strict) minimum performance
- The potential was discussed to extend PEGASUS scenario database to other AD functions, countries and stakeholders i.e. technical centres, traffic authorities, etc.
- Stakeholder cooperation: RTOs, Industry, Member States and other stakeholders should work together in order to solve the technical challenge. At some point, industry needs to jump in to solve the technical challenge and road authorities should support these efforts.

4.5. BO 05 - Big data, IoT, AI and deep learning

Organiser/Moderator: Sytze Kalisvaart, TNO.

Speakers:

- Tom Lüders, Hella
- Pieter Colpaert, Ghent University, IMEC
- Roberto Baldessari, NEC Europe Ltd.

Introduction

Modern vehicles are equipped with sensors monitoring the state of the vehicle itself and the world around it, thus becoming a source of big data. By applying artificial intelligence like machine learning and deep learning, they become learning devices as well. With the Internet of Things the cars will become a node in the network. In this session some key challenges of cars as sources of big data were discussed.

Vehicles use sensors to perceive the world around them. Verification of the sensors is an essential step towards automated driving, because the decision making in the automated car is based on the sensor output. However, sensor verification itself already brings some big challenges. The sensors produce a massive amount of data. A typical test setup has at least a number of cameras and radar and a LIDAR to determine the ground truth of the measurement. These sensors combined produce almost a gigabyte of data per second, which cannot be sent over the internet but needs to be recorded on a hard drive. This makes data transfer a slow process. In addition, the sensor output needs to be combined into a ground truth. This task still needs to be done primarily by humans, with the aid of suggestions by a deep learning algorithm. Typical standards require 100 000 km of driving for sensor verification, which means that millions of frames need to be annotated with the ground truth - is an immense task. Unfortunately re-using information from a previous test is not possible when validating a new sensor: the entire process needs to be redone.

An essential ingredient for connected automated driving is data sharing, for example on the infrastructure or traffic flow. For maximum re-use of data, the legal, technical, syntactic, and semantic interoperability needs to be raised. On the legal and syntactic side, open licenses/standards exist and are in use. On the technical side, the internet is already used to share data worldwide. The main challenges are therefore on the semantic level: how to access the data? The data interface should strike the golden mean between data publishing (cheap and reliable but user-unfriendly) and data services (expensive and unreliable but user-friendly).

On the technological side, object recognition appears to be a solved issue from an academic point of view; the current focus is on scene recognition. In the future, the software architecture abstraction might be foregone entirely, instead going directly from sensor input to path planning and control as a whole. Connecting cars with the Internet of Things can be done with existing technology, thus enabling connected driving. However, many challenges for connected automated driving still exist. Technical challenges include the definition of benchmarks to test against, how to make the burden of testing tractable, and how to ensure security, especially when cars are connected through the IoT.

Main outcomes and open issues identified

During the session, safety-related issues have been considered as the most important ones and different aspects/issues have been identified:

- The importance of the in-vehicle architecture that has a product-cycle of 5-10 years and therefore is a critical factor. The main elements are:
  - Hardware:
    - Digital maps that need to be continuously and accurately updated;
    - Sensors: whose raw data needs to be elaborated with other (redundancy of the sources) and "fused" into robust information
  - Software and communication: importance of the:
    - CAR2CAR consortium for the Vehicle-to-Vehicle and Vehicle-to-Infrastructure communication;
    - Automotive-Telecom Alliance for the deployment of the 5G mobile communication;
    - Cyber-security is becoming a fundamental aspect to be considered.
  - Importance of the subjects: Artificial Intelligence, Machine Learning, Internet of Things to build the applications.
- Validation, Certification and Authorisation of the new functionalities/systems/components.
- Affordability is a key success factor and the impact on the users with cost/benefit analysis is essential.
  A few systems seem to be ready for the broader market introduction:
  - Autonomous Emergency Braking,
  - Parking Assistance,
  - Lane Keeping Assistance,
  - Truck Platooning.

4.6. BO 06 - Human Factors & User awareness

Organisers/Moderators: Emma Johansson (Volvo Trucks) & Anna Schieben (DLR)

Speakers:

- Natasha Merat- Professor, Research Group Leader for Human Factors and Safety, ITS Leeds, UK
- Satoshi Kitazaki - Director, AIST Automotive Human Factors Research Center, Japan
- Trent Victor - Senior Technical Leader Crash Avoidance, Volvo Cars, Sweden.
- Andreas Keinath - Head of Usability, BMW Group, Germany

Introduction

The role of the driver is often considered to be diminishing when increased degree of automation is introduced in vehicles. However, vehicles today and in the future will offer different levels of automation and will be used in in different traffic environments. That is why humans will still play a central role as e.g.:

- *drivers* of these vehicles where their tasks and roles will shift according to the automation level.
- *other road users*, including drivers of manually driven vehicles as well as vulnerable road users (cyclists, pedestrians).
- *remote operators* of highly automated vehicles.

Proper design of the human-vehicle automation interaction is crucial in order to reach safe introduction of driving automation systems and driverless, automated driving system-dedicated vehicles and to ensure user acceptance and adoption.

Initial Human Factors related design recommendations have been suggested in order to support the design of safe, easy to use systems, ensuring positive outcomes from the implementation of driving automation systems whilst safe-guarding against potential downsides.

User-involved evaluation methodologies have been proposed which could capture intended as well as unintended effects of different levels of automation.

Main topics addressed

Driving automation systems can change the role of the human driver from an active operator of a vehicle towards a monitor or passenger. The session on **Human Factors and User Awareness** addressed challenges associated with the introduction of driving automation systems vehicles in mixed traffic environments, and outlined research needs within that domain.

Human Factors research supports the introduction of driving automation systems by providing knowledge and human-centred evaluation and design solutions to address different user groups with different needs (age, mobility behaviour, driving experience etc.) and cultural backgrounds.

Fundamental Human Factors challenges are to ensure safety, ease of use, trust, acceptance and comfort, for users/passengers of automated vehicles. Likewise, we shall ensure a safe and acceptable interaction with other road users including pedestrians and cyclists.

Key Human Factors research questions related to the above mentioned challenges are:

- to understand the interaction between humans and driving automation systems (in-vehicle and outside vehicle) at different levels of automation,
- to understand effects of vehicle automation on humans such as unintended use, skill degradation, trust, and motion sickness,
- to raise awareness and increase acceptance for automated driving,
- to adapt the vehicle automation to human needs and states and to establish adequate driver training,
- to derive interaction design concepts for the driving automation systems so that both the human driver and other humans in the surrounding sufficiently understand the capabilities and limitations of the vehicle.

The session on Human Factors and User Awareness addressed challenges associated with the introduction of driving automation systems in mixed traffic environments, and outlines current progress as well as future research needs. The two first presentations presented the international state-of-the art, followed by a description of the Human Factors results by industrial partners. The session was rounded up by a voting of the audience and discussion of CARTRE Statements (developed by the two specific CARTRE themes of interests on Human Factors and User Awareness) by the experts on the podium.

Main outcomes and open issues identified

The main outcomes of the session were the following:

- It is important to have a user centred design approach both in research as well as in development instead of designing and then hoping for (and measure) positive user experience, acceptance and high adoption. There is a strong need to study user interaction with vehicles in real world conditions. However, Human Factors research still need to iterate with more controlled laboratory settings/evaluations.
- There is a paradigm shift from looking at how to minimize secondary task engagement and how different types of secondary effect influence the causation of accidents and critical incidents. The new approach is to look if and how automation can actually be a distraction enabler. Will driving automation systems be the solution to distraction in traffic?
- The SAE levels of automation are often misunderstood by the general community including presentations at conferences on automated driving. Do the levels make sense since they are misinterpreted/ mistreated? For whom? One vehicle can contain several levels of automation. E.g. lower level 2 functions in certain Operational Driving Domains while level 4 only in other Operational Driving Domains. A level 5 function needs to be able to operate in any driving context a human driver would be able to handle. Thus, a vehicle without a steering wheel and pedals that is only able to run on certain roads (e.g. a campus) or in certain weather conditions is still level 4. A manufacturer can say that this is a level 2, 3, 4 function but what differs for the driver is whether s/he understands his/her role: “Am I in charge, are you? Do you drive or do I?”. There can be collaboration and situations where both driver and system co-exist but who has authority needs to be clearly indicated.
- Take over response time from automation to manual: Human factors research should not be about finding a specific figure of x seconds. Studies are showing ranges from 2-45 seconds or even minutes. It is important to look at quality of take over and what happens after a driver has regained control. A lot of work is on-going trying to find good ways to measure both driver alertness and general activation state, response times as well as quality of take over.
- Humans both over-trust automation and under-trust automation. For lower levels of automation drivers are sometimes not using the technology enough (low adoption rates) even though ACC and automatic braking systems have been proven to have a strong safety benefit. Drivers might at the same time over-rely on actual higher level of automation or systems they perceive to offer high level of automation especially if it works very well 99% of the time (described as “irony of automation” by Bainbridge, 1983).
- Driver training is often said to be key when introducing driving automation systems but if we rely on drivers to be trained – did we do our job properly? Does that mean functions in vehicles need to be standardised? There is a high risk relying on training for the systems to be safely used.
- In the session we had disagreement whether automation in vehicles needs to be clearly indicated to the surrounding environment, other road users etc. There are various pros and cons for indicating that an automated vehicle is driving in automated mode.
- The audience as well as the experts indicated a strong belief that people will change their behaviour after becoming accustomed to high level of automation in vehicles and that this will change the complete traffic system.

4.7. BO 07 – Digital IT Infrastructure and Connectivity

Moderator: Steve Phillips, General Secretary, CEDR

Speakers:

- Håkan Andersson, Director, ITS strategy ERICSSON
- Refi-Tugrul Güner, Head of Innovation and Standardization, KAPSCH
- Dr. Teodor Buburuzan, Leading Communication Engineer, Volkswagen
- Bob Banks, R&D Programme Manager, Vodafone, Germany

Introduction

Automated driving could leverage on the recent advances in telecommunication technologies (e.g. ITS G5, 4G/LTE/5G) and connectivity can extend the electronic horizon and the environment perception of on-board-sensors which have physical limitations. It can also work during harsh weather conditions (e.g. snow, fog, heavy rain) where some sensors are malfunctioning or providing significant errors. Several activities have been developed in the framework of EU funded projects (e.g. AutoNet2030, i-GAME, AdaptIVe) and EC initiative (C-ITS Platform - European Automotive-Telecom Alliance)

Main topics addressed

- Håkan Andersson
  - Automotive and C-ITS
  - Cellular-technology based V2X
  - Trials and Proof-of-concepts: Nordic Way, Convex, Kista 5G Test Network, BMW Driving Seoul
- Refi-Tugrul Güner:
  - C-ITS utilizing ITS G5 for V2X
  - Communication efficiency
  - Communication security (authenticity, integrity, pseudonymity and anonymity)
- Teodor Buburuzan:
  - Technology development roadmap
  - 5G including new use-cases and new technical requirements
  - ITS-G5 / 802.11p – Towards Cooperative Driving
- Bob Banks
  - Future of connected vehicle
  - Association and alliances
  - Current pilots (e.g. UK Cites (road and tracks); Germany LTE V2X pilot network)

Main outcome and open issues identified

This session involved various stakeholders, from telecom operators to industry. The focus was on the current activities and challenges related to the digital IT Infrastructure to support the deployment of connected and automated vehicles.

All the aspects related to connectivity were discussed including different technologies (ITS G5, LTE-V2X, LTE-advanced, 5G) and referring in particular to the challenges posed by the requirements of connected and automated vehicles e.g. safety, latency, reliability, localization, digital IT infrastructure etc. This took into account the different deployment phases/timelines of connected and automated vehicles.

The ITS G5 status and framework was presented considering frequency allocation, standards and evolution and complementary with other technologies.

C-ITS Platform activities are well underway for supporting C-ITS deployment. However, there are several topics with direct impact on the deployment process:

- certificate policy should focus on enabling a broad deployment in 2019 and integrate existing solutions and protocols;
- legal-basis for exchanging CAM and DENM information;
- challenging spectrum developments and the availability of harmonized norms;
- transparent policies regarding IPRs inside standards as well as clear guidelines that prevent an abusive use of SEPs and in consequence slow down innovation.

Associations and alliances (e.g. 5GAA and EATA) have been established to support collaboration among stakeholders. Several pilot sites have been set-up (e.g. UK CITE, Germany A9 LTE V2X pilot network) and projects are under development. For instance, the EATA Concorda project will focus on enabling services for highway chauffeur and high density truck platooning focusing on the following communication: LTE, ITS G5, LTE- V, MEC applications, network slicing, LTE broadcasting (GNSS offset, hazards and HD-map updates). The project will study business models responsibilities, safety concepts, quality of service, security and data protection, regulation and standardization.

4.8.BO 08 - Socio-economic impacts of CAD

Organiser: Satu Innamaa, VTT

Moderator: Satu Innamaa, VTT

Speakers:

- Scott Smith, Volpe Center, US DOT, US;
- Hiroaki Miyoshi, Doshisha University, Japan;
- Bart van Arem, TU Delft, The Netherlands;
- Torsten Geissler, BASt, Germany

Introduction

Connected and automated driving and transport technologies can have the potential to transform the world's road transportation system as a whole. Potential impacts are far reaching and complex. There are high expectations on what connected and automated vehicles shall be able to contribute to several societal goals. Some impacts will be direct and others in-direct, some intended and others unintended, and some will take place in short-term while others will take longer time to form.

Main topics addressed

The breakout session on Socio-economic impacts of CAD addressed methods for assessing impacts in different impact areas and underlying dependencies (in-direct impacts). It also provided examples on results obtained in the field of socio-economic impacts of connected and automated driving. Specifically, the topics coved by the presentations included:

- Scott Smith, VOLPE, US DoT
    - Framework for assessing the impacts

    - Different direct and in-direct impact, impact mechanisms
    - Areas of uncertainty: technology, policy, user response
    - Short review on US activities
- Hiroaki Miyoshi, Doshisha University
    - Safety impacts of level 1 & 2 automation systems
    - Monetary and non-monetary losses
    - Economic benefits of automated driving systems for users and non-users
- Bart van Arem, TU Delft
    - Spatial and transport impacts of CAD
    - Longer-term in-direct implications of CAD
    - Scientific challenges in this area
    - STAD activities
- Torsten Geissler, BASt
    - Cost-benefit assessment framework of CAD
    - Existing tools and knowledge
    - Process threats to Socio-economic Impact Assessment, different dimensions

Main outcomes and open issues identified

- Direct impacts include safety, vehicle operations, energy/emissions and personal mobility
- Indirect impacts include network efficiency, travel behavior, public health, infrastructure, land use and economic impacts
- Direct impacts provide a foundation for assessing the indirect impacts that are of interest to society
- Need for a clearinghouse on research, to facilitate sharing
    - What data are collected?
    - What methods (models) are used?
    - What are the most important key performance indicators?
    - What results are reported?
- Understand the big picture, to ensure the right data are collected

- Passive safety technologies have contributed significantly to the reduction of economic losses due to road traffic accidents; diffusion of active safety technologies will be needed in order to reduce the economic losses further.
- Economic benefits of the automated driving systems will be enjoyed not only by the users but also by many other economic entities; redistribution of costs burden among them will be necessary.

- The impacts of driver assistance/partial automation were related to comfort, efficiency, safety, costs; the impacts of conditional/high automation will also include mode choice, location choice, urban and transport planning; car driving will become more attractive.
- Spatial implications of CAD will include: geometric redesign of infrastructure, increasing sprawl of residential, commercial and employment locations, concentration of activities, combinations with car sharing and electric driving.
- Much progress on short term and small-scale impacts on driver behaviour and traffic flow. Research on longer term, indirect, wider scale impacts on mobility, logistics, residential patterns and spatial-economic structure in its infancy.
- Research shows that automated autonomous vehicles may decrease the road network capacity by 5% but automated cooperative vehicles may increase it by 10-15% and have 10% decrease in value of time for commuting and business car trips.

- Likely developments: in-depth measurements of impacts based on FOT and pilot data, as well as broader view resulting in multi-actor multi-domain assessment.

- All factors point towards more complex and time-consuming analyses. Can we afford it? – Constraints in terms of budget/time.
- Assessment processes are highly automated but e.g. data mining, arranging input data and drawing conclusions (How to generalise from the details, etc.) still involves human work, skills and time.
- Compensation might be sought in introducing more rule-of-thumb elements (reducing level of detail) in some parts of the assessment.
- Guiding star: Be economic in the Socio-economic Impact Assessment.

Open discussion

- Societal impact is underrepresented in this conference, more knowledge is needed on how to optimise the benefits of automated driving in cost-benefits analyses, i.e. how to turn insights into actions, what are the opportunities?
    - Make decision makers aware of impacts, create awareness
    - "Learning by doing"
- What steps do we need to take next to get the big picture of the socio-economic impacts of CAD?
    - Safety is on top of the list
    - More economists to do these studies
    - Monitoring of use of all automated vehicles now on the road, look at acceptance and share data

4.9. BO 09 - Shared economy - automation and electro-mobility

Organiser/s: VDI-VDE (Gereon Meyer)

Moderator/s: Gereon Meyer

Speakers:

- Prof. Wolfgang Gruel, Stuttgart Media University, Moovel Hochschule der Medien;
- Luc Texier, Head of Business Development, Bestmile;
- Dr. Wolfgang Dettmann, Director Funding Projects & Coordination, Infineon / Vice Chair Smart Systems Industry, EGVIA;
- Dr. Daniel Watzenig, Head of the E/E & Software department, Virtual Vehicle Centre, Graz;
- Marius Macku, Senior Associate, Public Policy & Government Relations, UBER

Introduction

Automation and electrification of road transport are both revolutionary topics, but considered in isolation, market acceptance is not guaranteed. In combination, and supported by new user and business models of the shared economy, however, automated and electrified vehicles can be brought into market with a social and economic impact. The synergies of automation, electrification and shared mobility can thus be expected to cause disruptive innovation. Additional synergies of automation and electrification can be found at the level of electric and electronic architecture. Those synergies can also be used independent of sharing concepts in form of automated light weight vehicles (no passive safety systems necessary), either resulting in longer fully electric driving range or decreased battery size of the vehicles. The topic of this session reflected current discussions on technology development, business models and user acceptance e.g. in the framework of European Technology Platforms, the Transportation Research Board and the International Energy Agency's Technology Collaboration Programme Hybrid and Electric Vehicles (HEV TCP,

where this session was motivated by the respective working group Task 29 “Electrified, connected and automated vehicles”).

Main topics addressed

The opportunities and challenges of electrification in combination with connectivity and automation of road vehicles have been discussed. The question is how automated driving changes the mobility sector and consequently changes our lives in cities. The general benefits of automated driving result in an increase in attractiveness. This in turn increases the travel volume, leading to more congestion and finally to a gain in traffic. Furthermore autonomous vehicles could be an attraction for people to move out of cities, resulting in a longer everyday commute and leading to a wider urban sprawl. All of this might increase the traffic use. Therefore, we should consider autonomous driving as a tool to find smart alternatives for our everyday mobility. Challenges like security and privacy issue also have to be taken into account. Additionally, new legal frameworks for automated driving have to be developed and implemented. The role of shared economy as an enabler for disruptive mobility solutions has been highlighted throughout the session. Although there are already a few car sharing operators on the market, there is still some need for further changes e.g. from vehicle sharing to a ride sharing. To make the use of autonomous vehicles as convenient and efficient as possible, sharing concepts have to be brought together with public transport, especially solving the first and the last mile problem. For further increase in attractiveness, vehicles that can be transformed regarding their task would make their usage (goods and/or passenger transport) more flexible. Moreover, the user perspective as an important factor for the implementation of automation and electrification has been considered. Finally, roadmaps related to automation (European roadmap smart systems for automated driving) and electrification (Roadmap for electrification of road transport) have been presented and the need for high performance technologies (control towers for automated driving) has been discussed.

Main outcomes and open issues identified

Autonomous vehicles are a first step towards smart mobility, but it also needs to go along with electrification, shrinking of vehicle size and shared economy. Automation by itself could possibly lead to unintended consequences as for example the initial increase in traffic use due to the high attractiveness of automated driving and additional user groups (elderly, young, etc.) mobilised. To reduce the number of car ownership, car sharing is a good solution. However, that might not necessarily help to reduce road use und congestion as well as emissions. Therefore, we need to make more efficient use of vehicles. One possibility to go along with automation is electrification to reduce overall emissions. A second possibility is ride sharing as a smart alternative to car sharing, which would directly cut down road use. Those sharing concepts need to be brought together with public transportation to provide a wide range of transport possibilities and make urban transport convenient and attractive for its users. Further changes have to be done regarding the size of the vehicles and their use. Small cars and vehicles that can be transferred regarding its special use should be preferred for our future mobility. Moreover, concepts like pay per use could help to decrease the road traffic.

Nevertheless, there are still some open issues regarding the broad use of automated vehicles in general and also regarding special use within the shared economy. Legal frameworks have to be developed and implemented and data security and privacy have to be further improved.

In summary, automated driving has to go along with electrification and shared economy to make changes towards an environmental-friendly and efficient, smart mobility in the future and to overall improve our lives in cities.

5. Evening event and demonstration

A networking evening was held after the first day (Monday 3 April) at Autoworld, within the vintage car museum itself.

The evening provided an opportunity to network, visit the museum, with possibility to experience CAD demonstrations.

The coordinators of CARTRE and SCOUT gave a short thank you speech and Urban Wass from EUCAR welcomed everyone to this gathering event.

Two demonstrations were on display:

Valet Parking feature: Vehicles could park themselves. The system was trigged using a smartphone. The cars would drive from a drop-off position to the parking spot and back-up into it. Using the smartphone again, the vehicle was triggered to drive back to the pick-up location. The demonstration was based on the results of the EC-funded project AdaptIVe which will end in June. IKA was the demonstration organiser.

Vehicle following mode was demonstrated by TNO as part of an IoT network. The manoeuvers demonstrated Gap closing, Hook up and CACC. The demonstration consisted of 2 loops of the circuit realized at the parking lot in front of the social event building. Beside the driver, a TNO manager was sitting in the car to explain the scope of the manoeuvers, emphasizing the benefits of having Connected Vehicles to perform the automated driving functionalities. The demonstrations were facilitated by the AUTOPILOT EC-funded pilot project.

6. Conclusions

The 1st European Conference on Connected and Automated Driving attracted over 540 industry, authority and academic representatives. The conference showed an important mixture of policy related and technology related sessions.

From the various sessions the following conclusions can be drawn:

- The involvement of four EC DGs illustrates how broad the impact of Connected and Automated Driving is. Further alignment of policy and research is desired.
- For shared and automated mobility services, real-life conditions large scale pilots and cross border testing, in different urban environments and with different categories of shared automated vehicles, are needed to determine the success factors and constraints.
- For the physical and digital infrastructure, the costs savings of CAD are only reached when CAD is widely adopted. Decisions on changes to infrastructure need to be made now where much uncertainty is still present.
- The key in-vehicle technology enablers require a common view on the future car electronics platform. They will be based on high speed and secure wireless communication, new and highly and integrated sensors and accurate positioning. Software engineering and sensor fusion are crucial.
- For vehicle validation, CAD still presents a methodological challenge and a major cost factor. Scenario based safety validation seems a promising approach. Cross-border and international collaboration and harmonisation is crucial for competitive speed.
- For artificial intelligence, benchmarking and validation of the AI enabled sensors and automated driving functionality is still a major issue. For sensor validation, annotation of raw data requires a huge effort. AI work is shifting from object recognition to scene recognition.
- More knowledge is needed on the socio-economic impacts of driverless vehicles as well as a better understanding of the methodology and data needed therefor.
- Human factors: a user centred design approach should be adopted from the start in both research and development; there is a strong need to study user interaction with vehicles in real world conditions, with more controlled laboratory settings/evaluations.
- Automated driving has to go along with electrification and shared economy to make changes towards an environmental-friendly and efficient, smart mobility in the future and to overall improve our lives in cities.

7. References

1. 1st European Conference on Connected and Automated Driving (CAD), EC links: https://ec.europa.eu/transport/themes/its/events/2017-cad-conference_en; CARTRE link: https://connectedautomateddriving.eu/conference/
2. All presentations of the conference are accessible on CARTRE website: https://connectedautomateddriving.eu/conference/
3. Picture of the conference are accessible on: https://connectedautomateddriving.eu/conference-pictures/
4. Overview video, https://youtu.be/XFCKqNZl2l8
5. Recordings of the sessions are accessible on:
    a. Day 1, 03.04.2017, Morning sessions (three plenaries and breakout session 'Shared and automated mobility services for our cities'), 9:15 – 13:15 https://webcast.ec.europa.eu/cad-day-1a
    b. Day 1, 03.04.2017, Afternoon sessions (breakout session 'Big Data, IoT, AI, Deep Learning' and two plenaries), 14:45 – 17:30 https://webcast.ec.europa.eu/cad-day-1b
    c. Day 2, 04.04.2017, Morning sessions (five plenaries), 9:00 – 13:00 https://webcast.ec.europa.eu/cad-day-2a
    d. Day 2, 04.04.2017, Afternoon sessions (breakout session 'Digital IT infrastructure and connectivity' and two plenaries), 14:15 – 16:30 https://webcast.ec.europa.eu/cad-day-2b
6. Strategic Transport Research & Innovation Agenda, STRIA, http://ec.europa.eu/programmes/horizon2020/en/news/towards-strategic-transport-research-innovation-agenda-stria
7. Cooperative, connected and automated mobility (C-ITS) platform, https://ec.europa.eu/transport/themes/its/c-its_en
8. High Level Roundtable on Connected and Automated Driving: https://ec.europa.eu/digital-single-market/en/news/cooperative-connected-and-automated-mobility-stepping-efforts-frankfurt
9. High Level Group on Automotive Industry 'GEAR 2030'; https://ec.europa.eu/growth/sectors/automotive/policy-strategy_en
10. EU-US-Japan Trilateral Working Group on Road Vehicle Automation; no specific webpage; see http://vra-net.eu/news/trilateral-eu-us-japan-wg-on-automation-in-road-transportation-meeting-14-january-2016/

Annex 1: Survey results

Participant statistics

Day 1 breakout sessions 12:00-13:15	Approved	On site	Grand Tota
In-vehicle technology enabler	96		96
Physical and Digital Infrastructure	94		94
Shared and automated mobility services for our	343	1	344
Grand Total	**533**	**1**	**534**

Day 1 breakout sessions 14:45-16:00	Approved	On site	Grand Tota
Big Data, IoT, AI, Deep Learning	341	1	342
Human Factors & User awareness	97		97
Vehicle Validation/Certification, Roadworthines	95		95
Grand Total	**533**	**1**	**534**

Day 2 breakout session 14:30-15:45	Approved	On site	Grand Tota
Digital IT Infrastructure & Connectivity	344	1	345
Shared economy - Automation and Electro-mol	89		89
Socio-economic Impact of CAD	100		100
Grand Total	**533**	**1**	**534**

Social Networking Event, 18:00 - 20:00	Approved	On site	Grand Tota
Yes	473	1	474
Grand Total	**473**	**1**	**474**

Status	Approved	On site	Grand Tota
Participant	452	18	470
Press	5	3	8
Speaker	68		68
Staff	23	1	24
Moderator	9		9
Exhibitor	5		5
Grand Total	**562**	**22**	**584**

Annex – Survey statistics

Title	Participant	%
Mr	443	75,86%
Ms	141	24,14%
Grand Total	**584**	**100,00%**

Organisation Type	Participant	%
Other	116	21,68%
Industry (automotive)	109	20,37%
Research organisation	91	17,01%
Association	54	10,09%
Small or medium sized enterprise (SME	36	6,73%
European Union institutions	34	6,36%
Secondary or higher education establis	26	4,86%
Industry (other)	25	4,67%
Industry (telecom, IT)	25	4,67%
Non-Governmental Organisation (NGO)	12	2,24%
Non-profit organisation	6	1,12%
International organisation	1	0,19%
Grand Total	**535**	**100,00%**

FILTER RESULTS (Hold CTRL for multiple selections)

Registration Status

Approved	Cancelled
No show	On site
Pending	Refused
(blank)	

Country	Participant	%
Belgium	171	30,54%
Germany	70	12,50%
Spain	41	7,32%
France	38	6,79%
Netherlands	38	6,79%
Sweden	31	5,54%
United Kingdom	27	4,82%
Portugal	19	3,39%
Austria	17	3,04%
Japan	17	3,04%
Italy	16	2,86%
Finland	12	2,14%
Ireland	10	1,79%
Turkey	8	1,43%
Czech Republic	7	1,25%
United States	6	1,07%
Romania	5	0,89%
Luxembourg	5	0,89%
Denmark	4	0,71%
Singapore	4	0,71%
Greece	3	0,54%
Switzerland	3	0,54%
The Netherlands	2	0,36%
Norway	2	0,36%
Estonia	1	0,18%
Hungary	1	0,18%
Russian Federatio	1	0,18%
United Arab Emira	1	0,18%
Grand Total	**560**	**100,00%**

Nationality	Participant	%
Germany	77	14,95%
France	56	10,87%
Belgium	49	9,51%
Netherlands	44	8,54%
Spain	43	8,35%
Italy	36	6,99%
United Kingdom	28	5,44%
Sweden	25	4,85%
Japan	22	4,27%
Portugal	18	3,50%
Austria	17	3,30%
Finland	15	2,91%
Ireland	10	1,94%
Greece	10	1,94%
United States	9	1,75%
Denmark	7	1,36%
Turkey	7	1,36%
Czech Republic	7	1,36%
Romania	5	0,97%
Luxembourg	4	0,78%
Poland	4	0,78%
Estonia	3	0,58%
Norway	2	0,39%
Switzerland	2	0,39%
India	2	0,39%
Singapore	2	0,39%
Bulgaria	2	0,39%
Brazil	1	0,19%
Korea, Republic O	1	0,19%
Germany	1	0,19%
Yemen	1	0,19%
Egypt	1	0,19%
China	1	0,19%
Russian Federatio	1	0,19%
Canada	1	0,19%
Lithuania	1	0,19%
Grand Total	**515**	**100,00%**

Shared and automated mobilit	Participan
TRUE	302

Physical and digital infrastructu	Participan
TRUE	236

In-vehicle technologies	Participan
TRUE	293

Vehicle validation/certification,	Participan
TRUE	204

Big data, IoT, Artificial intellige	Participan
TRUE	283

Human & User aspects	Participan
TRUE	220

Digital IT infrastructure & Conn	Participan
TRUE	245

Socio-economic impact asses	Participan
TRUE	177

Shared economy – automation	Participan
TRUE	214

Registration Status	Participants
Approved	562
Cancelled	63
No show (Approved who never	147
On site	22
Pending	3
Refused	85
Grand Total	**882**

ACTUAL PARTICIPANTS
584

Where did you hear about the 1st CAD conference?	#	%
Another website	13	8,90%
Another website;Invitation	2	1,37%
DG RTD/Transport web-page	25	17,12%
Invitation	47	32,19%
Other	51	34,93%
Promotional material (posters, postcards, etc.)	2	1,37%
Promotional material (posters, postcards, etc.);Invitation	1	0,68%
Twitter (@EUScienceInnov, #EUCAD2017)	2	1,37%
DG RTD/Transport web-page;Another website	1	0,68%
DG RTD/Transport web-page;Promotional material (poste	1	0,68%
DG RTD/Transport web-page;Invitation	1	0,68%
Grand Total	**146**	**100,00%**

Did you attend the 1st CAD conference in Brussels, B	#	%
No, I did not attend the event, and I did not (yet) follow the	3	2,05%
No, I did not attend the event, but I did follow it via the rec	4	2,74%
Yes, I did attend the event	139	95,21%
Grand Total	**146**	**100,00%**

On-line registration	#	%
-	4	2,74%
--	3	2,05%
+	42	28,77%
++	93	63,70%
Not Applicable	4	2,74%
Grand Total	**146**	**100,00%**

On-site registration	#	%
-	4	2,74%
+	30	20,55%
++	63	43,15%
Not Applicable	47	32,19%
--	2	1,37%
Grand Total	**146**	**100,00%**

Signposting inside the venue	#	%
-	7	4,79%
+	55	37,67%
++	69	47,26%
Not Applicable	14	9,59%
--	1	0,68%
Grand Total	**146**	**100,00%**

Catering	#	%
-	35	23,97%
--	34	23,29%
+	60	41,10%
++	9	6,16%
Not Applicable	8	5,48%
Grand Total	**146**	**100,00%**

Twitter (@EU_CAD2017, @I	#	%
-	10	6,85%
+	43	29,45%
++	24	16,44%
Not Applicable	68	46,58%
--	1	0,68%
Grand Total	**146**	**100,00%**

CAD web-page	#	%
-	19	13,01%
+	68	46,58%
++	46	31,51%
Not Applicable	13	8,90%
Grand Total	**146**	**100,00%**

Opening panel discussion	#	%
-	8	5,48%
--	2	1,37%
+	58	39,73%
++	64	43,84%
Not Applicable	14	9,59%
Grand Total	**146**	**100,00%**

Plenary sessions	#	%
-	5	3,42%
--	3	2,05%
+	66	45,21%
++	69	47,26%
Not Applicable	3	2,05%
Grand Total	**146**	**100,00%**

Breakout sessions	#	%
-	15	10,27%
--	2	1,37%
+	65	44,52%
++	58	39,73%
Not Applicable	6	4,11%
Grand Total	**146**	**100,00%**

In-vehicle technology enabler (03/	#	%
-	7	4,79%
+	23	15,75%
++	14	9,59%
Not Applicable	102	69,86%
Grand Total	**146**	**100,00%**

Exhibition booths	#	%
-	47	32,19%
--	8	5,48%
+	63	43,15%
++	12	8,22%
Not Applicable	16	10,96%
Grand Total	**146**	**100,00%**

Vehicle Validation/certification Rc	#	%
-	5	3,42%
--	2	1,37%
+	24	16,44%
++	10	6,85%
Not Applicable	105	71,92%
Grand Total	**146**	**100,00%**

Social networking event and c	#	%
-	10	6,85%
--	2	1,37%
+	48	32,88%
++	59	40,41%
Not Applicable	27	18,49%
Grand Total	**146**	**100,00%**

Big Data, IoT, AI, Deep Learning	#	%
-	10	6,85%
--	4	2,74%
+	48	32,88%
++	18	12,33%
Not Applicable	66	45,21%
Grand Total	**146**	**100,00%**

Shared and automated mobili	#	%
-	8	5,48%
--	3	2,05%
+	43	29,45%
++	29	19,86%
Not Applicable	63	43,15%
Grand Total	**146**	**100,00%**

Human Factors & User awarenes	#	%
-	5	3,42%
+	29	19,86%
++	23	15,75%
Not Applicable	88	60,27%
--	1	0,68%
Grand Total	**146**	**100,00%**

Physical & Digital Infrastructu	#	%
-	7	4,79%
--	2	1,37%
+	33	22,60%
++	15	10,27%
Not Applicable	89	60,96%
Grand Total	**146**	**100,00%**

Digital IT Infrastructure & Connec	#	%
-	11	7,53%
+	42	28,77%
++	24	16,44%
Not Applicable	69	47,26%
Grand Total	**146**	**100,00%**

Socio-economic Impact of CAD (04	#	%
-	6	4,11%
+	32	21,92%
++	16	10,96%
Not Applicable	90	61,64%
--	2	1,37%
Grand Total	**146**	**100,00%**

Shared Economy – Automation & I	#	%
-	3	2,05%
+	27	18,49%
++	16	10,96%
Not Applicable	100	68,49%
Grand Total	**146**	**100,00%**

Overall, to what extent were your e	#	%
Excellent	46	31,51%
Good	71	48,63%
Insufficient	4	2,74%
No opinion	1	0,68%
Sufficient	24	16,44%
Grand Total	**146**	**100,00%**

Age	#	%
18-30	14	9,59%
31-45	63	43,15%
46-64	63	43,15%
65+	6	4,11%
Grand Total	**146**	**100,00%**

Would you attend another EU-orga	#	%
No	2	1,37%
Yes	144	98,63%
Grand Total	**146**	**100,00%**

Would you recommend that the Eu	#	%
No	7	4,79%
Yes	139	95,21%
Grand Total	**146**	**100,00%**

I gained a better understanding of CAD	#	%
TRUE	72	49,32%
FALSE	74	50,68%
Grand Total	**146**	**100,00%**

I gained an overview of current CAD poli	#	%
TRUE	109	74,66%
FALSE	37	25,34%
Grand Total	**146**	**100,00%**

I networked with people from other cour	#	%
TRUE	89	60,96%
FALSE	57	39,04%
Grand Total	**146**	**100,00%**

I networked with people from other sect	#	%
TRUE	64	43,84%
FALSE	82	56,16%
Grand Total	**146**	**100,00%**

I met potential project collaborators	#	%
TRUE	36	24,66%
FALSE	110	75,34%
Grand Total	**146**	**100,00%**

I gained ideas for future projects	#	%
TRUE	46	31,51%
FALSE	100	68,49%
Grand Total	**146**	**100,00%**

I learned more about CAD research and	#	%
TRUE	80	54,79%
FALSE	66	45,21%
Grand Total	**146**	**100,00%**

I gained little benefit from the event	#	%
TRUE	5	3,42%
FALSE	141	96,58%
Grand Total	**146**	**100,00%**

Other	#	%
TRUE	101	69,18%
FALSE	45	30,82%
Grand Total	**146**	**100,00%**

Suggestions for future events

The following suggestions only reflect the opinion of their authors.

Suggestions for future events - Please note any suggestions (if any) on how to improve similar EU-organised events on CAD?
I would try to introduce a start-up "pitch" or presentation (5-7 min. each) to get the "new" feeling of CAD in this conference beside all the political debates. Some technical sessions would also help to increase the attractiveness.
Avoid any speaker tempting to promote his/her own products/firm, as we have has during the Connectivity and the Big Data sessions
As a researcher at industry I preferred the breakout sessions much more than the high level plenaries. I assume that's a bit of a challenge when you have that wide of an audience. Would have liked more technical sessions as well on vehicle technology. And longer sessions to allow for more interaction with audience as well as talks/presenters. And a pity there was so many parallel sessions. I often enjoy going to sessions which normally doesn't fit with my primary research field - to learn something completely new as well as bring in new ideas.
The amount of presentations was too dense. Maybe next time I would suggest having more space for discussions with each other.
I would highly appreciate it, if there would be room for exchanging information on concrete outcomes of running EU funded projects on CAD. The combination with side events later on in the week was excellent
Less security gates, better catering, more interactivity / networking opportunities
Involve end users such as professional drivers and fleet operators who were not sufficiently represented
Overall it was excellent, but here are a couple of things that could be improved: Catering-wise, some fruit or other healthy options would have been good; it was all sandwiches (more than enough though) with zero salad, very large unhealthy desserts, and the only fruit was made of plastic for display! Also the biscuits ran out before many people got any in the breaks. (The food was really good at Volvo Truck for the 3rd day events though.). Registration-wise, it was good for the main event but not for the 3rd day side events, where there was no automatic confirmation at all. I wanted some definite confirmation before booking hotels and travel!
Best plenary session by far was "EU Member States programmes on connected and automated driving"; Unfortunately speakers were urged to make their intervention extremely short.
A bit more time between the tight schedule of activities for networking and social get together
Longer breakout sessions with possibility to go deeper into different topics
It would be good to have broader representation from the industry - there was no one there from the aftermarket.
Keep up with these events, excellent moderator Katrina Sichel. Improve the space and time of the demonstrations and the Exhibition booths.
Maybe more speakers from academia and the insurance industry. It would be great if this could be a early event!
Ask companies and start-ups that actually value already
Too many sessions in parallel, I could not attend everything I wanted
Although the experience and information provided by panellists were so valuable more time for comments and questions from floor would enhance the discussion.
Further develop the excellent side events, exhibitions & demonstrations.
Unfortunately, due to other meetings, I could not attend the social event. I would suggest to provide more opportunities and organisations for contacts during the conference.
Improve the registration process and give possibilitity to attend on site more people
The discussions were more like short presentations and it didn't evolve naturally into a discussion. I also

hoped to have a bit more specific information about all the projects in Europe. A few countries are very active and I would have liked to hear what they have done, what they want to do in the near future and what the long term goal is.
More room for discussion, Q&A and interaction with the audience in panel debates. More technology than policy, statements.
There may also be sub events, basicly more focused on some dedicated topics.
Try to source speakers that are considered leading experts in their field so they can provide a background for the discussions in the breakout sessions
Please provide a common road map as starting point. It was highly confusing switching between visions, research, eventualities and realities.
Reduce the number of speakers during the sessions and allow for more interaction/discussion with the audience.
Please improve availability to breakout sessions. Organisation of this seemed somewhat arbitrary and was not monitored heavily at the venue.
Get speakers that have something other to represent than their business ideas!
Some countries were not represented at all (both business and gov) while some were simply overrepresented in the panel discussions
The event was a good overview but there wasn't anything particularly new presented or discussed. the breakout sessions especially on the socio-economic impact of CAD was too technical focused. it was a missed opportunity to be very dynamic and talk about CAD in a way that the average person can understand and engage with
The Commission must ensure better participation of women in the panel discussions. There are women experts in all fields and should make the effort to engage them. The panels themselves would probably become a lot more interesting.
Bring more leaders & thinkers also from other countries Bring innovators, there are many great start-ups who are active in the field
more interaction with audience, smaller sessions
The venue should be big enough to accommodate all interested to participate.
Should be held every 2 years--key message is that Comm DGs work together
There may also be sub events, basically more focused on some dedicated topics.
Please give more possibilities for spreading the number of people that could attend the event.
Consider organizing a B2B session for pre-arranged 1-to-1 meetings A participant's list / contacts would be useful
More depth, more findings from the projects, more research findings, more participation from member states' programs.
Keep up with these events, excellent moderator Katrina Sichel. improve the space and time of the demonstrations and the exhibition stands
more 2 way communication and discussion

Recommendations for improvement

The following recommendations only reflect the opinion of their authors.

Please share with us any further comments or recommendations to improve this type of conference:
As a researcher at industry I preferred the breakout sessions much more than the high level plenaries. I assume that's a bit of a challenge when you have that wide of an audience. Would have liked more technical sessions as well on vehicle technology. And longer sessions to allow for more interaction with audience as well as talks/presenters. And a pity there was so many parallel sessions. I often enjoy going to sessions which normally doesn't fit with my primary research field - to learn something completely new as well as bring in new ideas.
More focus on the transition period. Involvement of end users, professional drivers and fleet operators representatives.
It is a good and strong concept to bring the quadruple helix (government authorities, research, industry and users/consumers) together!
Due to the extension and importance of CAD in the future, this event should be done in 3 days, in order to give more time to the debate with the audience.
Ideally, Member states representative should have a louder voice
Further develop the excellent side events, exhibitions & demonstrations.
I recommend more specialised breakout sessions. Excellent event overall.
The days were packed with interesting speakers so I would definitely come back. Just a bit more in depth would be nice.
Next time have it in a location with some "real" action, to allow true demonstrations. Take advantage of all that goes on. Sweden should be a logical place for such a conference!
make somewhat better lunches, e.g. Belgium gas station sandwiches are substantially better
Get support from external experts on who to invite as speaker to the event. There was hardly any structure in any of the panels or session, no leading questions, the content was simply poor. Good for networking though.
The Commission must ensure better participation of women in the panel discussions. There are women experts in all fields and should make the effort to engage them. The panels themselves would probably become a lot more interesting.
The reception on the first morning at 8AM was BADLY managed, we were asked to be there very early, and when we arrived the reception team wasn't ready and we had to wait for them to get ready. This is not kind
organise more interaction with the audience, more parallel sessions or extended duration to accomodate more sessions
Better mix of policy and research - the April 2017 event was quite policy-oriented
Very well organised-- for future-- more high level speakers- CEOs
This was a wonderful first meeting. I hope there will be more. More of the world's research on CAD is being done in EU -- bring it forward
Due to the extension and importance of CAD in the future, this event should be done in 3 days, in order to give more time to the debate with the audience.
Less politically correct contributions and more focus on the real issues and dilemma's

Annex 2: Participants

Last name	First name	Company
GESSNER	Wolfgang	
Vallejos	Jorge	
Keating	David	2025AD
Doering	Marcel	3M
Nuyttens	Rik	3M Company
Allison	Matt	Access Partership
Jonnaert	Erik	ACEA
Kloos	Alfred	ACEA
VANTOMME	Joost	ACEA
Veh	Ulrich	ACEA
May	Claudia	ADAC e.V.
Nissen	Michael	ADAC e.V.
Stoyanov	Hristiyan	AdaptIVe Project
Nikolau	Stella	ADAS&ME project
Zube	Manfred	Adient Engineering and IP GmbH
Walravens	Jean	Agency for Roads & Traffic
Di Gennaro	Federico	AISCAT
BAURENS	Benoit	AKKA Technologies
Al-Gazali	Osama	AlbrechtConsult GmbH
Ledwon	Benjamin	ALDE
Phillips	Alexandra	Allen & Overy
Lymes	Thomas	Alliance Renault-Nissan
amselem	jacques	allianz
ANNESE	LEONARDO	ANAS S.P.A.
Netto	Karen	Anglicity
Bento	Sofia	ANSR
Fonseca	Ricardo	ANSR - Portugal National Road Safety Authority
Rosiers	Luc	AP
Boulnois	Wallerand	APCO Worldwide
Aparicio	Andrés	Applus IDIADA
Arrúe	Álvaro	Applus IDIADA
Wartnaby	Charlie	Applus IDIADA
Pillado	Marcos	Applus+ IDIADA
Damiani	Alessandro	APRE Italian Agency for the Promotion of European Research
Amelink	Maarten	Arcadis the Netherlands
De Simone	Fabrizio	ARCTURUS GROUP
Harrer	Manfred	ASFINAG
Hintenaus	Dieter	ASFINAG
Kindler	Holger	Association of German Chambers of Commerce and Industry (DIHK)
Adler	Martin	AtAdlerAdvisory
PAGNY	ROGER	Atec-ITS France
Tapié	Léonard	Athenora
Spyra	Henriette	Austrian Ministry of Transport, Innovation & Technology
Böhm	Martin	AustriaTech
Russ	Martin	AustriaTech Gmbh
VAVALIDIS	KYRIAKOS	AUTOLIV
SENCERIN	Jean Francois	Autonomous Vehicle PFA/NFI
Affenzeller	Josef	AVL List GmbH
Pfluegl	Horst	AVL List GmbH
Tosun	Orhan	Bantboru San Tic A.S.
Geissler	Torsten	BASt
Maes	Julie	Belgian Road Safety Institute
Sehgal	Sunil	Belron International

Last name	First name	Company
Nees	Gerd	Be-Mobile
Dijkink	Lotte	Benelux Business Roundtable
van der Niet	André	Benelux Union
Texier	Luc	Bestmile
Relange	Mathieu	Bird & Bird LLP
Federle	Anne	Bird&Bird LLP
Bishop	Richard	Bishop Consulting
Molin	Helge	BMVIT
Gräter	Armin	BMW
Keinath	Andreas	BMW Group
Nuotatore	Pietro	Bode
Tosun	Mehmet Oğuz	Bogazici University
HÄCKEL	MARKO	BOSCH
Vavassori	Roberto	BREMBO SPA
Wevers	Kees	BrightAngel ITS
Moura	Lara	Brisa Innovation
Saile	Dirk	Bundesverband Güterkraftverkehr Logistik und Entsorgung (BGL) e.V.
Ahearn	Jeff	Cartell.ie
Whelan	Keith	Cartell.ie
Dolado	Julio	CDTI
Petrescu	Alexandre	CEA
STREE	Bernard	CEA
Phillips	Steve	CEDR
Felizardo	José Rui	CEiiA
Silva	Helena	CEiiA
Vicente	Carmen	Cellnex Telecom
Kay	Alison	Centre for Innovative Human Systems, School of Psychology, Trinity College Dublin
Guinea	Iker	Centro de innovación de infraestructuras inteligentes
Mitsakis	Evangelos	CERTH-HIT
Cervioni	Giovanni	CETM
OSORO	kERMAN	CIE AUTOMOTIVE
Ivari	Mikael	City of Gothenburg
Blom	Geert	City of Helmond
Kahmann	Chris	CK
Di Stefano	Amalia	CLEPA
Doraczynska	Katarzyna	CLEPA
Mc Millen	Stephen	CLEPA
Thibaudat	Pierre	CLEPA
de Vries	Sigrid	CLEPA - automotive suppliers association
Coda	Alessandro	CLEPA - The European Association of Automotive Suppliers
ALBURNO	PAOLO	CLEPA European Association of Automotive Suppliers
RIOU	Yves	CNPA
Blakemore	Tim	Commercial Vehicle Engineer
Ahonen	Salla	Confederation of Finnish Industries EK
De Vreeze	Marije	Connekt / ITS Netherlands
Collins	Desmond	Continental
Försterling	Frank	Continental
Hofmann	Karsten	Continental
Mages	Mark	Continental
Salbert	Thomas	Continental
Ceauca	Florian Catalin	Continental Automotive Romania
Nicosevici	Tudor	Continental Automotive Romania
Razvan	Jurca	Continental Automotive Romania
Regep	Cezar	Continental Automotive Romania

Last name	First name	Company
Son	Andrei	Continental Automotive Romania
Lauxmann	Ralph	Continental Teves AG & Co.oHG
Cruz	Pedro	CONTROLAR - Innovating Industry
Diels	Cyriel	Coventry University
Kanarachos	Stratis	Coventry University
Vincent	Kevin	Coventry University
Kahmann	Siobhan	Covington & Burling
DAFONTE	PABLO	CTAG
Paul	Ana	CTAG
Sánchez	Francisco	CTAG
Nielsen	Thomas A. S.	Danish Road Directorate/Vejdirektoratet
Svendsen	Nicklas Vigand	Danish Road Safety Agency
De Broeck	Koen	De Lijn
Deiters	Oliver	DEKRA e.V.
du Boispéan	Stéphane	DEKRA SE
Boersma	Reanne	Delft University of Technology & University of Applied Sciences Rotterdam
Feyder	Camille	Delphi Automotive Systems Luxembourg S.A.
Narula	Prasant	Delphi Deutschland GmbH
Goto	Hirotaka	DENSO
Henchoz	Jean-Michel	DENSO
Leinmueller	Tim	DENSO Automotive Deutschland GmbH
Mittal	Prachi	DENSO Automotive Deutschland GmbH
Teshima	Kentaro	DENSO Automotive Deutschland GmbH
Shimonomoto	Ifushi	DENSO Corporation
Akatsuka	Hidehiko	DENSO International Asia PTE. LTD.
Blythe	Phil	Department for Transport
Gómez Garrido	Susana	DEPUTY DIRECTOR OF VEHÍCLES
Dr. Springer	Johannes	Deutsche Telekom / T-Systems International
Jacobfeuerborn	Bruno	Deutsche Telekom AG
Koch	Rainer	Deutsche Telekom AG
Makridis	Michail	DG Joint Research Centre
tassara	francesca	DG MOVE
Torre	Agnese	DG MOVE
Ordás	Jorge	DGT
Di Febbraro	Angela	DIME - UNIVERSITY OF GENOVA
Blanco Bergareche	Ana	Dirección General de Tráfico
Moreno García-Cano	Jaime	Directorate General for Traffic
Mosebach	Henning	DLR
Beckmann	Dirk	DLR - German Aerospace Center
Schieben	Anna	DLR - German Aerospace Center
Miyoshi	Hiroaki	Doshisha university
Hellaker	Jan	Drive Sweden
Dufeu	Sylvain	Drust
Dols	Han	DSM
Zhang	rui	DSM
Lu	Meng	Dynniq
van Schijndel-de Nooij	Margriet	EARPA
Ghiba	Dorina	EC RTD
Perault	Nathalie	EC RTD
Smit	Frank	EC RTD
Antonissen	Tom	ECG - The Association of European Vehicle Logistics
Foster	Alun	ECSEL Joint Undertaking
Lenoir	Catherine	ECSEL JU
Almeras	Caroline	ECTRI
Hinto	Helena	EE permanent representation to the EU

Last name	First name	Company
Back	Stefan	EESC (Swedish Confederation of Transport Enterprise)
Beaumel	Lucie	EGVIA
Péan	Stéphane	EIT Digital
Flynn	bob	Enterprise-ireland.com
Charlaftis	Angelos	ePAPHOS ADVISORS TEAMWORK
Stagl	Sebastian	EpoSS
Andersson	Håkan	ERICSSON
Fagerholt	Anders	Ericsson
Benton	Jonathan	ERTICO - ITS Europe
Jansseune	Luc	ERTICO - ITS Europe
Augarde	Benoit	ERTICO - ITS Europe
Brizzolara	Davide	ERTICO - ITS Europe
Somma	Giacomo	ERTICO - ITS Europe
Valente	Pamela	ERTICO - ITS Europe
Bangsgaard	Jacob	ERTICO - ITS Europe
Fischer	Francois	ERTICO - ITS Europe
Flament	Maxime	ERTICO - ITS Europe
Aertsens	Xavier	ERTRAC
Neugebauer	Stephan	ERTRAC
Peris	Miiko	Estonian Permanent Representation to the EU
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Townsend	Ellen	ETSC
Deix	Stefan	EUCAR
Stromdahl	Annika	EUCAR
BRESLIN	LIAM	EUR COMMISSION
Eifert	Harald	EurA AG
Hirschberg	Ralph	EurA AG
Schram	Richard	Euro NCAP
Cory	Michael	EuroGeographics
GUIDI	MATTEO	EURONEWS
Bettini	Stefania	European Commission
Bulc	Violeta	European Commission
Carbone	Maria	European Commission
Chiarini	Paola	European Commission
Demir	Mesut	European Commission
Jaaskelainen	Juhani	European Commission
Lobo	Georges	European Commission
Mercier-Handisyde	Patrick	European Commission
missen	robert	European Commission
Sakovica	Julija	European Commission
VAN GAEVER	ALAIN	European Commission
Vitiello	Luigi	European Commission
VON PETER	NIKOLAUS	European Commission
wohlschlegel	werner	European Commission
Zobbi	Roberta	European Commission
Hoefs	Wolfgang	European Commission - DG CONNECT
Coulon Cantuer	Myriam	European Commission - DG CONNECT H2
Skogsmo	Ingrid	European Commission DG RTD
Cozigou	Gwenole	European Commission, DG GROW
Wiewiorowski	Wojciech	European Data Protection Supervisor
Spinaci	Stefano	European Parliament
Ujhelyi	Istvan	European Parliament
Van Der Kamp	Menno	European Parliament
Diamandouros	Konstandinos	European Union Road Federation
Diez	Jose	European Union Road Federation
de Labaca	Julien	Eurorégion Aquitaine-Euskadi
Kewitz	Daniel	EWE AG

Last name	First name	Company
Potenza	Giacomo	EY
Andreone	Luisa	FCA-Centro Ricerche Fiat
Maia	Luis	FCT
Cronin	Brian	Federal Highway Administration, USDOT
Linget	Thomas	Fédération Internationale de Motocyclisme
Taal	Wim	FEMA
Willigers	Dolf	FEMA
Cuervo	Gabriel	Ferrovial
Fernandez	Julia	Ferrovial Servicios
Tavares	José Pedro	FEUP
Lenz	Olivier	FIA
Smith	Ferry	FIA
Corazza	Francesca	FIA Region 1
Krid	Laurianne	FIA Region I
Ferragina	Francesca	FIAT CHRYSLER AUTOMOBILES
Quintero	Ramiro	FICOSA
Koskela	Alina	Finnish Transport Agency
Kulmala	Risto	Finnish Transport Agency
Vehvilainen	Antti	Finnish Transport Agency
Viinanen	Reija	Finnish Transport Agency
Willgren	Tuuli	Finnish Transport and Logistics
Jalko	Reijo	Finnish Transport Safety Agency
Schirokoff	Anna	Finnish Transport Safety Agency
Pilli-Sihvola	Eetu	Finnish Transport Safety Agency (Trafi)
Sillanpää	Marko	Finnish Transport Safety Agency Trafi
Kenraali	Juha	Finnish Transport Safety Agengy
Lott	Alyssa	Fipra International
Zlocki	Adrian	fka
Burkard	Christian	fka Forschungsgesellschaft Kraftfahrwesen mbH
Kenis	Eric	Flanders Gov - Mobility & Public Works
Dedene	Nele	Flemish government
Maitre	Isabelle	FNTR
Yalcin	Anıl Dilara	FORD OTOSAN
Felber	Wolfgang	Fraunhofer IIS
Commeau	André	Frencg Senate
Miyata	Hiroshi	Fujitsu Laboratories Ltd.
Nakano	Yasuhiko	Fujitsu Ten (Europe) GmbH
Garrido	Graciela	FundingBox
Seoane	David	Fundingbox
Potter	Dennis	Gemeente Capelle aan den Ijssel
Goedickemeier	Simon	General Motors Europe: Adam Opel AG
Fritsch	Geoffrey	Geoffrey Fritsch Photography
Cyganski	Rita	German Aerospace Center
Busnadiego	Carlos	GMV
Gutiérrez Lanza	Sara	GMV
Delé	François	Goodyear Dunlop Tires Operations SA
Jensen	Rene	Goverment
Sandrock	Paul	Groupe PSA
Hazenberg	Joop	GSMA
Rooney	Shane	GSMA
Reuter	Judith	Hanse-Office
Ectors	Wim	Hasselt University
Becker	Lars	Hella Aglaia Mobile Vision GmbH
Lueders	Tom	Hella Aglaia Mobile Vision GmbH
Nasr	Ahmed	HERE
Herrtwich	Ralf G.	HERE Deutschland GmbH
Hirose	Junichi	Highway Industry Development Organization

Last name	First name	Company
Dalle Vedove	Mattia	HITACHI, LTD
Aigner	Walter	HiTec
Guel	Wolfgang	Hochschule der Medien/MOOVEL
Sergeys	Filip	Honda Motor Europe Ltd.
Roberts	Joanna	Horizon magazine
Lou	David	Huawei
Bretaudeau	Jean - Pierre	Hutchinson
Fickel	Frank	IAV GmbH
Fricke	Volker	IBM Deutschland Management & Business Support GmbH
Amditis	Angelos	ICCS
Arnold	Martina	IDA Ireland
Finnegan	Ken	IDA Ireland
Brimont	Laura	Iddri
Tobar	Marta	IDIADA AUTOMOTIVE TECHNOLOGY S.A.
Barrios	Jose-Manuel	IDIADA AUTOMOTIVE TECHNOLOGY S.A.
Arbeit de Chalendar	Odile	IFSTTAR
Bourquin	Frédéric	IFSTTAR
HAUTIERE	Nicolas	IFSTTAR
Marin Lamellet	Claude	IFSTTAR
Etienne	Virginie	IFSTTAR - Department of Transport health & safety
Kotte	Jens	ika - RWTH Aachen University
Guaspare	Françoise	Ile-de-France Europe
Colpaert	Pieter	IMEC
Curry	Phillip	IMI
Angiolini	Elena	impulse.brussels
Tiago	Ricardo	IMT - Instituto da Mobilidade e dos Transportes, I.P.
Castiñeira	Rodrigo	Indra
Gil	Mauro	Indra Sistemas
Sarros	Georgios	INEA
Dettmann	Wolfgang	Infineon Technologies AG
Meillaud	Laurent	Ingénieurs de l'Automobile
Schroeder	Joel	Inmarsat
Mothersole	Louise	Innovate UK
Pereira da Silva	Maria de Fátima	InOuCister, Lda & Institute Polythecnique of Coimbra-Traffic Psychology International
Andersson	Kristina	Inquiry into self-driving vehicles on the road
Jimenez	Felipe	INSIA-UPM
Cabrera Garcia	Juan Jose	INSPIDE
Gomez Castaño	Jose	INSPIDE
Will	Devid	Institut für Kraftfahrzeuge - RWTH Aachen University
Lytrivis	Panagiotis	Institute of Communication and Computer Systems
Bento	Carlos	Instituto Pedro Nunes
Macario	Rosario	Instituto Superior Técnico, Universidade de Lisboa
Fernandez Angel	Grisel	Insurance Europe
Gelin	Thomas	Insurance Europe
Makowitz	Rainer	Intel Labs Europe
Maly	Matej	INTENS Corporation
Robson	Matthew	Interel
Libbrecht	Amaury	Interel Group
steel	Richard	Intererel group
Viegas	José	INTERNATIONAL TRANSPORT FORUM (OECD)
Nogueira	Marcos	IrRADIARE,Lda
Giannini	Monica	IRU
Hadrovic	Emma	ITD, Association for the Danish road transport of goods
Elmore	Mark	ITS Ireland
Akiba	Toru	ITS Japan

Last name	First name	Company
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Tamoto	Shigetoshi	ITS Japan
Uchimura	Takahiko	ITS Japan
Merat	Natasha	ITS UNIVERSITYOF LEEDS
Uchida	Nobuyuki	Japan Automobile Research Institute
Shibata	JUN	Japan Digital Road Map Association
Alonso Raposo	María	Joint Research Centre - European Commission
Güner	Refi Tugrul	Kapsch TrafficCom
Lax	Richard	Kapsch TrafficCom
Fest-Bamonti	Karin	KFV
Lee	Yoon Been	KIC-Europe
Threlfall	Richard	KPMG LLP
Lam	Wee Shann	Land Transport Authority of Singapore
Poh	Patrick	Land Transport Authority of Singapore
Wee Shan	Lam	Land Transport Authority, Ministry of Transport
Doyle	Hugh	Lero, the Irish Software Research Centre
Gill	James	Lewis Silkin LLP
Falliti	Elisa	LOGOS Public Affairs
Ferrero	Francesco	Luxembourg Institute of Science and Technology (LIST)
Costa Fernandez	Ana	Magellan
Vaz Raposo	Ana	Magellan
Dietl	Philip	Magna Steyr
Ogawa	Norifumi	Mazda Motor Corporation
Coupe	Charlotte	MEEM - DGITM
Toussaint	Philippe	MENESR
Santamala	Harri	Metropolia UAS
Tirot	Grégoire	Ministère de l'économie et des finances - France
Valmain	Joël	Ministère de l'Intérieur
Iorio	Luciana	Ministero Infrastrutture Trasporti _IT
Fernique	Louis	Ministry for Environment, Energy and The Sea, France
Otto	Marcel	Ministry Infrastructure and Environment
Peetre	Johann	Ministry of Economic Affairs and Communications
Tidström	Catrin	Ministry of Enterprise and Innovation
Vagland	Asa	Ministry of Enterprise and Innovation
de Kort	Antoine	Ministry of Infrastructure and the Environment / Rijkswaterstaat
Schultz van Haegen	Melanie	Ministry of Transport and the Environment Netherlands
Horváth	Zoltán	Ministry of Transport Czech Republic
Pichl	Martin	Ministry of Transport of the Czech Republic
Stojanovova	Marie	Ministry of Transport of the Czech Republic
Shindo	Kazumi	Mission of Japan to the EU, Ministry of Foreign Affaires
Verhoeff	Eric	Mitsubishi Electric Automotive Europe B.V.
Persi	Stefano	MOSAIC FACTOR
Czako	Josef	Moving Forward Consulting
Gronier	Pierre	National Institute of Geographic and Forest Information
Kitazaki	Satoshi	National Institute of Advanced Industrial Science and Technology
Böse	Manfred	NEC
Baldessari	Roberto	NEC Europe Ltd.
Christiernin	Stefan	NEVS
Sampson	Eric	Newcastle University
Yip	Fiona	Newcastle University
Domenech	Anna	NISSAN
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East	Mary-Jay	NISSAN EUROPE
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Last name	First name	Company
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Lund	Bjørn	Norwegian Public Roads Administration
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Geraets	Maurice	NXP Semiconductors
Dobelmann	Janine	NXP Semiconductors GmbH
Grønberg	Nikolai Grødum	Nye Veier
Saumweber	Stefan	OEAMTC
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Schiltz	Jean	On behalf of the Ministry of Economy of Luxembourg
Maj	Aleksandra	Opel Group
Özcan	İsmail	Ottonom Engineering Solutions
Tripoteau	Lucas	Pan European Networks
Bamps	Joke	Permanent Representation of Belgium to the EU
Husen	Peter	Peter Husen Political Solutions
Schoevaars	Arno	PNO Consultants
Ranft	Florian	Policy Network
Mourey	Thomas	Polis
Podgorska - Buompane	Anna	Polish Perm. Rep. to the EU
Posaner	Joshua	POLITICO
Ledesma	Ramon	Pons
Gomez Arche	Ana	Pons Road Safety
Kacerovsky	Josef	Prague City Hall
De Koninck	Guy	Private citizen
Bolignano	Dominique	Prove&run
Puyenbroek	Marinus	Province of Noord Brabant
Mermans	Edwin	Province of Noord-Brabant
Gatta	Matteo	PROXIMUS
parvais	ivan	proximus
Weber	Ralf	Qualcomm
Laborda	Josep	RACC Automobile Club
Butter	Richard	RAI
van Vliet	Arjan	RDW
Montanari	Roberto	RE:Lab
Mugnai	Alexandre	Red Sentinel B.V.
Göpfert	Marcus	Region Stuttgart
Coutant	Patrick	RENAULT
Page	Yves	Renault
Meyer	Claire	Renault - Nissan
Leclair	Nadine	RENAULT SAS
Pascual	Valérie	Renault SAS
Hoene	Falk - Florian	Representation of the Land Brandenburg to the European Union
Alkim	Tom	Rijkswaterstaat
Nord	Stefan	RISE
Kallianos	Theodoros	RMS
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Knoedler	Kosmas	Robert Bosch GmbH
Mueller	Werner	Robert Bosch GmbH
Steiger	Eckard	Robert Bosch GmbH
Tegtmeier	Joerg	Robert Bosch GmbH
Winterboer	Andi	Robert Bosch GmbH
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Last name	First name	Company
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Forsberg	Dennis	Scania CV AB
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Soria	Maria Luisa	SERNAUTO
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García de Sandoval	Aurora	Spanish traffic directorate general
Langheim	Jochen	ST Microelectronics
O'Neil	David	STIF
Van Dyck	Thomas	Subaru Vandenplas
Ishige	Masao	SUMITOMO ELECTRIC
Nishimura	Shigeki	Sumitomo Electric Industries, Ltd.
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Claridge	Nigel	Sustainable Innovation AB
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Zarghampour	Hamid	Swedish Transport Administration
Bjelfvenstam	Jonas	Swedish Transport agency
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Nielsen	Per Seiverts	Technical University of Denmark
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Antoniou	Constantinos	Technical University of Munich
Delgado	Estibaliz	TECNALIA
Isasi	Lucia	TECNALIA
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Sakai	Koichi	the University of Tokyo
Sefiani	Marouane	Thuraya telecommunications
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de Brabandere	Rodolpe	Tipik communication Agency
Devillers	Quentin	Tipik Communication Agency
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Petitprez	Anne-Sonia	Tipik Communication Agency
Ponteville	Olivier	Tipik Communication Agency
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Last name	First name	Company
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Machado	Jorge	TRANSDEV
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Kakollu	Durgaprasad	TSSG
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Zichner	Marco	TU Dresden
Rutten	Ben	TU Eindhoven
Van de Weijer	Carlo	TU Eindhoven
Cinalioglu	Pertev	TUBITAK
Happee	Riender	TUDELFT
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Simoes	Anabela	U. Lusofona
Macku	Marius	Uber
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Rebora	Francesco	Università degli studi di Genova
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Fraboni	Federico	University of Bologna
Pietrantoni	Luca	University of Bologna
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Martire	Jacopo	University of Stirling
Kawamoto	Masayuki	University of Tsukuba
Gross	Ana	University of Warwick
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Smith	Scott	US DOT / Volpe Center
Sugawara	Takahiro	UTMS society of Japan
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Meyer	Gereon	VDI/VDE Innovation + Technik GmbH
Zachäus	Carolin	VDI/VDE-IT GmbH
Blervaque	Vincent	VEDECOM
Faul	Nadège	VEDECOM
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Last name	First name	Company
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Etemad	Aria	Volkswagen AG
Briout	Aurelie	Volvo Car
Domecq	Celine	Volvo Car
Eugensson	Anders	Volvo Car
Junghard Zander	Anna Christina	Volvo Car Corporation
Varela	Javier	Volvo Car Corporation
Hermansson	Tord	Volvo Car Group
Samuelsson	Håkan	Volvo Car Group
Victor	Trent	Volvo Cars
Kärrberg	Anders	Volvo Cars Group
Sazaklidou	ZOI	VOLVO CE
Mile	Ausra	Volvo Construction Equipment
Biston	Frederique	Volvo Group
Rosenqvist	Mats	Volvo Group
Walsh	Krista	Volvo Group
Wass	Urban	Volvo Group
Johansson	Emma	Volvo Group Truck Technology
Tamm	Therese	Volvo Truck Corporation
Jacquemyns	Philippe	Volvo Trucks
Boyd	Martha	VolvoTruck Corporation
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Koskinen	Sami	VTT
Tavares	Thiago	VVA
Pesce	Monica	VVA Brussels
Sichel	Katrina	Wit and Word Communications
Gminder	Nathalie	ZF Friedrichshafen AG
Stephan	Tobias	ZF Friedrichshafen AG