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Regulatory needs and solutions for deployment of Vehicle and Road Automation (Draft2)

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Table of Contents

List of Figures

Executive summary

On one side the hype created by the industry announcements and on the other side the intense research and development ongoing on Automated Vehicles has reached a point where public agencies need to step in and take policy decisions.

From a policy point of view, the main objectives of the European Member States are to maintain global competitiveness of its industry as well as to encourage research and development investments on promising societal innovations such as, in our case, Automated Vehicles. This is materialised, at national level, by creating the correct framework for the industry to perform the needed testing while setting a framework preserving the safety of its citizens. In some cases, strategic innovation programmes have been announced together with a substantial increase of funding in the national research programme.

As the national tests are being rolled out, the Member States are reviewing and, eventually, will amend their domestic regulations to increase the legal certainty around the market introduction of these vehicles.

This spins out from still ongoing UNECE discussions on the amendment of the Vienna convention in Working Party 1 and of type approval regulations in WP29 such as R79 on active steering. And, now, the domestic attention turns to issues such as liability, risks & insurance, driver training, required minimum performance, technical approval and inspection, and data recorders. Even topics such as interactions with other road users and role of car assessment programmes are addressed at national level.

Unfortunately, the current economic situation has accentuated the policy *competition* between Member States to the point common issues have not been addressed collaboratively.

The VRA D3.2.2 reviews the different national initiatives and discusses the topics in more details. It concludes by suggesting to the leading EU Member States to work on pre-*competitive* issues beside the work done at UNECE. This could be done in the following way:

- Create a group of leading European Member States who would share the common concerns about the need to make policy decisions and set concrete steps to harmonise pre-*competitive* legal framework
- Ensure Road Authorities provide a harmonised authorisation to drive on open road
- Ensure Vehicle Authorities are following same or harmonised exemption rules
- Ensure that communication operators provide continuity of data services across borders for automated vehicles
- Engage driver licensing authorities to possibly consider additional trainings
- Ensure at European level that the motor insurance industry facilitate automated driving market introduction without prejudice to the consumers

Related tasks may be to:

- Raise awareness of potential benefits and limitations of Automated Vehicles to wider public as well as to policy makers

- Stabilise a liability framework taking into account the shift of risks between users, public bodies and industry
- Propose European code of practice, type approval and periodic technical inspection (incl. Mutual Recognition scheme)
- Clarify together a European connectivity approach: how connected should an automated vehicle be and what data should it deliver
- Specify the policy for fitment of Data Recorders as well as the rules linked to the use of this data
- Clarify, at European level, obligations of the road operators and traffic managers as well as the requirements for accurate maps (incl governance and standards)

Beyond the regulatory aspects, the document also encourages the Member States to engage its agencies and encourage its industry to participate in the H2020 research and innovation programme on Automated Road Transport in order to joint effort to:

- Demonstrate safety, reliability and efficiency of automated driving systems
- Assess the impact of Automated Vehicle technology
- Encourage user-centric design in order to maximise user and societal acceptance of Automated Vehicles
- Address the needs for physical and digital road infrastructure

1 Contractual information

1.1 Purpose of Document

The objective of this deliverable is to provide an update on the latest results of the task WP3.2 of VRA on regulatory needs for the deployment of vehicle and road automation. The second period span from Oct 2014 to September 2015. This phase of the task was to investigate deeper each of the regulatory concerns and identify possible solutions especially when it requires collaboration at European or even international level.

1.2 Structure of Document

This document consists of the following sections:

- Contractual information
- Introduction
- Mapping of current activities at EU, MS, and international levels.
- Related projects
- (First version of Legal and regulatory concerns planned in Draft2)
- Report on current achievements
- Annexe: recommendations drafted by the discussion group

1.3 VRA Contractual References

VRA, Vehicle and Road Automation, is a Support Action submitted for the call FP7-ICT-2013-10. It stands for *Vehicle and Road Automation Network.*

The Grant Agreement number is 610737 and project duration is 42 months, effective from 01 July 2013 until 31 December 2016. It is a contract with the European Commission (EC), Directorate General Communications Networks, Content & Technology (DG CONNECT).

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1.4 Project Objectives

In the field of vehicle and road automation, VRA's main objectives are:

- To maintain an active network of experts and stakeholders
- To contribute to international collaboration
- To identify deployment needs
- To promote research and deployment initiatives

In practice, VRA will:

- Organise or support international meetings together with similar initiatives in US and JPN. (WP2.1)
- Support the iMobility Forum Automation WG and extend its role as a reference group for European activities on the topic eventually formulating common positions, especially at European level (WP2.2)
- Aggregate information on existing research or deployment activities in a shared wiki (WP2.3)
- Describe valid business models and deployment paths & scenarios and investigate the broad socio-economic implications of automation for the future societies (WP3.1)
- Clarify, report and setup a plan of actions on legal, liability, insurance and regulatory issues in different member states (WP3.2)
- Monitor and steer standardisation, compliance and certification for vehicle and road automation (WP3.3.)
- Contribute to the discussion on relevant topics for the deployment of Vehicle and Road Automation: Connectivity (WP3.4), Human Factors (WP3.5), Digital Infrastructure (WP3.6), Evaluation of Benefits (WP3.7) and Decision and Control Algorithms (WP3.8).

1.5 Disclaimer

The content of this deliverable should be considered only as information and does not constitute in any way any obligations for or commitments of the referred governmental bodies or the industry stakeholders.

2 Introduction

2.1 Definitions

The research around automation in road transport has been approached from two distinct expert communities. Over the past year, it has often been illustrated with a graph comparing Levels of automation and Level of segregation of the Automated Vehicles (see Figure 1).

Figure 1: Two different approaches to introduce automated vehicles: Something Everywhere vs. Everything Somewhere

The legal and regulatory issues around these two approaches are quite different. This document reports on the known regulatory activities related to both kind of systems.

2.1.1 Something Everywhere: the evolution of ADAS

On one side, the evolution of the Advanced Driver Assistance Systems (ADAS) led by the automotive industry and supported by a large number of automotive research centres.

ADAS are systems developed to automate/adapt/enhance vehicle systems for safety and better driving. Safety features are designed to avoid collisions and accidents by offering technologies that alert the driver to potential problems, or to avoid collisions by implementing safeguards and taking over control of the vehicle. Adaptive features may automate lighting, provide adaptive cruise control, automate braking, incorporate GPS/ traffic warnings, connect to smartphones, alert driver to other cars or dangers, keep the driver in the correct lane, or show what is in blind spots. ADAS technology can be based upon vision/camera systems, sensor technology, car data networks, Vehicle-to-Vehicle (V2V), or Vehicle-to-Infrastructure systems. Next-generation ADAS will increasingly leverage the progress on HMI, sensing, V2X and actuation leading to progressively more and more automation of the driving function, often referred as Highly Automated Driving (HAD) systems. Figure 2 shows the gradual implementation of automated functions on the new vehicle models.

The term Something Everywhere may be misleading as the automated function may only be designed in a specific road context e.g. on highways. "Everywhere" then would mean on every highways.

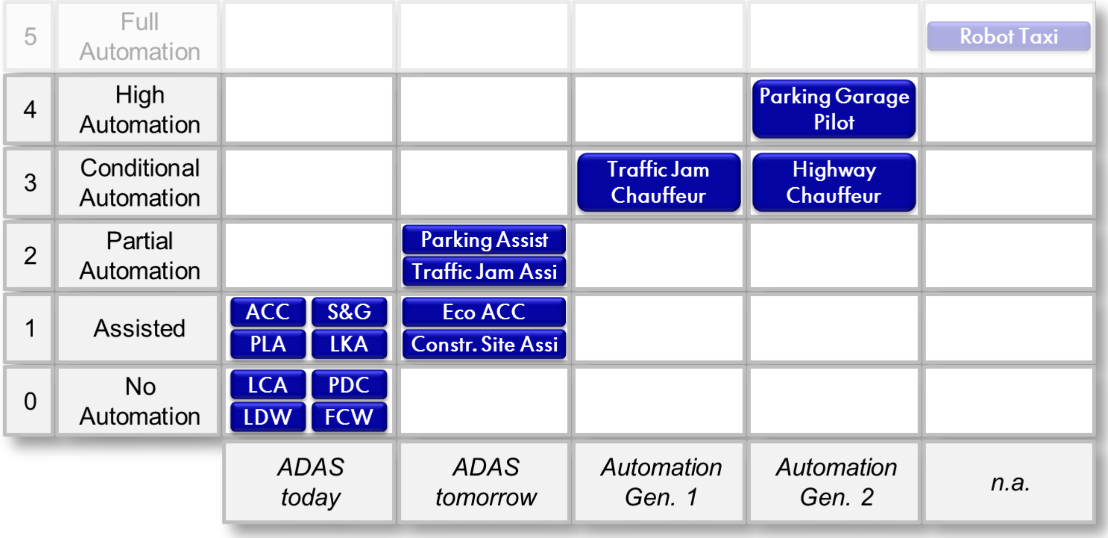


Figure 2: The evolution of Advanced Driver Assistance Systems towards Highly Automated Driving applications ©AdaptIVe project

2.1.2 *Everything Somewhere: the demonstration of Automated Road Transport Systems*

On the other side, the evolution of the automated rail transport systems is brought to the road, first in segregated tracks and gradually in mixed traffic environment. Automated road transport systems (ARTS) are transport systems based on the use of fully automated road vehicles controlled by a fleet management system, which also controls the vehicles' interaction with the infrastructure. ARTS allow providing scheduled, on-demand, or door-to-door services on a specific road infrastructure that can be segregated, dedicated or shared with other road users. ARTS are aimed (at least at the beginning) to supplement mass transit in the last miles and are commercially available today.

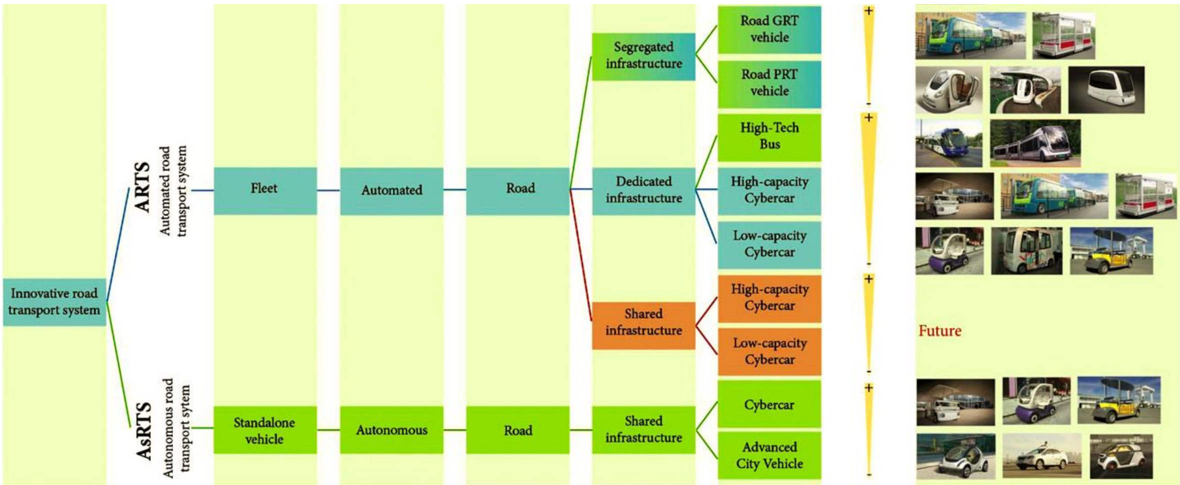


Figure 3: Evolution of Automated Road Transport Systems (ARTS) as a supplement to mass transit ©CityMobil2

2.2 Objectives and scope of the VRA task on regulatory needs (WP3.2)

The WP3.2 activities consist of the following tasks:

- Convene specific meetings, and lead and contribute to the discussions on:
  - regulatory needs for deployment of automation and automated vehicles in Europe,
  - legal and liability issues linking with regulatory measures
- Contribute to reach common positions and write a white or position paper on the topic and present it to key stakeholders (such as UNECE WP29),

WP3.2 outcome will be consolidated at the end of each period of the VRA contract in the deliverable series D3.2.x on “Regulatory needs and solutions for deployment of Vehicle and Road Automation.” due at M15, M27, M41 (starting from July 2013).

The meeting protocols, agreements and draft documentation will be documented and reported regularly in European and International meetings (WP2.1-WP2.2).

2.3 Stakeholders tree

The stakeholders to be taken into account in vehicle and road automation can be divided into four big categories: technology providers (e.g.: OEM´s, GNS suppliers, research and consulting), service providers (highway operators, assurance companies), decision makers (e.g.: local and national authorities, certification bodies) and final consumers (e.g.: drivers associations). Following the distinction of roles for VRA, the stakeholder groups are illustrated in Figure 4. Illustration of stakeholder groups and their role vehicle and road automation. The four sides of the rectangle represent these four roles.

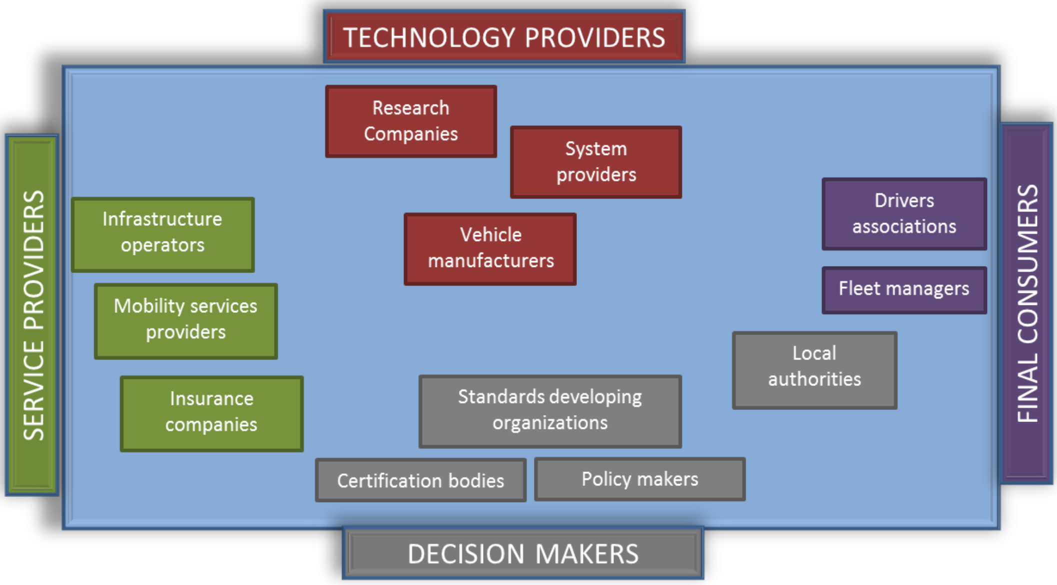


Figure 4. Illustration of stakeholder groups and their role vehicle and road automation

This general overview is customized in Table 1, in which the stakeholders are analysed indicating main function and also key aspects on regulatory needs that are affecting them.

This is important to focus the discussions depending on the group of stakeholders that VRA is addressing at each moment

Table 1. Stakeholder tree identification and regulatory key aspects

Stakeholder	Function	Regulatory issues
Policy makers and legislative bodies	Produce regulations and ensures compliance	Role of governments (European, national, local) regarding automated driving (e.g.: guidance, regulation, oversight) Governance issues related to automated road transport, Data use and ownership
Vehicle manufacturers	Manufacture and sell vehicles with a level of automation	Regulations affecting vehicles manufacturing Ask for changes in the regulatory framework for new paradigms Need clarification of Liability framework
System providers	Offer VRA related systems and applications for vehicles and infrastructures	Regulations affecting new systems Cyber security and privacy regulation
Research companies	Provide new paradigms and application solutions. Part of the technology providers chain	Ask for changes in the regulatory framework for new paradigms
Service providers	Make business providing services based on vehicle and road automation	Accomplish with regulations
Infrastructure operators	Explode roads and highways. Is a potential service provider	Accomplish with regulations
Final consumers	Buyers of technology (drivers, fleet owners, local authorities,…)	Vulnerable road users protection Level of transparency of automated systems operation to the users. Understanding of underlying functions, limitations and contingencies.
Certification bodies	Homologation of vehicles, equipment and drivers for automation	Harmonization with policies in automated driving to enable new certification procedures
Insurance companies	Provide Insurance for automated vehicles. Safe mobility and responsibilities	Liability and risk issues
Standards Developing Organizations	Primary activities in developing, coordinating, promulgating, revising, amending, reissuing, interpreting, or otherwise producing technical standards that are intended to address the needs of some relatively wide base of affected adopters	Harmonization with policies in automated driving to enable new standards.

2.4 Methodology description

The key aspects and strategy for discussion groups is based on the following:

- Creation and exploitation of a wide range of contacts related to the topic of regulatory issues
    - At European Member State level: experts working within the different national ministries but that are not directly involved in the European affairs. These persons are often linked to national projects and/or national governance bodies such as type approval authorities or interior ministry. Also, the network of European ITS national organisations offers a good link to such experts.
    - At EU MS expert level: experts that are appointed by the European Member States to follow the European affairs for example in the framework of the ITS directive or the recent C-ITS platform. These persons have large experience on EU affairs and know well the relevant contact points within their organisation.
    - At international level: experts in US, Japan or other countries outside Europe. Typically, linked to TRB committees and events or to ITS organisations similar to ERTICO: ITS America, ITS Japan, ITS Asia Pacific, ITS China, Austroads, ITS Singapore, and many others
    - At UN level: coordinators of and experts involved in the WP29, WP1 or ITS-AD activities as well as ITF-OECD contributors.
    - Independents point of views (consultants)
- Participate to meetings related to the topic at all geographical levels and advocate on the importance of a harmonised approach on regulations for automated vehicles
- Gather information on relevant activities as well as positions from the different European Member States and beyond and report yearly on the progress, eventually engage the expert community to contribute to improve the report.
- Organise discussion meetings, breakout sessions or dedicated workshops with the support of other groups such as the Legal Issues Working Group of the iMobility Forum or the TRB committee AL040 Emerging Technology Law Committee.

2.4.1 Tools for stakeholders engagement in regulatory issues

The main tools used for stakeholders engagement are:

- Annual TRB meeting: The US transport experts meet once a year beginning of January. The Transport Research Board (TRB) is organised in a large number of committees. Many committees are now engaged in the many aspects of Road and vehicle automation. The committees meet at least once a year to report on their activities.
- Joint TRB/AUVSI symposium: This symposium has been organised yearly since 2012 and is at its 3rd edition. The last edition gathered more than 600 participants in Ann Arbor in July 2015.
- ITS European and world congresses: The ITS world congresses are organised jointly by ITS Asia-Pacific, ITS America, and ERTICO - ITS Europe. Their locations alternate between the three regions. The world congresses are often organised in October. Whenever the ITS World Congress is not in Europe, a European ITS congress takes

place. As the audience is as much representing the industry than the public sector, the ITS congresses are good opportunities to discuss on the regulatory issues around automation. The next meeting will take place in Bordeaux in October 2015.

- EU MS experts: Currently there is no dedicated EC initiative around vehicle automation. However, a lot is happening around C-ITS. The EU MS experts nominated to deal with C-ITS are often involved in vehicle automation issues in their country.
- C-ITS platform: WG3 and WG4 of the C-ITS platform coordinated by EC DG MOVE help clarfifying issues related to legal and data protection issues of C-ITS. The context of automation is not directly in the scope but the discussions often refer to it.
- European presidency: mobility week: the European presidencies are rotating every six months around the EU MS. The local support of the presidency on specific topics gives automatically a Europe wide visibility. In May 2014, the Greek presidency organised an event with VRA and Citymobil2 on the topic of certification of ARTS. In April 2016, it is planed that the Dutch presidency gathers the transport ministers and addresses the deployment of automated vehicles.
- iMobility Forum: The iMobility Forum WG on Automation in Road Transport has been active since early 2012 and has published a series of roadmaps and recommendations. A sub-WG is dedicated to legal issues and linked to the Legal Issues WG (LIWG) of the iMobility Forum.
- Other EU funded projects: the currently funded project AdaptIVe, iGame, Companion, Autonet2030, CityMobil2, etc…

2.4.2 Implementation plan

The following tasks are foreseen over the 42 months duration of the WP3.2 activities:

- First period (July 2015 – Sept 2014):
    - Identify the active contact points,
    - Clarify current initiatives of EU Members States,
    - Identify the inputs from EU and national -funded projects,
    - Network internationally especially with US and Japan to identify their regulatory initiatives,
    - Provide first recommendations for EU level coordination.
    - Publish findings in a first draft report
- **Second Period (Oct 2014 – Sept 2015) = this deliverable**
    - Initiate concrete interaction with identified contact points,
    - Request feedback on first draft report and extend its scope,
    - List current regulatory concerns and which actions are needed,

    - Organise at least one workshop on regulatory issues in collaboration with the legal issues WG of the iMobility Forum,
    - Update report with status of initiatives and project results, add any new ones,
    - Publish findings in second draft report,

- Third period (Oct 2015 – Dec 2016)
    - Support relevant actions identified and propose solutions,
    - If needed follow-up with one workshop to validate a plan of actions,
    - Update report with status of initiatives and project results, add any new ones,
    - Publish findings and actions in the final report.

3 Mapping of the past and current activities and stakeholders

This section maps the different activities at different levels. First, looking at the national activities, then European level as well as comparing with US activities. Finally, a short overview of the UNECE progress is provided.

3.1 European Commission

The EC funded SMART64 study "*Definition of necessary vehicle and infrastructure systems for automated driving"* led by TNO established a list of issues to be addressed in view of automated driving. Among the non-technical issues, Liability and legal issues were discussed briefly.

Figure 5: early discussions in the SMART64 study on liabilities for automated driving ©SMART64/2010 TNO

The document is available on the VRA wiki [1].

In 2012-2013, the European Commission conducted a study under the ITS action plan action 5.2 on the Liability aspects related to ITS applications. The study organised a workshop in June 2012. The results of the study were published in a final report in December 2012.

As presented by Daimler at the workshop, the report used the BASt degrees of automation and mapped them according to the application ranges: Low speed automation, limited duration automation, and permanent driving. See section 3.2 for the German activities.

Since 2012, the BASt degrees of automation have been further developed eventually making their way in the SAE standard J3016. See section 3.4.2.

	Low speed manoeuvering	Manoeuvers of limited duration	„Permanent“ driving
Partly automated	**Parking assistant** • Driver-initiated automated parking. • Driver needs to supervise continuously, • must interrupt if necessary.	**Passing assistant** • Driver-initiated automated passing (single manoeuver) • Highway only • Driver needs to supervise continuously and retain control as necessary	**Construction site assistant** • Automated longitudinal and transversal control •.construction sites on highways only • Driver needs to supervise continuously and retain control as necessary
Highly automated		**Lane change chauffeur** • Driver-initiated automated lane change • Highway only • Driver does not need to supervise	**Highway chauffeur** • Automated longitudinal and transversal control •.Highway only • Driver does not need to supervise, will be requested to take over control in due time
Fully automated	**Parking pilot** • Automated valet parking. • No driver resp. driver goes away from vehicle	**Automated emergency stop** Automatically bringing the vehicle to a safe state if driver becomes unconscious etc.	**Highway pilot** • Automated longitudinal and transversal control •.Highway only • Driver does not need to supervise, no need to take over control

Figure 6: Automated Driving - Matrix of categories with examples (©Daimler, J. Schwarz, 2012)

The report listed the main challenges for legal and liability issues related to Automated Driving:

- Paradigm shift: The role of the driver of a vehicle might develop in direction of a passenger.
- Regulatory law: Road traffic which contains vehicles “without drivers” (or drivers that are out of control) is a blank field in regulatory traffic law.
- Liability: The burdens of vehicle manufacturers in terms of product liability increase massively.

The publication of the report led to a few actions during 2013-2014: Most importantly for our purpose, the EC granted funding to the integrated project AdaptIVe including activities on vehicle automation liabilities and legal issues within the sub-project called RESPONSE4 led by Daimler.

In May 2014, the European Commission organised a workshop but eventually focussed on the access and availability of multimodal travel and traffic data.

On 17 September 2016, AdaptIVe hosted their first workshop in Paris to report on RESPONSE4 activities and to discuss perspectives on automated driving regulations.

3.1.1 European Commission “Platform for the deployment of C-ITS in the EU”

The platform addresses the main barriers and enablers identified for the deployment of C-ITS in the EU, in relation to the services likely to be introduce in the first stage (Day 1 applications) in view to provide policy recommendations to the European Commission for the development of a Communication on the Deployment of C-ITS in the EU by the end of 2015.

A draft work programme "Gap Analysis: What is to be done for C-ITS Deployment" has been published as a background document for the call for experts.

It was foreseen that some of the policy discussions about automation would take place in the European Commission C-ITS platform (see section 3.1.1) launched in Dec 2014 but the scope of the WG3 was eventually restricted to C-ITS in order to progress more constructively and efficiently.

3.1.2 European Truck Platooning Challenge

As holder of the EU Presidency in 2016, the Netherlands will be organising the European Truck Platooning Challenge. Automated trucks of various types will drive in convoy (platooning) on public roads from a number of European cities to the Netherlands. They will travel on the main EU ITS corridors like the Nordic Logistic Corridor and the route between Rotterdam, Frankfurt and Vienna.

The Netherlands hopes that the Challenge will bring truck platooning a step closer to implementation, since they believe that it can become a reality in Europe by 2020.

With close cooperation between the automotive industry, research institutions and government authorities, the ambition is to make truck platooning the norm.

3.1.3 iMobility Forum Working Group Automation in Road Transport

The Working Group Automation in Road Transport was created under the iMobility Forum after the successful workshop organized by the European Commission in October 2011. This workshop initiated three SMART studies [1], executed in 2011 for the European Commission, DG INFSO specifically focusing on automation, the future of internet and the connected car and during the workshop a clear need was identified to discuss further and guide the research, development and deployment of automation for road traffic and road transport systems.

The mission of the working group on Automation in Road Transport [2] is to identify how automation and its subsequent applications can help to improve efficient, clean, safe and reliable road transport now and in the future and what is needed to foster deployment and implementation. In its initial phase, the working group focussed its activities on the common agreement on developing one or more roadmaps for future developments in the area of automation in road transport.

The process that led to the roadmaps basically consisted of the following steps:

1. Define the issues in the mobility domain that need to be solved;
2. Define a set of functions or applications that can help to do so including the value proposition and a clear and SMART description of these functions;
3. Map the functions with a clear value proposition to create a subset that covers all levels of automation;
4. Define the research needs and state of the art on specific topics needed to reach implementation or piloting of these functions.

Figure 7: approach defining roadmap

The first deliverable of the working group was published in May 2013 with the roadmap and recommendations for future research.

This document focusses on challenges and prospects for automation including automation definition, impact areas, concepts, State of the Art, research needs, key applications and milestones. It finally presents a series of automation roadmaps together with a detailed list of recommendations.

Since the publication of the document, the roadmap has been updated in order to take into account the newest initiatives and projects. The WG has worked deeper on specific collaboration areas related to automation. Due to the breadth and complexity of the topic, the activities are now planned around eight sub-Working Groups corresponding to the collaboration areas depicted in Figure 8. The last area on Cybersecurity is left aside for the time being until more results emerge from other groups such as the Harmonisation Task Group HTG6.

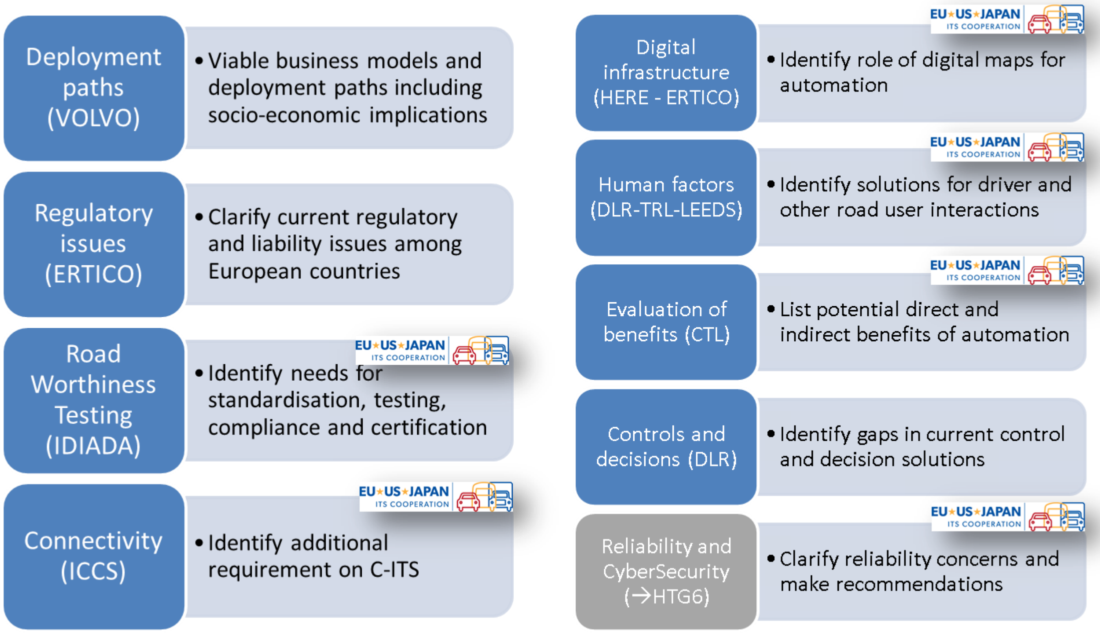


Figure 8: current sub-working groups of the iMobility Automation WG (leading organisation in parentheses)

During 2014, further work has been done on the deployment scenarios complementing the research roadmaps. The recommendations were further elaborated and categorised. A consolidated list of recommendations was presented to the European Commission in October 2014 especially targeting the preparation of the Horizon 2020 Work Programme 2016-2017. In addition, the roadmap and recommendations were promoted in relevant groups such as the R&I Working Group of the iMobility Forum as well as the ERTRAC TF on Automation.

In 2015, the WG is working on a white paper consolidating the sub-working groups' results into one consolidated message for the Automation WG. The main ambition of the white paper is to serve as guidance to the research community for the preparation of project proposals under the Horizon 2020 WP2016-2017.

All activities are reported on the iMobility Forum secretariat website [3]. Its first public result "Roadmaps for the automation of road transport" was published in June 2013.

The VRA support action is directly supporting the WG, organising meetings, gathering inputs and reporting on the outcome.

The Sub-WGs are created on a "per need" basis to answer aspects that are too specific to be discussed at plenary level. The sub-WG on regulatory issues was created in 2013 as many discussions were on-going at National level but there was no clear red line from EU level. The VRA task WP3.2 is directly supporting the sub-WG activities. For instance, this document constitutes a basis for the work of the sub-WG.

The scope and first outcome of the sub-WG is reported in Annex 1.

In April 2015, a specific workshop on national regulatory issues was organised with the support of the VRA. This deliverable reports on the main findings of this workshop.

3.1.4 ERTRAC Task Force on Automated Driving

ERTRAC is the European Road Transport Research Advisory Council. It is the European technology platform which brings together road transport stakeholders to develop a common vision for road transport research in Europe.

The final version of the joint European roadmap on Automated Driving has been released in June 2015. This Automated Driving roadmap is the result of a one-year effort of ERTRAC as a European platform to bring together industry representatives, research providers and national authorities. As mentioned above, the work of the iMobility Forum Automation WG has contributed to the ERTRAC Task Force on Automated Driving.

3.2 EU Member States

This section reviews the activities related to regulation of automated vehicles as reported by the different Member States: Germany, The Netherlands, UK, France, Sweden, Finland, Spain and Greece.

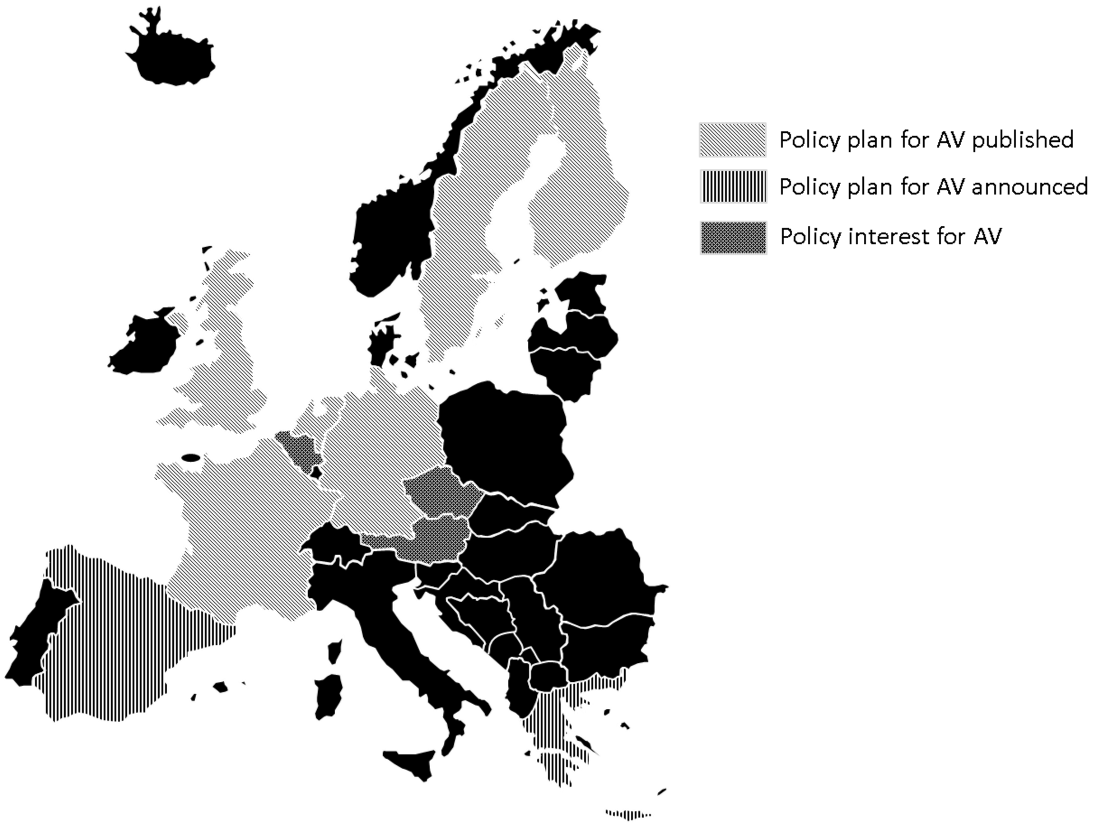


Figure 9: mapping of the EU member states policy plans for Automated vehicles

3.2.1 Germany

Germany has been studying the legal aspects of vehicle automation systems to determine what legal changes may be needed and how these relate to different levels of vehicle automation (which they defined very carefully and precisely). A joint work [4] of the Working Group of the German Federal Highway Research Institute (BASt) led by Tom Gasser had considerable impact on the expert community. For the first time, a study made an extensive legal assessment with respect to regulatory law and liability law, and, offered a classification of the degrees of automation from a policy perspective. This definition was at the source of the NHTSA levels and eventually the SAE standard[1].

The study suggested that the current legislation would allow partial automation levels on public roads i.e. “The system takes over longitudinal and lateral control, the driver shall permanently monitor the system and shall be prepared to take over control at any time.”

Further, BASt has proposed to work on other dimensions namely the speed range and utilisation time. They have proposed three speed ranges from manoeuvring level, traffic jam assist / city speed and highways, and, three utilisation time, short, medium and long. These concepts are further explored in the RESPONSE4 activity of AdaptIVe, which should publish their first results in September 2015 along with the AdaptIVe workshop in Paris.

[1] SAE defines an additional level of automation, essentially the fully automated eTaxi concept

The German Federal Ministry of Transport and Digital Infrastructure established a Round Table “Automated Driving” in November 2013. This Round Table can be considered as a national platform where all relevant stakeholder groups (Federal Ministries involved, public authorities, industry, insurance companies, user associations, technical inspection, research institutes) are represented. The operational work is done by the Working Groups “Legal Issues”, “Driver/Vehicle” and “Research”. The objectives are building a consensus with respect to core issues of automated driving thereby creating basic precondition for the implementation of highly automated driving. This national platform also acts as an advisory board of the Federal Ministry of Transport and Digital Infrastructure. Contact person: Dr. Christhard Gelau (christhard.gelau@bmvi.bund.de). More information is maintained on the NMVI website: http://www.bmvi.de/EN/TransportAndMobility/Mobility/AutomatedDriving/

At its third meeting on 10 June 2015, the plenary session of the Round Table approved the reports submitted by the chairs of the Round Table working groups. The working groups discussed issues and challenges relating to automated driving, including the approval procedures for automated systems, questions of liability and research requirements. The report by the Research Working Group on the need for research into vehicle automation is publicly available which marks the successful conclusion of the group.

In addition, the plenary session of the Round Table had set itself the objective of developing strategic benchmarks for the evolution of automated driving over the period to 2020. At its meeting on 10 June 2015, the plenary session adopted these strategic benchmarks. The benchmarks focus on the introduction of highly automated driving by 2020 and address several thematic areas. This is based on the likely scenarios for the deployment of highly automated vehicles. As deployment scenarios for 2020, the focus will be on the motorway and multi-storey car park environments.

In June 2015 the research program “New Vehicle and System Technologies” was published by the German Federal Ministry of Economic affairs and Energy.

In Sept 2015, Germany's Minister of Transport has announced a project that will see a section of the A9 autobahn that connects Berlin and Munich set it up for autonomous vehicle testing. The A9 project will include infrastructure provisions for vehicle-to-vehicle communication, as well as liberating the 700 MHz radio spectrum. The project is expected to get underway as of the end of 2015.

In September ahead of the Frankfurt motor show, the BMVI published its "Strategy for automated and networked driving“ in which Germany wants to “establish a legal framework in which an automated and networked vehicle can autonomously take over driving tasks, without the driver having to constantly monitor the system.” The strategic paper focusses on the “Legal Certainty” needed for deployment of automated vehicles which includes work on:

- International Legal Framework: extension of the definition of driver, R79, …
- National Legal Framework: allow use of automated and networked vehicles, consider situations where the system performs the driving,…
- Driver Training: handover and takeover of the driving task,…
- Technical Approval and Inspection: adoption of Code of Practice, PTI,…

3.2.2 The Netherlands

On June 16th 2014, the Dutch Minister of Infrastructure and Environment announced in a letter to the Dutch Parliament its intention related to the promotion of automated driving in the Netherlands.

The high-quality infrastructure of the Netherlands combined with the positive cooperation between the automotive industry, researchers and the government make the Netherlands an extremely suitable country for the intended innovation, development and use of self-driving cars. Compared with neighbouring countries, they have a high-quality main road network, with sufficient slip roads and a high-quality separation of traffic. Moreover, RDW is already a significant global party for the certification of new vehicles, as recently occurred with the Tesla. Many German manufacturers have their new models certificated by RDW for the European market. The Netherlands is also among the frontrunners when it comes to the combination of autonomous driving and vehicle-to-vehicle communication, aimed at creating high (societal) added value, with the long history of cooperation between government and industry and knowledge institutes as a key factor.

A progressive and collaborative government can reinforce this good baseline position. This is another field where the Dutch have a lead, because they are accustomed to cooperating with knowledge institutions, market parties and authorities, witness the national public-private Connecting Mobility action programme, the cooperative ITS corridor of Rotterdam-Frankfurt-Vienna, and the Dutch Automated Vehicle Initiative (DAVI). The sector is already involved in small-scale trials on the main road network, such as the Dutch Integrated Test Site on Cooperative Mobility (DITCM) in Helmond.

As of July 2015, the Ministry of Infrastructure and the Environment (I&M) has opened the public roads to large-scale tests with self-driving passenger cars and lorries. The Dutch rules and regulations have been amended to allow large-scale road tests. In collaboration with Rijkswaterstaat and the RDW (Dutch Vehicle Authority), the Ministry of I&M have been exploring safe ways to conduct tests on the public roads. The RDW is responsible for the admission of vehicles to the public roads, including self-driving passenger cars and self-driving lorries.

Under the amended legislation, the RDW (Dutch Vehicle Authority) has the option of issuing an exemption for self-driving vehicles (in Dutch). Companies that wish to test self-driving vehicles must first demonstrate that the tests will be conducted in a safe manner. To that end, they need to submit an application for admission.

The Dutch EU Presidency in Q1 of 2016 will provide possibilities for showing the way in cooperation at European level.

3.2.2.1 Learning by doing

The sector and researchers expect it to take many years yet before self-driving cars will be usable safely and on a large scale. The automatic functions will be increased step-by-step and will need to be tried out in practice. This is important on account of the technical availability and on account of consumer acceptance of these applications and their confidence in using them. To be ready for issues that lie ahead, we will adopt a flexible stance and will cooperate intensively with stakeholders. The Netherlands will examine questions concerning data (ownership, management, interchange and security), liability, driving skill requirements and the potential impact on the (digital) infrastructure. These are questions that will receive extra attention during the transition, because for many years there will still be mixed usage of legacy cars and models with (completely) autonomous functions. There are also initiatives taken to research the impact on the insurance branch.

It is essential to perform tests to monitor the use of new technology and to set down the necessary regulations. Testing will allow other road users to become accustomed to these vehicles on the roads.

The approach to enable large-scale testing in the Netherlands

1. Implement innovation-promoting legislation
    a. To enable self-driving cars (and tests with them) on the public highway from a legal point of view, the existing Order in Council (the decree allowing exemption for exceptional transport movements) under which RDW grants exemptions has been amended in July 2015.
    b. The Netherlands will additionally strive for national/international legislation that enables the market introduction of self-driving vehicle technology. For this purpose we will take the initiative in international consultative bodies (EU and UN) and we will support relevant proposals. In preparation for the Dutch Presidency of the EU in 2016, the Netherlands will take stock of which regulations/frameworks would need to be amended at European level for self-driving cars, or where a joint framework is desirable. The Netherlands will naturally cooperate with other countries in this respect.
2. Facilitate large-scale practical tests and develop knowledge
    a. RDW provides information on the conditions and the locations for performing the aforementioned test in Dutch and English on its website (www.rdw.nl)
    b. We will use the first tests to develop a basic procedure and a set of conditions for structurally testing automatic vehicle technology in practice. The objective is to conduct safe tests and structurally to assure knowledge for subsequent initiatives and projects. To this end the Dutch Rijkswaterstaat is cooperating with knowledge institutions, the business community, RDW and road managers.
    c. Rijkswaterstaat will participate actively in international initiatives. For example, we participate in the World Economic Forum, where together with the automotive industry and other relevant parties the barriers and possible solutions for self-driving cars will be identified. This might include issues concerning data (ownership, management, interchange and security) and liability. At national level we will commission studies into these subjects, also factoring in privacy and driving skill requirements.
3. Make the Netherlands an international leader and interact with the general public
    a. Together with the automotive industry and knowledge institutions, the Netherlands will look for further ways of making the Netherlands an attractive test country and promoting this role. The Netherlands will encourage new test applications by means of direct contacts with car and lorry manufacturers and by building up an international network in this field.

b. The Netherlands is starting with an initiative to create a community of early adopters for insights into practical experience and a 'challenge' with self-driving cars on the public highway (similar to the World Solar Challenge for solar-powered vehicles) as a platform for parties working on this development.

3.2.3 United Kingdom

As part of the 2013 National Infrastructure Plan, the government pledged a review of the legislative and regulatory framework to enable the trialling of driverless cars on UK roads. The government also announced in the 2013 Autumn Statement that it "will work to encourage the development and introduction of autonomous vehicles".1 The Automotive Council, chaired by the Business Secretary, sees autonomous vehicles as an important technology for the UK, especially given the strength of UK based automotive research and development, and wishes to promote UK based expertise.2 On 30 July 2014, the government also launched a driverless cars competition inviting UK cities to join together with businesses and research organisations and host vehicle trials locally.

Over the summer 2014, the UK Department for Transport (DfT) has been asking for views on creating a framework for the testing of driverless cars on UK roads as part of a review. The review will establish the obstacles that prevent the testing of self-driving cars on UK roads. We will also consider how these obstacles can be removed whilst maintain existing high levels of road user safety.

The UK DfT has published a background document and opened a consultation on the subject:

- any issues, including regulatory, safety and social issues, which need to be addressed
- the best ways to trial cars with qualified drivers and, looking further ahead, fully autonomous vehicles

A Code of practice has been published in 2015 [5].

Previous to this activity, the same team at DfT had contracted a preliminary study on the feasibility of road trains on the UK roads so called platoons. The study is not published but TRL and Ricardo published part of the results at the RTIC2014 [6].

3.2.4 France

Already during the PREDIT 2 period (1996-2000), the French research centres were studying the issues of the introduction of automation in road transport. The focus was very much on the introduction of more and more ADAS which at this time did not require changes of legislation. Also, French activities on Cybercars attracted media attention but were not mature enough to start regulatory actions.

In Sept 2013, the French government announced a strategic review to define France's industrial policy priorities or "Nouvelle France Industrielle" framed into 34 industrial renewal (or "reconquête industrielle") initiatives. Their aim is to focus economic and industrial stakeholders around common goals, to align government means more effectively to these goals, and to harness local ecosystems to build a new, competitive French industrial offering that is able to win market share in France and internationally, thereby creating jobs.

Among the 34 priorities, “driverless vehicles” or “Véhicule à pilotage autonome” has attracted a lot of media attention. The aim of this initiative is to make the French automotive sector a pioneer in vehicle automation, notably by removing regulatory barriers to growth.

The action plan for this action was made public in July 2014 [49]. One of the five actions for the driverless vehicles is to “change the regulatory and normative framework for experimentation and the placing on the market of autonomous vehicle”, especially the “Changes in the regulatory and normative framework for experimentation and the placing on the market” and “Establishment of an insurance scheme”.

In December 2014, a text should lay down the Statutory instrument authorizing experimentation on open road.

In 2015, the action should propose standards and regulations for experimentation and in the longer term (2017/18), they aim to establish a French Label for “Safe Autonomous Vehicle" or “Véhicule Autonome Sûr”.

For 2018, the same action plans the establishment of an insurance scheme in the form of an “Autonomous vehicle special insurance fund.”

Finally, in 2019, a series of standards on the process and test rules for automated vehicles.

As a major step forward, on 17 August 2015, the bill on the Energy Transition proposed by Ségolène Royal was adopted. The energy transition law provides in Article 37, IX that the French Government is authorized to adopt “by ordonnance” any legal measures to allow the operation of passenger or freight vehicles that are partially or totally automated, for experimental purposes and under safe conditions for all road users by providing, if necessary, an appropriate liability regime. Also adding that “Vehicle traffic in partial or total delegation of conduct cannot be allowed on public transport lanes, except in the case of vehicles used for public transport of persons”.

3.2.5 Sweden

3.2.5.1 Transportstyrlesen

Beginning of September 2014, The Swedish Transport Authority (Transportstyrelsen) unveiled its feasibility study on the need to modify the Swedish traffic and vehicle regulations in view of the increased automation in the transportation system. This pre-study was presented in conjunction with the Road Safety Conference in Tylösand [7].

The study concludes that there is currently no need for major changes as the partially automated driving systems require that a driver is behind the wheel ready to take over operating control. This means that the responsibility remains with the driver. Driving tests do not need to change because of the new technology.

The pre-study notes that the Transport Agency needs to be more proactive and be active in the development of automated vehicles, and that the law should not stand in the way of technological developments that contribute to better safety, environment and accessibility.

The pre-study lists a number of areas that the Authority intends to work with the future including:

- Participate in or follow the relevant test activities (eg, Drive-Me project and KTH’s automated public transport (bus) project)

- Continue to investigate opportunities to experiment with fully self-driving vehicles on public roads in limited areas.
- Continue to monitor and participate in the work on the EU-level legislation in the field of automated vehicles, cooperative road systems and intelligent transport systems.
- Monitor developments at the international level including USA.
- Increasing knowledge of the safety of complex and safety-critical systems may be requested.
- Investigate the impact of such systems on the community planning.
- Deepen cooperation with the Ministry of Industry, other government agencies, industry and academia to contribute to a national consensus.

Transport Agency's Director General, Staffan Widlert has also pointed out the importance of automated vehicles provide new opportunities for people who get their license revoked because of illness.

The full pre-study in Swedish is available online on the agency's website.

3.2.5.2 Lindholmen Science Park

Lindholmen Science Park is leading a national process out from ”the Automated Transport System”. The current main activity is to establish a so called Strategic Innovation Program through the Swedish Innovation Agency Vinnova. Along this activity Lindholmen is involved in other initiatives, like the Drive Me project, initiated by Volvo Cars. Drive Me partners are currently the Swedish Transport Administration, the Swedish Transport Agency, the City of Gothenburg and Lindholmen Science Park.

From a test & demonstration perspective it is also valid to mention the infrastructures now in place in Sweden; SIM-4 (a full scale driving simulator run by the Swedish institute VTI) and ASTA (a recently inaugurated proving ground for active safety and autonomous drive, run by ASTAZero, a company owned by Chalmers and SP).

Legal and regulatory issues are clearly a very important dimension concerning automation of the transport system. Lindholmen Science Park, as a partner in the Drive Me project, and as the host of the national strategic Innovation Program, will engage the Swedish Transport Agency and other relevant organisations, in order to secure the necessary development needed.

3.2.6 Finland

The Ministry of Transport and Communications has been preparing an amendment to the Road Traffic Act that would allow for driverless robotic cars to drive within a restricted area on public roads. The amendment in question would constitute experimental legislation that would be in force for five years starting at the beginning of 2015. Robotic cars could be tested, subject to a permit, in areas defined by the Finnish Transport Safety Agency. The testing of robotic cars in public road traffic would be possible within limited time periods and in predetermined areas.

In the preparatory work for the amendment, the Ministry, together with the Finnish Transport Safety Agency, has closely examined all related legislation and regulations in Finland. The Ministry has come to a conclusion that current Finnish legislation (including adherence to international conventions) allows for the use and testing of self-driving vehicles on public roads given that each vehicle has a specified driver and that the driver is, at all times, capable of controlling his vehicle. The Ministry has found that there is no legislative or regulative requirement for the driver to be inside the vehicle, which allows, in principle, for solutions that use remote control (similar to remotely piloted aircraft).

The outcome of the amendment preparation is therefore a finding that current legislation and regulations in Finland allow for the testing of very high-level automated driving and that no additional regulations or amendments are currently needed. The Ministry of Transport and Communications will work together with other authorities, cities and commercial actors to enable and support testing of automated vehicles in different test environments around Finland (e.g. Tampere, Ivalo). As part of this work, the Ministry will commission a roadmap for automated driving that will be developed in 2015.

From a regulatory standpoint, the Ministry currently sees that the biggest challenges will likely be encountered on liability issues, namely moving away from driver liability and towards product (i.e. vehicle) liability.

At the international level, Finland is actively working towards changing the UNECE Conventions on Road Traffic so that, in the future, they would allow for all kind of testing related to self-driving vehicles and vehicle fleets.

3.2.7 Greece

The Greek Ministry of Infrastructure, Transport and Networks in cooperation with stakeholders in the country has begun discussion regarding the possibility of allowing driverless vehicles within the Greek transport network from 2013. The occasion for starting this discussion was the possible CITYMOBIL2 pilot in the Greek city of Trikala, involving automated public transport systems, including driverless vehicles. The discussion led to a consultation which has taken place in between the different ministry divisions and the involved parties (ICCS, e-Trikala). The ministry has encouraged discussion between all relevant actors in different European countries and for this conveyed a meeting on May 2014 in Athens with representatives from other ministries to discuss different approaches.

As an outcome a legislative act was voted by the Greek Parliament allowing pilot trials of automated vehicles in public roads, under specific conditions (which involve mainly a thorough analysis of the proposed routes, a supervision by appropriate research or academic bodies and an active support by local authorities).

The CityMobil2 large-scale demonstration in Trikala (Greece) was officially launched by the municipality of Trikala during an opening ceremony on 10 November. [8]

3.2.8 Belgium

The current Belgium law allows prototypes with driver to be tested on Belgian roads provided that the prototype is authorised to be tested. . As a reminder, Belgium has been one of the countries at the origin of the modification of the Vienna convention to clarify that driving assisting systems are not contradictory to the principle of having constant control over the vehicle.

To allow testing of their prototypes on Belgian roads, manufacturers will need to go through a 2 steps process:

1. The Regional authority responsible for the road network will need to give its permission to let the vehicle driving on its road network. This permission will be granted after analysis of a file describing, among others, the test conditions. This file will need to contain all necessary information to allow the authority to make its opinion. In order to help the development of this file, the Belgian Federal administration in charge of transport is currently managing a group of experts aiming at developing a code of good practices. The Regions are associated in this process. The UK code of practice is used as basis for this work. This document should describe the conditions to be fulfilled and the procedure to be followed to allow a prototype vehicle to drive on Belgian roads. The document should be completed before end of 2015.

2. The Federal authority responsible for transport will need to give its permission to allow the prototype vehicle to drive on Belgian roads. This permission will be granted after analysis of the vehicle construction.

Belgian authorities are seeking to have a transparent approach with clear rules in order to encourage testing of such vehicles in Belgium in the coming months.

3.2.9 Spain

The Spanish DGT is expected to announce their strategy for the deployment of automated vehicles by the end of 2015.

3.2.10 Other EU member states

Other EU Member States are welcome to report on their current activities related to regulatory aspects. Any addition will be reported in draft 2 of this document planned to be published in Oct 2015.

3.3 International dimension

While this report focusses on the European activities related to regulatory issues, this section lists several relevant activities in other countries.

3.3.1 Tri-lateral EU-US-Japan collaboration on legal issues

The European Commission (EC) Directorate-General for Communication Networks, Content and Technology, Smart Cities and Sustainability (DG-CONNECT), the United States Department of Transportation (USDOT) and the Road Bureau of Ministry of Land, Infrastructure, Transport and Tourism (MLIT) of Japan have a long history of sharing information on ITS (Intelligent Transportation Systems) activities. This exchange was formalized in 2009 and 2010 with a series of three bilateral agreements among the three parties, officially authorizing exchange activities among them.

Through the organizational structure of Steering, Coordinating, and Working Groups, depicted below, the three parties address high-priority areas of shared interest (Figure 10). The color key identifies which of the topics are addressed trilaterally and which are bilateral. Some topics are addressed trilaterally, according to the interests of the parties.

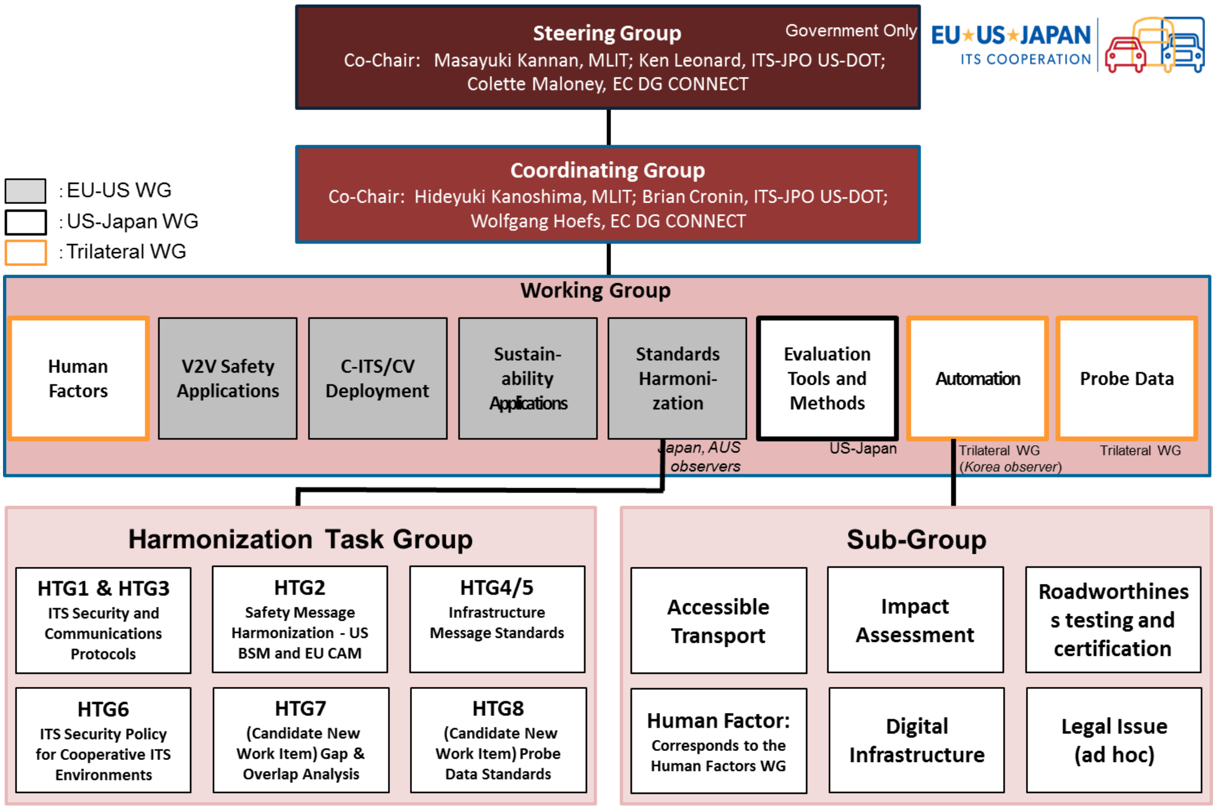


Figure 10: Organisational Overview for the EU-US-JAPAN ITS Cooperation

The Tri-Lateral Automation in Road Transportation Working Group (ART WG) was established by approval of the Steering Group in October 2012 at the Vienna World Congress. The first meeting was convened January 2013 at TRB in Washington, DC.

The overall goals of the Automation in Road Transportation Working Group are to support shared learning, develop solutions to shared challenges, and harmonize approaches where appropriate. The WG seeks to achieve these goals by (1) learning from one another's programs, (2) identifying areas of cooperation where each region will benefit from coordinated research activities, and (3) engaging in cooperative research and harmonization activities.

The working group is focused on connected automation as a mean of achieving maximum benefits in safety, mobility and environmental impacts. Seven areas of shared interest have been agreed upon as candidates for ART WG cooperation. Topics are taken up for bilateral or trilateral work within the ART WG according to the interests and resources of the parties. This does not preclude additional areas being nominated for consideration, nor does it require all three regions to engage in all seven areas:

- Human factors
- Accessibility
- Impact Assessment
- Digital infrastructure
- Connectivity
- System Reliability and Security (including cybersecurity)
- Roadworthiness/Testing and Certification

3.3.2 United States

The US DoT published its ITS Strategic Plan 2015-2019 [9] describing “Realizing Connected Vehicle Implementation” and “Advancing Automation” as the primary technological drivers of current and future ITS work. The Automation Program is organised along 5 major tracks (Figure 11).

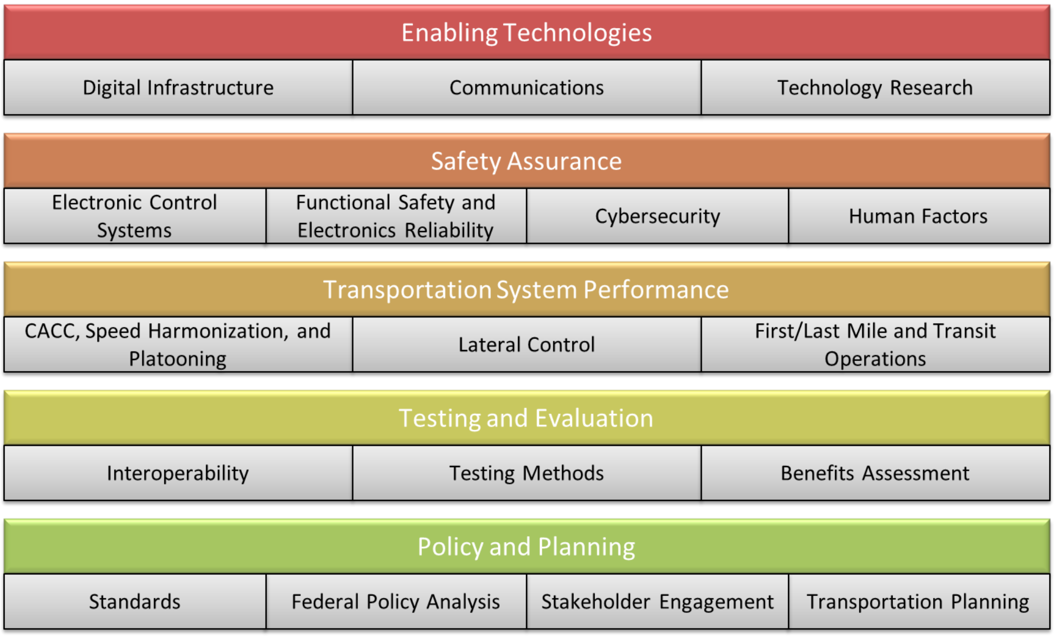


Figure 11: US DoT ITS JPO Automation Program research tracks

For the policy and planning track, the focus is on identifying where current Federal Motor Vehicle Safety Standards (FMVSS) pose challenges to introduction of AVs – particularly as they move into concepts of ‘human out of the loop’ or ‘driverless’. A roadmap has been established for the research in Automated Vehicles Policy.

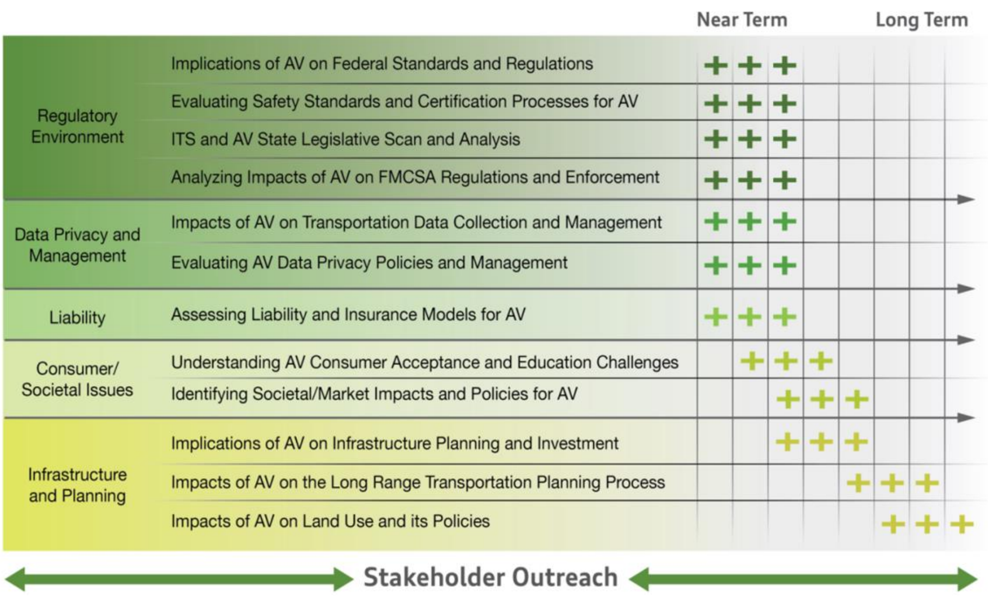


Figure 12: US DoT AV Policy Research Roadmap (Source ITS JPO)

From a regulatory stand point: in the United States, state vehicle codes generally do not envisage — but do not necessarily prohibit — highly automated vehicles [10]. In May 2013, the vehicle safety branch of US DoT, NHTSA, provided guidance to states permitting testing of emerging vehicle technology.

To clarify the legal status of and otherwise regulate such vehicles, several states have enacted or are considering specific laws [10]. As of the end of 2015, four U.S. states, (Nevada, Florida, California, and Michigan), along with the District of Columbia, have successfully enacted laws addressing autonomous vehicles. In 2015, Tennessee State enacted a law prohibiting local governments of prohibiting the use of vehicles solely on the basis of it being equipped with autonomous technology if the vehicle otherwise complies with applicable safety regulations.

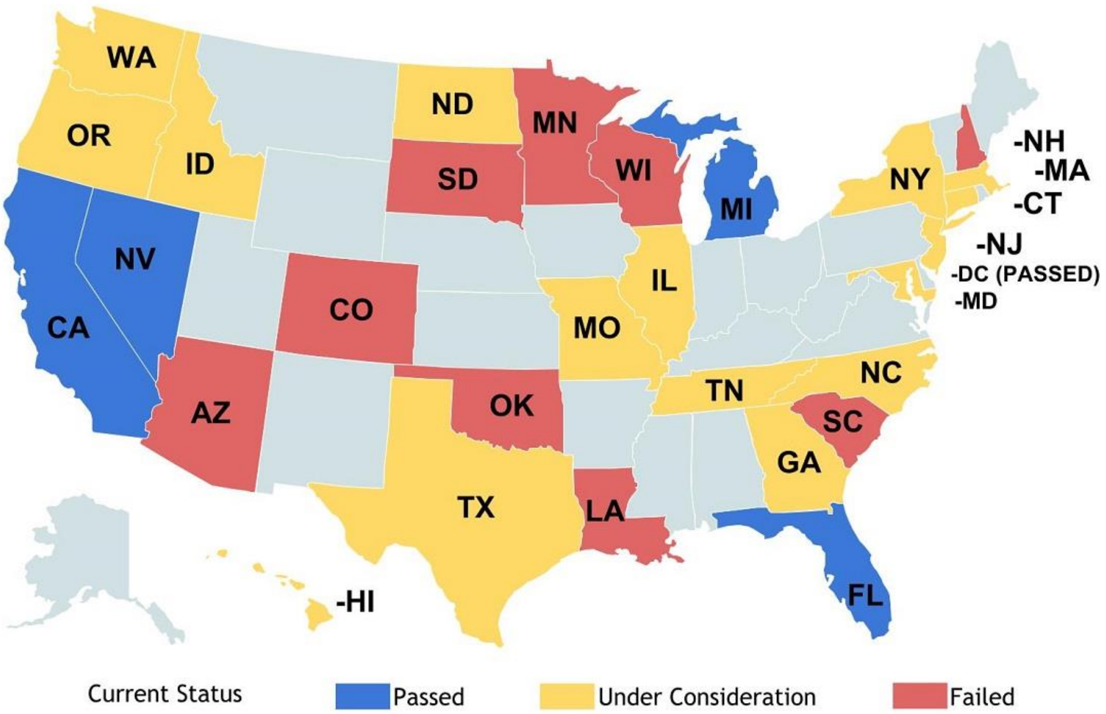


Figure 13: Status of state bills in the United States [10]

Californian DMV delivered their autonomous vehicles testing regulations which became effective on September 16, 2014 [12]. However, the following regulation to allow the market introduction of such vehicles, which was expected in January 2015, is still pending.

A federal bill for "Autonomous Vehicle Privacy Protection Act" was introduced in Nov 2015 asking to assess the organizational readiness of the Department of Transportation to address autonomous vehicle technology challenges, including consumer privacy protections.

3.3.3 Japan

Japan's Cross-Ministerial Strategic Innovation Promotion Program (SIP) includes a new research and development plan for an Automated Driving System as one of ten priority policy issues. The plan was initiated in May 2014 and includes 2.45 billion yen for fiscal year 2014.

Targets include Level 2 systems in 2017, level 3 in the early 2020s, and Level 4 sometime thereafter. There are three working groups which include both public and private members: system implementation, international cooperation, and next generation urban transportation.

The vision for the next generation transportation system is to integrate multimodal transportation into rural and urban environments, to serve Japan's aging population and those with disabilities. Once developed, the entire system could be exported to developing countries or other parts of the world.

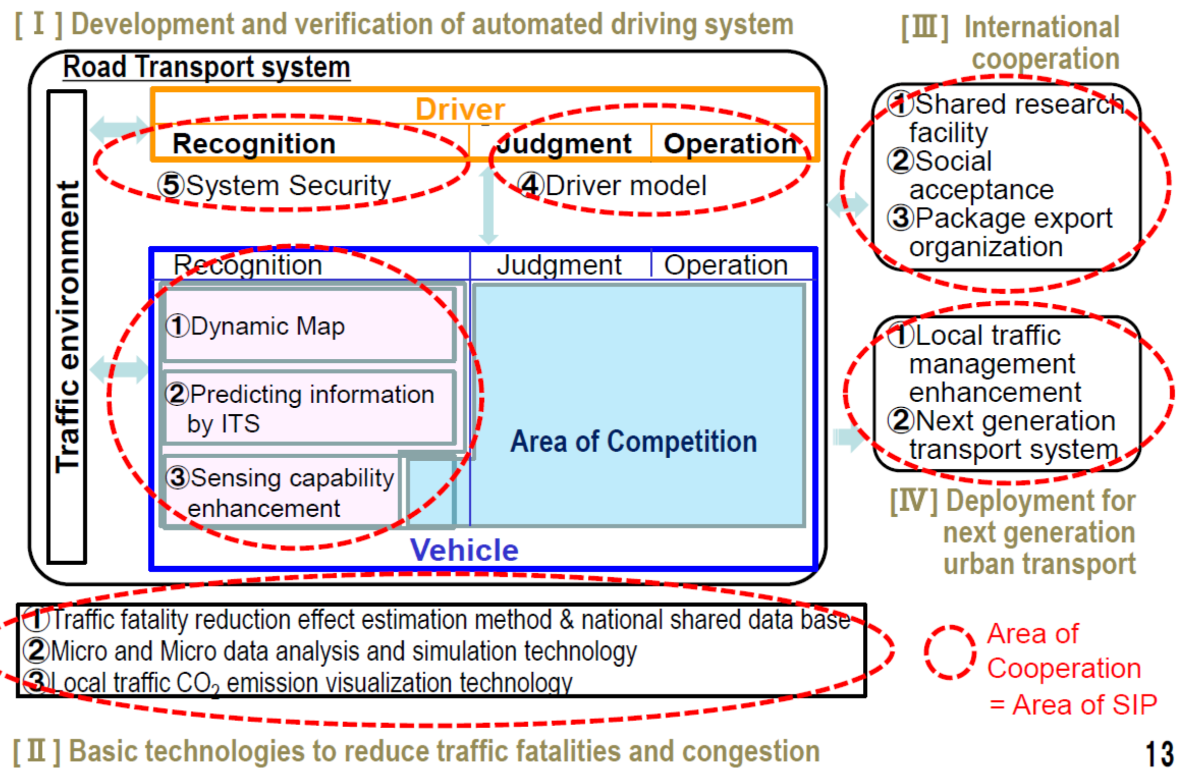


Figure 14: Japan Cross-Ministerial Strategic Innovation Promotion Program (SIP) Automated Driving System Research themes

While the SIP does not specifically mention regulatory aspects as a main action point, it is embedded in many of the activities.

3.3.4 Australia

Australian government is currently reviewing and updating its 'Policy Framework for ITS in Australia' [13]. It is intended that the update to this Policy Framework will provide policy principles and guidance on governance and actions to support AV deployment. The updated Policy Framework is planned to be approved in May 2016. The National Transport Commission (NTC) is finalising a business case to undertake a review of regulatory barriers to the deployment of AVs.

This legal audit of current regulations will include but not be limited to road rules, vehicle regulations, liability and insurance. The review is due to commence in November 2015. A few of the state governments have commenced legal reviews of their state-based regulations to do with vehicles and road use. Most notably, the South Australia government recently developed a proposed legislative amendment to facilitate on-road testing of AVs. Austroads has a number of projects that are underway investigating the issues that will need to be addressed in a nationally consistent way to support the deployment of AVs. This includes how roads should be designed and operated, how vehicles should be registered and insured, how drivers should be licensed, and whether nationally consistent guidelines should be developed to support the testing and deployment of AVs across the states.

3.3.5 China

In China, many institutions, such as Tsinghua University, National Defense University and Tianjin Academy of Military Transportation, have also been developing driverless technique independently. National Defense University designed and completed a 286---km---journey test in 2011 [14]. Tianjin Academy of Military Transportation also completed a 114 km journey on the Beijing-Tianjin highway in real traffic in 2012 [15]. They accomplished car following, lane changing and overtaking missions successfully. BYD is testing their driverless car on the streets of Suzhou, China. The driverless car was co-developed by BYD and the Beijing Institute of Technology (BIT). BYD Surui driverless car was the winner of the 2013 China Future Smart Car Challenge [17].

Driverless cars have been tested in annual races in China, known as Future Challenges. End of 2014, China held its sixth driverless car competition, with the unmanned vehicles having to navigate their way through various obstacles. [no public information is available] [16].

3.3.6 Singapore

In 2014, the Land Transport Authority [18] of Singapore started testing driverless cars.

3.4 International bodies

3.4.1 UNECE

In 2011, the UNECE Inland Transport Committee (ITC) published its "Road Map for Promoting ITS – 20 global actions 2012 – 2020" [19]. The parties involved in the elaboration of the Road Map document are the World Forum for Harmonization of Vehicle Regulations (WP.29), the Working Party on the Transport of Dangerous Goods (WP.15), Working Party on Inland Water Transport (SC.3), Working Party on Intermodal Transport and Logistics (WP.24), Working Party on Rail Transport (SC.2), the Working Party on Road Traffic Safety (WP.1), the Working Party on Road Transport (SC.1) and the Working Party on Transport Trends and Economics (WP.5).

Working Party on Road Traffic Safety (WP.1) is the only permanent intergovernmental body in the UN dealing with road safety open to all countries throughout the world. It is responsible for administering the international road safety-related conventions including the 1968 Conventions on Road Traffic and Road Signs and Signals. It works in conjunction with WP.29 and other working parties to offer a platform that enables cooperation and the exchange of road safety information and best practices among governments.

The World Forum for Harmonization of Vehicle Regulations (WP.29) is a UN body that develops and adopts harmonized vehicle regulations that can be applied worldwide. The research-based regulations promote the design and construction of safer and more environmentally-friendly vehicles. To date, over 140 regulations have been developed (annexed to the 1958 and 1998 "Vehicle Regulations" Agreements). The WP.29 also sets standards for periodical technical inspections.

The key UNECE international legislation relating to road safety are "Convention on Road Traffic", Vienna 1968 and the "Convention on Road Signs and Signals", Vienna 1968 signed by 73 parties [20]. In Addition, the previous versions of the same conventions from Geneva 1949 [21] [22] [23] are also relevant as they were signed by 96 parties including USA, Japan, Australia, etc which are missing for the 1968 convention.

In April 2014, the WP.1 adopted proposal amendments of Article 8 of 1968 Convention on Road Traffic [25]. A new paragraph (i.e., paragraph 5bis) is to be inserted into Article 8. The paragraph 5bis shall read as follows:

> *5bis. Vehicle systems which influence the way vehicles are driven shall be deemed to be in conformity with paragraph 5 of this Article and with paragraph 1 of Article 13, when they are in conformity with the conditions of construction, fitting and utilization according to international legal instruments concerning wheeled vehicles, equipment and parts which can be fitted and/or be used on wheeled vehicles**
>
> *Vehicle systems which influence the way vehicles are driven and are not in conformity with the aforementioned conditions of construction, fitting and utilization, shall be deemed to be in conformity with paragraph 5 of this Article and with paragraph 1 of Article 13, when such systems can be overridden or switched off by the driver.*

The amendment may have solved some of the current concerns related to the Vienna convention, but some further issues still need to be clarified such as the operation of fully automated vehicles in applications such as cybercars or valet parking.

In the framework of Action 20 of the Road Map, the ITC organised a joint workshop on 17-18 Nov 2014 with the Federal Public Service Mobility and Transport of Belgium titled "Towards the future driving and transportation culture: technology innovations for safe, efficient and sustainable mobility". One of the objectives of this meeting is to explore how UNECE can reach a harmonized approach for the development and evaluation of cooperative systems and autonomous driving. A panel will help to articulate expectations towards the regulators, national and international bodies.

As a result the new ITS/AD informal group was formed. [add reference when more info is available]

Very good reference to read on the topic [24].

3.4.2 Standardisation

Standardisation is in itself not a legal or regulatory issue but it may help to clarify the liability framework linked to the deployment of automation. In its early stage, standardisation of automation is important in order to guarantee a minimum level of safety and enable interoperability at defined interfaces but it should absolutely not limit innovation. SAE, ISO and others have started to look into definitions and interfaces.

3.4.2.1 SAE

SAE has taken the initiative to propose a standard for the levels of automation based on the previous work of BASt and NHTSA.

Summary of Levels of Driving Automation for On-Road Vehicles

This table summarizes SAE International's levels of *driving* automation for on-road vehicles. Information Report J3016 provides full definitions for these levels and for the italicized terms used therein. The levels are descriptive rather than normative and technical rather than legal. Elements indicate minimum rather than maximum capabilities for each level. "System" refers to the driver assistance system, combination of driver assistance systems, or *automated driving system*, as appropriate.

The table also shows how SAE's levels definitively correspond to those developed by the Germany Federal Highway Research Institute (BASt) and approximately correspond to those described by the US National Highway Traffic Safety Administration (NHTSA) in its "Preliminary Statement of Policy Concerning Automated Vehicles" of May 30, 2013.

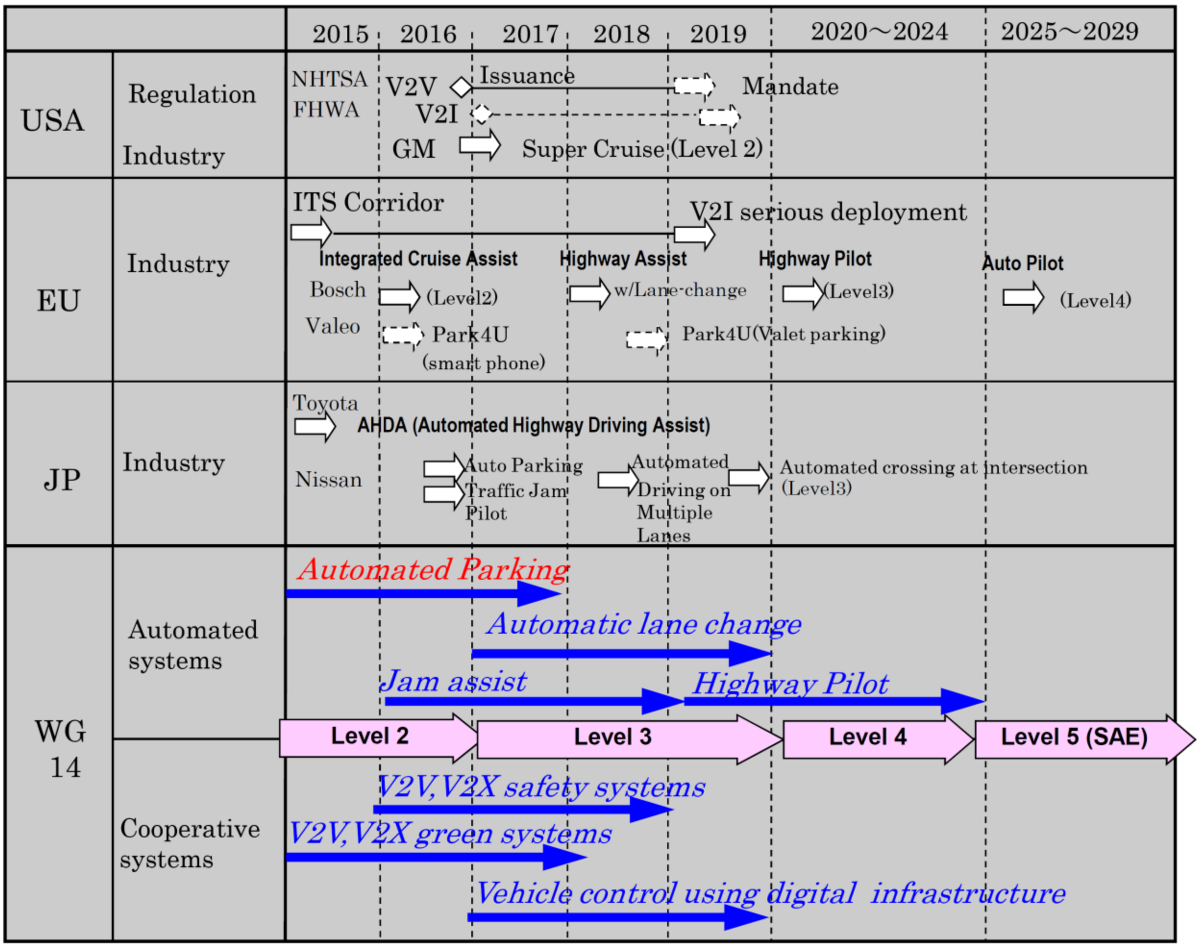
Level	Name	Narrative definition	Execution of steering and acceleration/ deceleration	Monitoring of driving environment	Fallback performance of *dynamic driving task*	System capability (*driving modes*)	BASt level	NHTSA level
***Human driver* monitors the driving environment**								
0	No Automation	the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a	Driver only	0
1	Driver Assistance	the *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	Human driver and system	Human driver	Human driver	Some driving modes	Assisted	1
2	Partial Automation	the *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	System	Human driver	Human driver	Some driving modes	Partially automated	2
***Automated driving system* ("system") monitors the driving environment**								
3	Conditional Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task* with the expectation that the *human driver* will respond appropriately to a *request to intervene*	System	System	Human driver	Some driving modes	Highly automated	3
4	High Automation	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*	System	System	System	Some driving modes	Fully automated	3/4
5	Full Automation	the full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver*	System	System	System	All driving modes	-	

Figure 15: J3016 SAE – Taxonomy and Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems [26]

3.4.2.2 ISO TC204 WG 14

WG14 is part of the Technical Committee 204 (Transportation Information and Control Systems) of the International Standards Organization (ISO). WG14 is charged with establishing standards for systems that avoid accidents, increase roadway efficiency, contribute to driver convenience, and reduce driver workload.

For a few years, WG14 is working on the standardisation of automated vehicle functions.



- Traffic Jam Assist
- Automated Parking System
- Automated Lane Change System
- Highway Pilot

3.4.2.3 ISO TC22 SC3

ISO/AWI 19206 specifies performance requirements for target vehicles and objects used to assess the system detection and activation performance of active safety systems.

ISO TC22/SC03/WG16 is working on functional safety. ISO26262 is clearly relevant for functional safety. Its serves as a suite of standards to reduce product liability of the manufacturers. The standard has ten parts.

TC22/SC39: Road Vehicles – Operational Definitions for Measures of Human Performance and State within the Context of Automated Vehicle Systems. Support test methods development – AV HMI development and evaluation – Common language for developers and researchers – Level 2 and 3 automation.

3.4.2.4 TC204 WG3

PWI 20524 Approved in October 2014 in Vancouver

Title: Intelligent transport systems - Geographic Data Files (GDF) - GDF5.1

This project will extend/revise ISO 14825 (Geographic Data Files (GDF) - 5.0 for the exchange of map data between providers and ITS system integrators) to meet the requirements of emerging Cooperative-ITS APs, Multimodal Transportation APs, and Automated Driving Systems APs.

Focusing static map data!

Target date: December, 2017

4 Regulatory-related studies from funded research projects

4.1 FP7 HaveIT (concluded)

HaveIT project worked extensively on the controllability of the status of the automated function i.e. the driver awareness wrt the intention of the vehicle. The sophisticated HMI concept developed in the HAVEit project was considered as an enabler for the integration of highly automated driving functions with current driver assistance systems.

Also the work on Misuse of the automated function was tackled using different sensors to monitor the state of the driver: driver monitoring cameras with head and eye blink detection, operation of the driver on the vehicle controls such as hands-on the wheel sensors, lane keeping behaviour.

The work enabled the automotive industry to gain more experience on the way to design the more and more automated functions while mastering the manufacturer's duty of care and eventual product liability. Even if this was not explicitly mentioned, this is seen as an extension of the Code of Practice for the development of ADAS of REPSONSE3.

4.2 InteractIVe (concluded)

The integrate project InteractIVe has provided a test and evaluation framework for the assessment of each interactIVe application with respect to human factors and technical performance. Also, test scenarios, concrete evaluation methods, and test procedures as well as tools for evaluation like equipment, test catalogues, procedures, questionnaires or software and support for testing have been provided. Test and evaluation criteria were defined. The corresponding legal aspects for broad exploitation of the applications have been analysed.

Basis for discussions were the project deliverable D7.3 "Legal Aspects" [27]. This document has been written by BASt and IKA with regard to the legal framework for the developed interactIVe functions. The deliverable covers the vehicle type-approval for interactIVe functions according to relevant UN ECE regulations as well as the legal framework on EU-level with the focus on product liability and international law (Vienna Convention on Road Traffic).

4.3 FP7 SARTRE (concluded)

SARTRE project has published a report "D5.3 Summary of Policies" [28] looking at the policies and the legislative impact of platooning on European roads. What legislations will need to be changed, removed or created? The report states that the technology for platooning is close to mature even if it will require further testing and improvements. One of the remaining challenges is to address the regulatory aspects.

The report gives an overview of the current regulations at UN and Spanish levels. The report calls for an international multi-state approach (at UN or other level) rather than state-by-state initiatives.

The report refers to the activities in other part of the world especially in US where the technology might pick up faster as there are clear economic savings to be made for commercial fleet operations. However, the first applications may opt for simplified automation which only regulates the speed of and inter-distances between the vehicles.

Issues related to override of the automation, monitoring of the driver attention, and abuse were briefly discussed.

4.4 FP7 COMPANION (concluded)

The new project COMPANION led by SCANIA will develop the off-board system for optimal platoon coordination, and the on board system for coordinated platooning. In addition they will propose legal solutions and standards to advance large scale adoption. Moreover, they will also demonstrate platooning operations on EU roads in multiple countries. They stressed the issue that standards and legal issues are needed to extend platooning and also they are looking forward into collaboration opportunities with other projects. Standardisation was among the topics of the discussion and the need to develop harmonised architecture for the overall platooning system. ETSI ITS and IDIADA is responsible for both standards and legal issues in the project.

4.5 FP7 Citymobil2 WP26 (ongoing)

During the last year, two deliverables related to legal issues have been finalised under the WP26 ‘legal framework’ activities of Citymobil2: D26.1 ‘legal issues and certification of the fully automated vehicles: best practice and lessons learned’ and D26.2 ‘legal concerns related to the deployment of fully automated urban vehicles’.

In work package 26 the first task was to gather and resume past experiences and lessons learned. The exercise was completed by INRIA with the active collaboration of ERTICO, the deliverable D26.1 finalized and submitted. One of the major achievement of the task was the identification of available standards and lessons learned which was used as an additional building block of the next task (26.2).

Task 26.2 was aiming to interview the participating cities to identify their legal concerns and map the available legal framework in the participating countries. In this context the work was not only focusing on the local level but was mapping the international and European context as well. The analysis of the two relevant international framework, the Geneva and the Vienna Conventions and the mapping of the different European Directives which may be relevant for CityMobil2 was carried out through a literature study approach as many European and international source documents are available in this context. It was more important to see how these legal tools are implemented in the different countries whether the local framework provides some flexibility to move forward with the demonstration without the need of time consuming legal authorization processes. The document is currently under internal review.

The on-going task 26.3 is aiming to provide a certification framework proposal which can be used in every country in Europe simplifying the authorization phase for the deployment of automated road vehicles. The certification framework for the transport system operations, based on a Failure Mechanism Effects Criticality Analysis (FMECA), is now being tested in the different cities where the demonstrations of the citymobil2 vehicles are foreseen: Oristano (small demo), La Rochelle and Lausanne EPFL campus. The first three demonstrations will provide a good basis to evaluate the validity of the proposed framework.

4.6 FP7 AdaptIVe Response4 (ongoing)

Response 3 developed code of practice for ADAS. REPOSNSE 4 is taking upon the results of the Response 3 results and goes beyond in developing targeted and fully automated driving (beyond ADAS).

The scope of RESPONSE 4 is to identify steps that need to adopt to allow for market introduction of automated driving and identify changes. RESPONSE4 will work on different aspects linked to the legal and regulatory issues of vehicle automation. The ambition is to be as successful as in RESPONSE3 with the publication of the Code of Practice. R4 will define a list of requirements for the validation of automated functions. A link will be created with the trilateral WG on the topic of "Roadworthiness Testing".

The project outlined two main issues system classification and safety validation and also legal aspects for the introduction of automated driving.

To allow consistent terminology, the AdaptIVe project is in the process of defining a classification scheme for automated systems and typical scenarios that can occur when using an automated driving system. Legal questions will be raised based on this naming scheme. First results are expected in Dec 2014.

From the discussion that took place, it was agreed to develop a collaboration mechanisms between EU, US and JP working group and RESPONSE4 but this is not active yet.

4.7 DRIVE Me (SE – ongoing)

The DRIVE ME projects plans to test in 2017 100 self-driving Volvo cars on public roads in every day driving conditions around Gothenburg. The pilot will include selected roads; typical commuter arteries and motorway conditions with frequent queues. It is a joint initiative of Volvo Cars Group, the Swedish Transport Administration, The Swedish Transport Agency, Lindholmen Science Park and the City of Gothenburg.

Studies will be carried out and focus on:

- How autonomus vehicles bring societal and economic benefits by improving traffic effeciency, the traffic environment and road safety,
- Infrastructure requirements for suitable autonomous vehicles,
- Typical traffic situations suitable for autonomous vehicles,
- Customers confidence in autonomous vehicles,
- How surrounding vehicles interact with self driving cars.

The participation of the public Authorities at various geographic levels makes this project highly relevant for our WP3.2 purpose: The city of Gothenburg is mainly focussing on the automated operation of the vehicles in dedicated areas e.g. public parking houses. The Swedish Transport Agency (Trafikverket) is focusing on the operations on its road network and envisages the establishment of a monitoring system especially for the operation of automated vehicles. The Transport Agency (TransportStyrelsen) is looking at the authorisation of these vehicles on the road network (See section 3.2.5).

4.8 HF Auto (NL - ongoing)

The Work Package of the Legal aspects and Market perspectives in HF Auto has two main purposes [29].

The first is to address issues of liability, regulations, and privacy (i.e., data collection and transmission) of partially, highly, and fully automated driving systems.

The second is to propose a framework for market introduction of automated vehicles, including legal admission, type approval, product liability, maintenance, insurance concepts, and best practices in product design.

HFAuto focusses on the human interaction with highly automated driving in highway conditions, and WP5 will in particular result in guidelines for the remaining role of the driver taking into account legal aspects, and suggest guidelines for testing the human interaction with automation.

Building upon previous worldwide research, and in close cooperation with the project's industrial partners, applicable working groups, and European and selected National authorities, WP5 reviews the state-of-the-art of legal aspects of automated driving, to determine ambiguities, and subsequently indicate changes to be considered. The liability levels for relevant stakeholders (e.g., manufacturers, governmental bodies, insurance companies, and consumers) will be defined, including the cases of transition between automated and manual control. In addition, the requirements for new products type approval across Europe will be stated and ambiguities will be addressed. Finally, the possibilities for testing automated vehicles on European public roads, under the current legal status, will be examined and suggestions to overcome today's limitations will be suggested and implemented in collaboration with the Dutch Type Approval Origination RDW.

The project will also analyse the impact of different levels of automation on the acceptance and willingness of consumers to purchase automated vehicles. Surveys will poll peoples' opinion on safety, travel and environmental impact, mobility allowance, cost, and subsidisation policies of automated vehicles. The results of the surveys will provide thorough insights into consumers' perception regarding automated vehicles and indicate the major areas of promise and concern among the international public. Thus, they could be useful for vehicle developers and other stakeholders involved in the development of automated driving technology. More information, and among it the results of a first survey [30], can be found on the website: http://hf-auto.eu/

4.9 NL DAVI (ongoing)

The DAVI regulatory activities will be detailed in draft2 (planned in Oct 2015).

4.10 FR ABV (concluded)

Beyond the technical aspects, the french ABV [33] project also aims at evaluation the impact on societal aspect. On this part, the project aims at:

- Studying what are the legal limitations that forbid full autonomous systems on open road and design possible evolution, both on the system and on the legal aspect.
- Evaluating the impact of the system on the traffic with a scaled introduction of the system in the traffic.

4.11 UK Autodrive (2015 – 2017)

The three year project will deliver feasibility studies and demonstrations in Milton Keynes and Coventry. These studies will provide valuable insight for vehicle manufacturers, cities, operators, legislators and insurer to develop the framework for adopting and deploying autonomous mobility. It is not clear yet if a specific study will contribute to the regulatory aspects.

4.12 UK Gateway (2015 – 2017)

GATEway is an 8 million GBP project funded by industry and the Innovate UK Competition and led by the Transport Research Laboratory (TRL). It is one of the three projects awarded by the competition that set to "introduce driverless cars to UK roads" and will deliver demonstrations of automated vehicles in the urban setting of the Royal Borough of Greenwich. GATEway will see three public trials of zero emission, automated vehicles: fully automated shuttle transport on the Greenwich peninsula and Autonomous valet parking.

The project will investigate legal challenges and barriers to adoption.

4.13 UK Venturer (2015 - 2017)

This 36-month project will run demonstrations and tests in both physical and virtual environments along with collecting data from buses in Bristol, UK. The project aims to run tests of sensor equipment and communications as well as tackle issues related to cybersecurity, insurance and liability. In addition, it wishes to explore public reaction to autonomous vehicles.

4.14 NL European truck Platooning Challenge (April 2016)

The challenge will involve various brands of automated trucks driving in columns (platooning), on public roads from several European cities to the Netherlands. Main European ITS corridors could be used such as the Nordic Way and Rotterdam-Frankfurt-Vienna.

The aim of the Challenge is to bring the concept of platooning closer to implementation, and bring together the member states and private parties with the aim of harmonising policies and technical issues. The project foresees to strengthen the collaboration between partners in the truck industry, logistics services, research institutes and governments.

4.15 DE PEGASUS

In Germany, the project "PEGASUS" (Project for establishing generally accepted scenarios and simulation methods for highly automated, cooperative vehicle functions) is in preparation, in order to define the set of traffic situations which defines the risk scenarios.

This should be the basis for a generally accepted method to assess the safety of highly automated vehicles. The project should also define methods to ensure the controllability of the different traffic situations.

[no public reference as of Nov 2015]

5 Legal and Regulatory concerns

This section lists different concerns related to the legal and regulatory frameworks expressed by European Member States or by the European Stakeholders [34]. Each section attempts to justify or clarify what is being done in EU and beyond to address these issues. In this Draft2, most concerns have been discussed with transport agencies and stakeholders in order to give a first overview of the situation. Each section may be completed in the final document (to be published Dec 2016) with possible targeted recommendations.

5.1 Role of the Transport Agency: Public Safety

In most of the case, the Transport Agencies' point of view is that the law should not stand in the way of technological developments as long as the development meets the transport policy objectives of safety, security, environment and accessibility.

To be broader, one of the first duties of any public administration is to guarantee safety to its citizens. Keeping this in mind helps to understand why and how the public administration act in view of the introduction of automated vehicles.

During the VRA discussions on regulatory issues, the "Principe of Precaution" has been mentioned several times to justify the careful adoption of new automated form of transport. Interestingly, the principle of precaution should act in favour of the fast introduction of automated road transport. Indeed, the principle is used by policy makers to justify discretionary decisions in situations where there is the possibility of harm from making a certain decision (e.g. introducing automated vehicles) when extensive scientific knowledge on the matter is lacking (e.g. unbiased studies evaluating the overall societal impact of automated vehicles). The principle implies that there is a social responsibility to protect the public from exposure to harm (e.g. being killed in a traffic accident), when scientific investigation has found a plausible risk.

5.2 Interpretation of international laws

As mentioned in section 3.4.1, the European national traffic regulations are all based on the same set of conventions and treaties to ensure mutual recognition and international compatibility of the traffic rules and of the road vehicles.

The most recent convention is the 1968 Vienna Convention on Road Traffic which some large countries did not sign. This is the case for the US and Japan but also some European countries did not ratify this convention notably UK and Spain. However, a series of former acts are binding these countries together such as the 1949 Geneva Convention on Road Traffic and the 1926 International Convention relative to Motor Traffic and the International Convention relative to Road Traffic signed at Paris on 24 April 1926. Also, the 1909 Convention with Respect to the International Circulation of Motor Vehicles signed in Paris.

Over the past years there has been a long debate on the interpretation of the international conventions. A very good summary was done by Bryant Walker Smith [20].

Among some of the endless discussions, the interpretation of the definition of driver has been largely debated, especially noting that defining "driver" as "a person who drives a vehicle" does not define the term at all. Also, whether the driver needs to be a physical person or may be a moral one. Or even, can the driver be outside the vehicle right next to it or in a remote location. Notably, Germany has taken the position that “driver” necessarily “means a natural person, not a system.” Other discussions relate to the definition of control and whether the driver needs to be in direct or may be in relative control of the vehicle.

One thing to remind ourselves is that the conventions have the purpose to "facilitate international road traffic and to increase road safety through the adoption of uniform traffic rules", and, that the different articles discussed in relation to the deployment of automated vehicles have the original purpose to increase road safety. With this in mind, it is much easier to take one step back and interpret the text in order to accept the introduction of advanced driver assistance systems and automated systems as long as they endorse safe driving principles and they aim to promote road safety policies.

Indeed, a closer look at some provisions of the Conventions seems to suggest that the framers never intended to impose an interpretive burden, quite the opposite. Chapter IV, Annex V states that "For domestic purposes, Contracting Parties may grant exceptions form the provisions of this Annex in respect of: […] Vehicles used for experiments whose purpose is to keep up with technical progress and improve road safety". In other words, Annex V seems to demonstrate that the idea of technical and scientific progress can be used as a general principle to inspire the overall evolutionary interpretation of the Convention.

5.2.1 Modification of national traffic regulations

With the international discussions in mind, many countries, such as UK, NL, Sweden, Finland, Spain, Greece and others have taken a pragmatic step to consider that the problem does not lie necessarily in the international texts but rather in their own national regulations, traffic code, and type approval process. Therefrom, a wave of national studies [ref SE, FI, UK] have analysed and proposed national dispositions to allow, first, the testing of the vehicles on specific public roads, and, second, to allow future market introduction of such vehicles.

Germany has recently announced that the same principle is true for the testing of the AV on the A9 highway tesbed. France is formalising the process through a decree requiring a request to the MEDEE in charge for transport. At the same time, the US state of California has pushed in a law making process which may eventually serve as a good practice for many European Member States.

5.2.2 Allowing experimentations of automated vehicles on public roads

The Chapter IV of Annex V of the Vienna Convention clearly indicates that the member states are free to encourage the experimentation of automated vehicles contributing to improve road safety. In practice this is realised in many EU member states by issuing registration plates for prototype vehicles.

In the US, the California DMV has been the first one to clearly lay down a series of rules for the testing of the vehicles and later for its commercialisation [31]. For the testing, it requires that:

- a driver must be seated in the driver’s seat and capable of taking control during AV testing,
- all AVs be equipped with an independent *[extended]* Event Data Recorder (EDR) to record AV sensor data for at least 30 seconds before a collision and store the data for at least 3 years. See section on EDR below.

- test vehicles must indicate at all time the automation state,
- AVs must be equipped with several means to disengage the automation (including steering and braking overrides),
- AVs must be able to detect faults and, if a fault is detected, the system must alert the test driver and be capable of bringing the vehicle to a stop if the driver does not respond.

In Europe, the Swedish transportstyrelsen was one of the first one to publish a pilot study on the Autonomous Driving [32].

More recently, the UK Government published a detailed review in February 2015 laying down a long list of actions to be undertaken to pave the way to automation. The main conclusions declare that “Driverless vehicles can legally be tested on public roads in the UK today […] providing a test driver is present and takes responsibility for the safe operation of the vehicle; and that the vehicle can be used compatibly with road traffic law.” A Code of Practice has been published in July 2015 for those wishing to test driverless vehicles on UK roads with the following recommendations:

- Test driver, or operator, able to take control and holds appropriate licence
- Test driver or operator has received appropriate training
- Vehicle should be fitted with ‘event data recorder’
- Vehicle should be protected from unauthorised access (‘hacking’)
- Vehicle technology should have been proven on closed roads or test tracks

In France, a decree (which is not a law) is in preparation and will certainly states that whoever who would like to conduct an experiment (actually get a special registration for the experimental vehicle) on AD has to submit a request to the Administration. They are proposing a formal approval process similar to the acquisition of the “W-plates” for prototype vehicles. In parallel, France suggests a simple experimentation taxonomy:

- ‘Hands on’ & ‘Eyes on’ experiments: do not represent any experimentation issues
- ‘Hands off’ & ‘Eyes on’ experiments: no problem as long as this is done “reasonably”
- ‘Hands off’ & ‘Eyes off’ experiments: a new regulatory framework is needed.

Published in March 2015, the report SAE J3018: Testing Guidelines for Safe On-Road Testing of SAE Level 3, 4 and 5 Prototype Automated Driving Systems, give an overview of the best practice for testing of AV eventhough it may appear its practice is at its infancy.

The content gives more guidelines than what the European Member States are suggesting. It defines test driver levels – novice, trained, expert, the test driver training, workload and management, the test data capture – DAS and driver reports, the test route selection criteria and a series of safety provisions – overrides, graduated testing, safety development, software development and modifications.

However, the guidelines are not a recipe to prove a vehicle is safe enough and may not be considered as a basis for possible self-certification scheme and/or type approval testing.

5.2.3 Preparing for the market introduction of automated vehicles

Pushed by Google and others, the work done by the Californian DMV [12] is one of the best examples of proactive law making towards the eventual commercialisation of automated vehicles i.e. the rules for operation of automated vehicles by the public. These regulations have the ambition to ensure public safety without discouraging technical innovations and to define meaningful requirements in the absence of existing technical standards for automated driving systems. In a recent article describing the Californian regulatory process [31], topics such as regulatory models of certification, driver training and licensing requirements, and a discussion of the distinction between behavioural competency (how well the automation handles the environment) and functional safety (how well the vehicle handles internal faults and failures) are discussed.

The DMV's regulations covering the testing of autonomous vehicles on California roads took effect in September 2014. The department was supposed to have regulations covering the general use of driverless vehicles in place on Jan 2015. The DMV missed the deadline and is still developing those regulations.

Sweden plans to amend the legal in 2017. A series of related studies are building up the basis for such decision.

In the UK, a review and amend domestic regulations by summer 2017 to accommodate driverless vehicle technology.

France suggests that in addition to the current transposition into national laws of the international convention, the main issues to be addressed are related to liability, data privacy, and insurance.

5.3 Incompatibility of traffic rules

Sweden has recently launched a study on the need to modify specific traffic rules for automated driving.

Indeed back in 2006, the LAVIA project which field tested Intelligent Speed Adaptation clearly mentioned that the system had to break the speed limit in specific transition places but also that the acceptance of the system was very much related to "how justified was the speed limit on the road segment". [Reference missing]

For example, in the citymobil2 demonstrations, particular attention and regular interventions were required in trivial situations because of unplanned construction works, campus deliveries and irregular parking.

And, in some instances, the traffic law is not precise enough for the operation of vehicles and would welcome elements such as speed profiles or required deceleration after a speed limit changes, etc. These may be agreed among vehicles manufacturers in collaboration with public authorities.

Other relevant traffic rules that may need some exemptions when in automated mode are the minimum distance headways when in Cooperative ACC or in platoons. Also resting time regulations may need to be reconsidered if following vehicles in a platoon do not necessitate full attention of the professional driver.

Finally regulations related to the interaction with other road users may need to be reconsidered.

5.4 Role of EURONCAP ranking

One of the deployment enablers is the User Awareness Programmes which is promoted by User associations such as FIA, RACC but also testing houses such as IDIADA. In Europe, the highly successful programme EuroNCAP led to the introduction of various equipment without requiring any regulatory actions.

This kind of market driven introductions of intelligent vehicle functions is triggered by a better consumer awareness which leads to a strong demand and willingness to pay. The role of Euro NCAP for the introduction of automated functions will be very important but the definition of new test protocols is complex and a long process requiring a clear consensus.

The most recent example of wide take of safety functions is the introduction of Automated Emergency Braking Systems. In only one year after the new EuroNCAP rating for AEB was agreed, from 2012 to 2013, the penetration of the AEB system tripled from 2.7% to 8.9% in Europe.

The role of EuroNCAP will not be clear until there are more products on the market and that new benchmarking tests are worked out and agreed.

5.5 Liability framework

In October 2015, Volvo Car Group President and CEO Håkan Samuelsson said that the company will accept full liability whenever one of its cars is in autonomous mode. This may appear as bold and courageous statement but the only thing it says is that the car company will take its legally binding responsibility for the product it is putting on the market. Should a product fail, the producer is indeed responsible by law.

We need to keep in mind that the automotive industry has been dealing with product safety issues for decades. OEMs have well-established processes for designing and testing the systems to make sure they address potential safety problems. They know that the consequences are severe if something gets on the market that is not safe, and they go to great lengths to avoid that. Here there is one big difference between the European and US industry organises itself: Europe generally reduces market introduction risks through collaboration on the definition of industry technical standards and test protocols so that they can refer to a “best practice” and show they have done their duty of care before introducing a product on the market.

Derived from the former Code of Practice for ADAS [35] developed in the 2000’s in RESPONSE3 project [36], third party ISO26262 functional safety certification may appear the most appealing for the industry. However, as for now, ISO26262 does not consider HMI and the complexity of the standard may lower its acceptance for AV certification.

Now what is needed is to work on a similar clear set of testing rules for the introduction of automated vehicle functions, and, when public safety is at stakes, bring these rules to the regulator in order to make them mandatory through type approval and periodic technical inspections (PTI).

The key question here is *“whether the relevant technologies have reached a demonstrated level of socially acceptable risk*,” to quote Bryant Walker Smith, in short to agree on “*how safe is safe enough”*.

But, let’s imagine that the systems we put in these vehicles prove to be actually ten times safer than human driving today, but fail once after a trillion kilometres. Could we image that, for that particular failure, the liability of the vehicle manufacturer will fade away? Unless the manufacturer can proof he has followed the *agreed* code of practice, the answer is most probably no.

For this reason, manufacturer will certainly get together to set the basis for a code of practice. The German PEGASUS project will propose an alternative certification process that may be better suited for the AVs needs. (See DE Pegasus project)

As a side note: In its programme of Nouvelle France Industrielle, France has mentioned the possibility to establish an “Autonomous vehicle special insurance fund.” Indeed a similar principle exists already in the US for vaccine funds, the National Vaccine Injury Compensation Program (VICP). The VICP is a no-fault alternative to the traditional tort system for resolving vaccine injury claims that provides compensation to people found to be injured by certain vaccines. Considering the introduction of Automated vehicles as a vaccine to the Road fatality epidemic may lead to the creation of an Injury Compensation Program similar to the VICP.

5.6 Impact on Insurance business

A series of concerns have been expressed by member states and other VRA partners on the need to review the insurance models for automated vehicles. [46]

According to Mr Stephane Penet of the French Federation of French Insurers, three main areas of concerns are:

- Is the current insurer’s legal framework adapted to insure an automated vehicle
- The shift of risk and therefore liability between drivers and automakers
- The business model of the insurers

On the first point, the current insurance regulations in Europe define in details the obligations of the insurers with regards to the coverage of both the vehicle’s and the driver’s risks. The current laws seem to be compatible of the introduction of automated vehicles and no specific changes are considered to be necessary independently of the drivers in the direct control of the vehicle or not.

On the shift of risks between actors, the basic principle is that, in case of incident, the insurances will compensate the victims on the basis of the harm done to the victims. It is their daily jobs to establish who is liable on the basis of the facts that they can collect: reports from the involved parties, from the police officers, or even from witnesses. In the vast majority of the cases, these elements are sufficient to assess the responsibility. Thus, whatever the level of automation engaged at the moment of the incident, the basic principle for establishing who is liable will not change even if the automated vehicle may be at fault.

Once this is clarified, and if this is deemed necessary, the challenge may reside in the establishment of clear proves of product failure or, even in some cases, infrastructure or road operators failures. For these reasons, the possibility to reproduce the circumstances that led to the incident is highly desirable. Vehicle manufacturers, road authorities and insurers agree to work on the definition of an Event Data Recorder (discussed separately below) which could provide valuable information to establish if the vehicle was operating in an advance level of automation, and/or, if it failed to detect a danger or to act up properly up this danger. In this respect, the insurers insist on the non-discriminatory access to the EDR information. However, even if this is the case, it may often lead to a no-fault situation between the owner and the vehicle manufacturer e.g. in the case of a vehicle in SAE L3 automated mode failing to detect or avoid an animal.

Last point, concerning the business model related to the increasing penetration of automated vehicles: the model used by insurers is directly related to the risk that needs to be covered. Working out the correct price for insurance premiums is a complex process that must balance the availability of funds, the likelihood of certain claims (the risk) and the ability for the pool of money from all insurance premiums to cover the cost of claims. Insurers must rely on claims histories, statistics and probability calculations to plan how much they may have to pay out. They may also seek specialist help or information on certain risks, such as flood maps or seasonal weather forecasts.

The risk affected by the introduction of automated vehicles is mainly related to the risk of traffic accidents going from vehicle body damage to fatalities. Even if some collateral damages may be caused by the use, malfunction or failure of the automated functions in the vehicle, it is reasonable to assume that the overall risk of collision, injuries and fatalities, and therefore the risk to be covered by the insurances, will decrease dramatically. From a pure financial point of view, this decrease is actually a treat to the insurance industry. So insurers may have to revise their business model to stay competitive. This being said, this volume of risks may represent only a minor part of the total risk covered by the auto insurers. It does not include other kind of risks such as window shatters, vandalism, fire, flood, theft, fraud, etc. but also, new risks may have to be added such as misuse, malicious use, cyber attack risks.

5.7 *Event Data Recorder*

As mentioned above, the regulatory obligation for installation of performance extended Event Data Recorders EDR for data collection and data storage which could be used to determine if the vehicle was in automated mode and understand the circumstances of the accident.

The EDR would have to be specified in national regulations in order to be receivable as a piece of evidence in court. It would be possible to prove the good behaviour of the vehicle in terms of road traffic regulations i.e. whether an offense was caused by driver or Level 3 System. The EDR would secure the obligations of the OEM to monitor their products.

In California, the DMV requires that all AVs should be equipped with an independent *[extended]* Event Data Recorder (EDR) to record AV sensor data for at least 30 seconds before a collision and store the data for at least 3 years.

In March 2015, the UK DfT introduced to the UNECE WP29 a first proposal to recommend the use of Event Data Recorder in vehicles having higher levels of automation. A supporting statement was made for the German ministry in its "Strategy for automated and networked driving."

5.8 *"How safe is safe enough": Minimum performance criteria or behavioural competency*

At the moment, the initial proposal is to perform test in gradually more challenging environment; below the example of The Netherlands:

1. Simple Technical & Functional Tests in labs and simulation
2. Technical & Functional Tests on tracks

3. Technical Functional Tests on open roads with warning escort
4. Human Factors tests on selected and authorized open roads
5. Large Scale Human Factors tests on selected and authorized open roads
6. Large scale FOT without experimenter

However, it may not lead to a very thorough approach and some suggestions include the use of software simulation with Hardware in the Loop.

Besides the above, there is no specific process in place to allow or not new types of automated vehicles to hit the road. The best solution at this stage is to set minimum performance criteria, so-called behavioural competency in California [31], reflecting the required level of safety. However, this proposal did not materialise *yet* into the DMV regulation which is expected to be open for consultation in January 2016 (with around 1 year of delay).

Table 2: Minimum Behavioural Competency Requirements in CA DMV regulation

Critical Driving Manoeuvres	Freeway	Rural Highway	City Streets	Valet Parking	Low-Speed Shuttles
Detect System Engagement/Disengagement Conditions Including Limitations by Location, Operating Condition, or Component Malfunction	✔	✔	✔	✔	✔
Detect & Respond to Speed Limit Changes (Including Advisory Speed Zones)	✔	✔	✔		✔
Detect Passing and No Passing Zones					
Detect Work Zones, Temporary Lane Shifts, or Safety Officials Manually Directing Traffic	✔	✔	✔		
Detect and Respond to Traffic Control Devices		✔	✔		
Detect and Respond to Access Restrictions such as One-Way Streets, No-Turn Locations, Bicycle Lanes, Transit Lanes, and Pedestrian Ways			✔	✔	✔
Perform High Speed Freeway Merge					
Perform a Lane Change or Lower Speed Merge			✔		
Park on the Shoulder or Transition the Vehicle to a Minimal Risk State (Not Required for SAE Level 3)					
Navigate Intersections & Perform Turns		✔		✔	
Navigate a Parking Lot & Locate Open Spaces				✔	
Perform Car Following	✔	✔	✔	✔	

Including Stop & Go and Emergency Braking					
Detect & Respond to Stopped Vehicles	✔	✔	✔	✔	✔
Detect & Respond to Intended Lane Changes / Cut-Ins	✔	✔	✔		
Detect & Respond to Encroaching Oncoming Vehicles		✔	✔	✔	
Detect & Respond to Static Obstacles in Roadway	✔	✔	✔	✔	✔
Detect & Respond to Bicycles, Pedestrians, Animals, or Other Moving Objects		✔	✔	✔	✔
Detect Emergency Vehicles	✔	✔	✔		

6 Possible shift of roles and responsibilities of stakeholders

This section will be further elaborated in the final version of this document.

6.1 Road operator

Greater focus: May lead to the need of rigorous maintenance of road signs and road markings.

Role of the Map maker?

- Roads and road markings
- Signs and traffic management systems

Depending on scenarios, levels of automation and design choices:

- Separate lanes, (parking)areas
- Supporting systems (signage, markings, traffic lights, barriers, magnetic markers, etc.)
- Different construction requirements (different wear and tear)

Maintain Digital infrastructure (maps)

- Static (see presentation Shibata-san)
- Dynamic (requires communication)

How to integrate real time, accurate dynamic information?

- Work zones / lane closures
- Variable speed limits and other TM measures

Requires stakeholders to agree on processes and formats

6.2 Driving License issuers

Who can use the system in a full automated vehicle?

6.3 Vehicle type approval authority and PTI

Still approving a vehicle; how to test efficiently?

PTI Roadworthiness testing; how to assess routinely an automated system in an effective wqy and cost effective for the driver; software routines.

6.4 Vehicle manufacturers

May have more responsibility to respond to a detected failure.

7 Harmonisation needs between national and DGs

This section is left intentionally blank. It will be further elaborated in the final version of this document.

8 Achievements of the WP3.2

8.1 Building a network for discussion groups

Through the various meetings of VRA and iMobility meetings as well as the ITS congresses and the TRB meetings, the WP3.2 has succeeded in establishing a list of relevant contact points in different active EU members states and beyond.

8.2 Current status of discussions

While there are many initiatives at EU MS level and UNECE, there is little consolidation at EU level. VRA WP3.2 plans to further work with the established contact points in order to identify what should be done together at EU level and how this could be approached.

This report is the results of the investigation work of VRA during its first period: Identify the active contact points, Clarify current initiatives of EU Members States, Identify the inputs from EU and national -funded projects, Network internationally especially with US and Japan to identify their regulatory initiatives, and Provide first recommendations for EU level coordination.

During the Second Period (Oct 2014 – Sept 2015) of VRA, WP3.2 has initiated concrete interaction with identified contact points, Requested feedback on the present draft report and extend its scope, work on Chapter 5 to list current regulatory concerns and which actions are needed, and Update report with status of initiatives and project results, add any new ones if identified.

On March 26th 2015, the iMobility Forum Automation WG and legal issues WG together with VRA WP3.2 organised a workshop on regulatory issues.

8.3 Next steps

During the last period of VRA (Oct 2015 – Dec 2016), the WP3.2 will consult further with the public authorities in order to monitor the current progress of their national activities and identify the issues that need to be worked out together at EU level. A workshop may be organised in March 2016 to contribute to the update of this document.

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Annex 1: 2014 recommendations from the Regulatory issues discussion group

Legal issues are at the moment mentioned as one of the main concerns for the introduction of highly automated driving systems. The responsibility and liability of all stakeholders needs to be clearer before we can introduce such systems. Industry, government and market players need to clarify their rights and obligations related to the use of automated vehicles.

The main target today should be to reach a harmonised regulatory approach for automated driving at EU level that would allow for innovation and, also, improve safety, efficiency and environment while preserving the comfort of the travellers.

The legal issues are in themselves an inherent bottleneck and risk for the introduction of automated driving. But most importantly, the foreseen legal solutions should preserve the user and societal acceptance.

The Regulatory and legal framework for introduction of highly automated driving on the roads goes beyond the H2020 programme. A clear strategy would be needed at the EU level.

The EU MS are already taking some initiatives within their jurisdiction.

However, Fragmentation of regulatory approaches might hinder implementation and have negative effects on European Competitiveness. The industry needs global solutions.

The MS and the industry should be brought together in order to identify a harmonised regulatory approach for road transport automation.

Items to be addressed are:

- Regulatory framework to allow of highly automated driving vehicles testing at European Scale within a very near time horizon
- Regulatory framework to allow the commercialisation of highly automated driving vehicles at European scale in a longer term
- Clarify the roles and responsibilities of all relevant parties including road operators, and infrastructure providers

As the automated driving evolves, Liability issues still needs to be properly addressed by all the stakeholders including drivers, industry, insurances, and public side.

Also lessons learned from other sectors would be of high value.

On-going and Foreseen activities and initiatives might already provide the initial grounds for the needed regulations at EU level e.g. RESPONSE4 within AdaptIVE, as well as the EC DG MOVE C-ITS platform. Also one needs to learn from activities in other parts of the world e.g. US, Japan, Singapore. Finally, the UNECE discussion should be considered.