

THE | AUTONOMOUS

**CHAPTER EVENT
SAFETY & REGULATION**

Co hosted by



EXECUTIVE SUMMARY

On July 9th, 2020, The Autonomous together with POSSER SPIETH WOLFERS & PARTNERS (PSWP) hosted a virtual Chapter Event on “Safety & Regulation”. The event featured six presentations and two panel discussions. A moderator managed the interaction between the audience and the speakers. The audience participated by submitting numerous questions that were answered by the presenters and by completing a post-event survey. The event focused on two main topics: (i) **Attaining and Certifying Safety in AD– Regulatory Perspective** and (ii) **Attaining and Certifying Safety in AD– Industry and Standardization Perspective**. This report summarizes the presentations, panel discussions, the Q&A, and the results of the post-event survey.

FOCUS I: ATTAINING AND CERTIFYING SAFETY IN AD - REGULATORY PERSPECTIVE

The topic aimed to answer important questions for the future of safe autonomous driving, such as: “What legal framework do we need on a national and international level for autonomous and automated driving?” as well as “Is it recommended that single nations make their own regulations for autonomous vehicles before international laws are defined?” Three keynotes from remarkable industry legal experts were presented on this matter, and numerous highly relevant questions were thoroughly discussed – some of which are:

- What are the biggest obstacles to harmonizing regulatory requirements?
- When we talk about translating international standards into national law - is a homologation system better suited to do so than a self-certifying system?
- Who is liable when an autonomous car crashes?

FOCUS II: ATTAINING AND CERTIFYING SAFETY IN AD - INDUSTRY AND STANDARDIZATION PERSPECTIVE

The second session provided an excellent opportunity to dive deeper into the challenge of harmonizing international rules and standards with industry representatives. Once again, three high-quality keynotes were presented, and numerous questions from the panelists and the virtual audience were passionately discussed. Some of them are:

- Is it sufficient to use simulations for autonomous vehicle testing?
- How can we assess the average human driver performance in comparison with an autonomous driving system?
- How safe should an autonomous vehicle be?

Quote:

“It is not the regulation work that makes the entry into the market so long to wait for. It is the technology that must be good enough to have customer value.”

BACKGROUND AND EVENT DETAILS

THE INITIATIVE

For all actors involved in the development of autonomous mobility solutions, who position safety as a fundamental value of their products - **The Autonomous is a knowledge ecosystem** - that generates new knowledge and technological solutions **to tackle key safety challenges** that shape the future of safe autonomous mobility. Complementary to standardization organizations that establish uniform engineering or technical criteria, methods, and processes, The Autonomous will develop **Global Reference Solutions** for autonomous mobility that conform to relevant standards and facilitate the adoption of these solutions on a grand scale. The benefits The Autonomous will provide to the partners of the ecosystem are:

- Development of safe and best-in-class AD solutions thanks to the wisdom of the crowd;
- Reduction of potential product liability risk by (i) tightly working with government and regulatory institutions and (ii) developing common basis for regulatory bodies;
- Reduction of development costs by (i) developing modular and reusable Global Reference Solutions and (ii) sharing the development efforts;
- Reduction of potential product liability risk by (i) tightly working with government and regulatory institutions and (ii) developing common basis for regulatory bodies; Development of safe and best-in-class AD solutions thanks to the wisdom of the crowd; Reduction of risk of wrong development by joint definition of state-of-the-art and state-of-practice;
- Accelerating the learning curve by collectively learning from individual failures and field observations

Towards this vision, The Autonomous is hosting a series of events - **“The Autonomous Chapter Events”** to facilitate discussions among experts and take the first steps towards the targeted Global Reference Solutions. The fourth Chapter Event titled **“Safety & Regulation”** was hosted by The Autonomous, together with **POSSER SPIETH WOLFERS & PARTNERS (PSWP)**

EVENT DETAILS

Focus I: Attaining and Certifying Safety in AD – Regulatory Perspective

- Regulation as a key to safety – Overview of the legal framework, incl. current drafts | Benedikt Wolfers | PSWP
- UN/ECE perspective to attain safety in AD by regulation and standardization | Richard Damm | UNECE Working Party on Automated/Autonomous and Connected Vehicles (GRVA)
- Safety in AD - The U.S. regulatory perspective | Jonathan Morrison | NHTSA

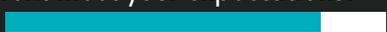
Focus II: Attaining and Certifying Safety in AD - Industry and Standardization perspective

- Worldwide Regulation Approaches from an Industrial Point of View | Armin Gräter | BMW
- Strategy to harmonize global requirements for ADs | Barnaby Simkin | NVIDIA
- Testing and approval of Autonomous Vehicles from a technical service perspective | Christian Gnant | TÜV Süd

FACTS

222 event registrations
129 different companies attended
150 unique views
101 concurrent viewers
73 questions asked by the audience

FEEDBACK

45 participants provided feedback
Did the event meet your expectations?
Yes 83%  No 17%
How would you rate the event?
★ ★ ★ ★ ★ 5/6

TECHNICAL REPORT

CHAPTER EVENT SAFETY & REGULATION

Edited by
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The Autonomous
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CONTENT

| | |
|---|-----------|
| 1 THE INITIATIVE | 8 |
| 1.1 Vision | 8 |
| 1.2 Mission | 8 |
| 1.3 Approach | 9 |
| 1.4 Chapter Events | 10 |
| 2 CHAPTER EVENT SAFETY & REGULATION | 11 |
| 2.1 Scope and Topics | 11 |
| 2.2 Event Statistics | 11 |
| 3 FOCUS I: ATTAINING AND CERTIFYING SAFETY IN AD - REGULATORY PERSPECTIVE | 12 |
| 3.1 Talk 1: Regulation as a key to safety – Overview of the legal framework, incl. current drafts | 12 |
| 3.2 Talk 2: UN/ECE perspective to attain safety in AD by regulation and standardization | 13 |
| 3.3 Talk 3: Safety in AD - The U.S. regulatory perspective | 13 |
| 3.4 Panel discussion on Safety in AD | 14 |
| 4 FOCUS II: ATTAINING AND CERTIFYING SAFETY IN AD - INDUSTRY AND STANDARDIZATION PERSPECTIVE | 17 |
| 4.1 Talk 4: Worldwide Regulation Approaches from an Industrial Point of View | 17 |
| 4.2 Talk 5: Strategy to harmonize global Requirements for ADs | 18 |
| 4.3 Talk 6: Testing and approval of Autonomous Vehicles from a technical service perspective | 19 |
| 4.4 Panel discussion Attaining and Certifying Safety in AD - Industry and Standardization perspective | 20 |
| 5 SURVEY RESULTS | 24 |
| 5.1 Contributors | 24 |
| 5.2 Subject: General AD | 24 |
| 5.3 Subject: The Autonomous | 26 |
| 5.4 Subject: Automated Driving & Regulation | 27 |
| 6 APPENDICES | 30 |
| A List of abbreviations | 30 |
| B Compliance guidelines | 30 |
| C Standard settings guideline | 31 |
| D Acknowledgments | 33 |
| E Feedback | 34 |

1 | THE INITIATIVE

As autonomous mobility is moving closer to becoming a reality, safety and trust concerns prove to be the main hurdle in the way of reaching broad acceptance. OEMs and technology suppliers (Tier 1, 2 & 3, and others) cannot overcome the safety challenge and the necessary investment costs with a “go-it-alone” approach. Therefore, the autonomous mobility industry and other relevant institutions need to come together and show significant efforts in prioritizing and ensuring safety on all technological levels, as well as set common technical and legal standards. Towards this, TTTech Auto initiated The Autonomous - an open platform that brings together actors from the autonomous mobility ecosystem to align on relevant safety subjects.

1.1 VISION

*Create a safer, more livable,
and more sustainable future.*
—The Autonomous

For all actors involved in the development of autonomous mobility solutions, who position safety as a fundamental value of their products - [The Autonomous is a knowledge ecosystem](#) - that generates new knowledge and technological solutions to [tackle key safety challenges](#) and shape the future of safe autonomous mobility. Complementary to standardization organizations that establish uniform engineering or technical criteria, methods, and processes, The Autonomous will develop [Global Reference Solutions](#) for autonomous mobility that conform to relevant standards and facilitate the adoption of these solutions on a grand scale. The benefits The Autonomous will provide to the partners of the ecosystem are:

- Developing safe and best-in-class solutions for Automated Driving (AD) challenges thanks to the wisdom of the crowd;
- Reduction of potential product liability risk by (i) tightly working with government and regulatory institutions and (ii) developing a common basis for regulatory bodies;
- Reduction of development costs by (i) developing modular and reusable Global;
- Reference Solutions and (ii) sharing the development efforts;
- Reduction of risk of wrong development by joint definition of state-of-the-art and state-of-practice;
- Accelerating the learning curve by collectively learning from individual failures and field observations;

Furthermore, the work products of The Autonomous are expected to serve as further input to existing standardization activities and may also result in new standardization projects.

1.2 MISSION

Towards the above-defined vision statement, The Autonomous will:

- Provide a diverse and balanced knowledge ecosystem for autonomous mobility;
- Set the stage for open discussions on main technical and architectural questions where controversial approaches can be freely discussed;
- Act as an interface between industry requirements, standardization, regulation bodies, and academic research in safe autonomous mobility. Collectively identify important gaps in the field and focus the efforts;
- Build consensus on major safety solutions within the automotive industry;
- Generate high-quality know-how and Global Reference Solutions compliant to relevant standards in autonomous mobility;
- Facilitate the adoption of the Global Reference Solutions on a grand scale by placing them into applicable standards as solutions compliant to their requirements.

1.3 APPROACH

Current Approach

The development approach of automotive systems has remained unchanged over many years. Generally speaking, a car manufacturer (OEM) and its suppliers (Tier 1, 2 & 3, and others) cooperate and then compete with other manufacturers in providing better solutions and products (see Figure 1). This approach has worked well for developing standard, well constrained, and deterministic automotive embedded systems like Anti-Lock Braking System (ABS), Engine Control Units (ECU), and others.

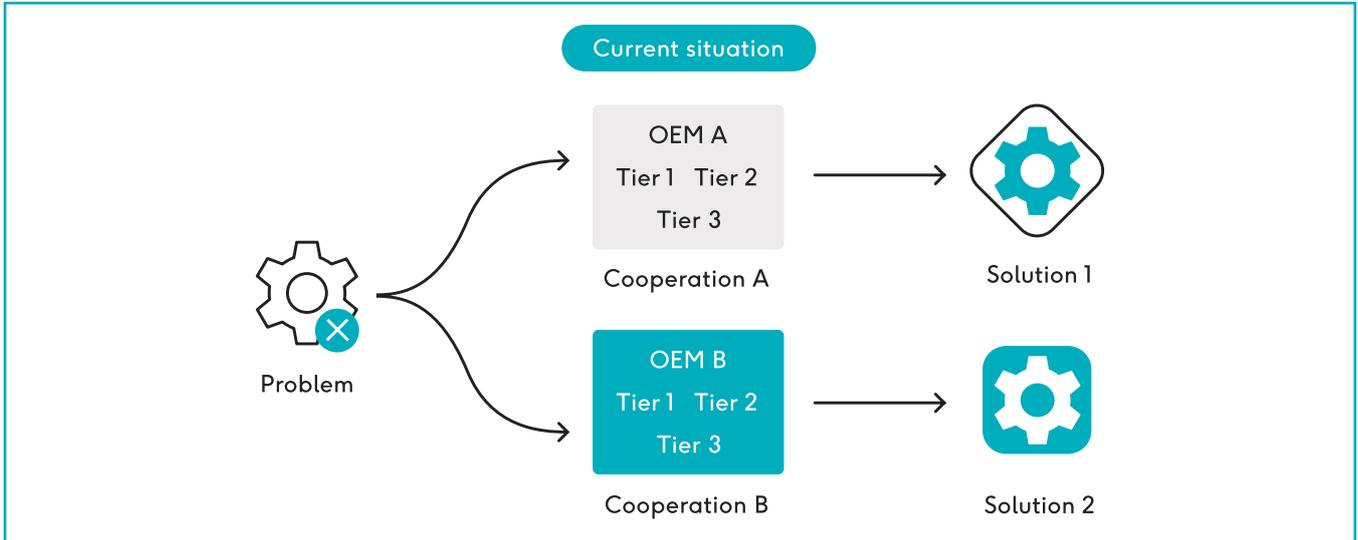


Figure 1: Current development approach of automotive systems.

However, the approach is sub-optimal when it comes to the development of upcoming SAE Level 3 - Level 5 Automated Driving Systems (ADS). The rationale for this is (i) the novelty and high complexity of the AD systems, (ii) the unprecedented high development costs, and (iii) the difficulty in aligning different technical solutions on a common state of the art.

Proposed Approach

To reduce the development cost, a shift from many interdependent cooperation groups (where cooperation groups compete with each other on providing a better solution for a given problem) to a single, broader, and more diverse knowledge ecosystem where partners collaborate towards a single shared goal is necessary (see Figure 2). Such an approach will enable (i) the development of safe and best-in-class products, (ii) an ecological and sustainable development, and (iii) faster development autonomy. Furthermore, in addition to car manufacturers and technology suppliers, The Autonomous also invites stakeholders from governmental, academic, regulatory, and standardization institutions in order to ensure an integrated view.



Figure 2: Proposed approach for development of future AD systems.

In “STEP1” of the proposed approach, the partners of the knowledge ecosystem will work together on Global Reference Solutions that conform to relevant standards. The notion of the Global Reference Solutions is to cover all relevant problems in the development of future AD systems. Hence, more than one reference solution will be available, i.e., ranging from Fail-Operational/Fail-Degraded (FO/FD) architectures to verification and validation (V&V), runtime verification approaches, sensor and sensor fusion configuration, and others. In “STEP 2” of the proposed approach, the partners of the ecosystem will be able to individualize the Global Reference Solution to their needs and therefore, keep the competition “alive”.

1.4 CHAPTER EVENTS

In 2020, The Autonomous kicked off a series of virtual technical workshops, also known as “The Autonomous Chapter Events”, to facilitate discussions among experts and work towards the target Global Reference Solutions. Figure 3 presents a summary of the Chapter Events that took place so far.

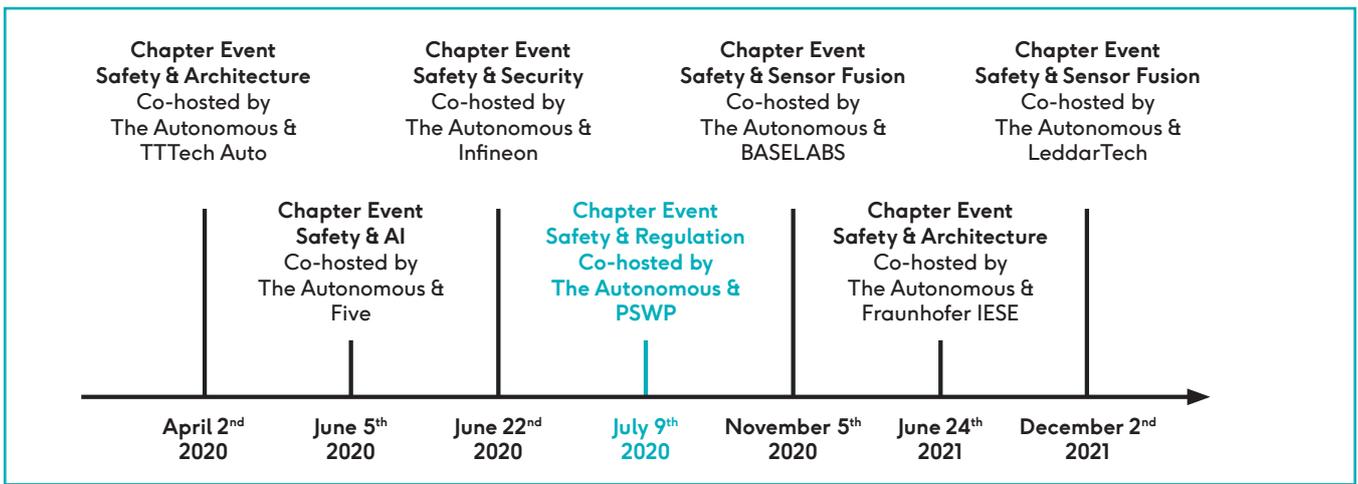


Figure 3: Summary of all Chapter Events that were organized so far

The target outcome of each Chapter Event is a high-quality content summarized in a report. The current report is a summary of the Chapter Event Safety & Regulation.

2 | CHAPTER EVENT SAFETY & REGULATION

2.1 SCOPE AND TOPICS

The Safety & Regulation Chapter Event explored **the challenges and approaches for attaining and certifying safety in Automated Vehicles**. Towards this goal, we gathered regulatory and governmental bodies, OEMs, semiconductor suppliers, technology providers and relevant standardization groups to share know-how and debate on the following (but not limited) topics:

1. Overview of current standardization and regulation process for automated and autonomous driving, e.g., UN/ECE 79, UN/ECE ALKS Draft, UL 4600, EU Mobility Package, EU Guidelines Exemption Procedure Automated Vehicles, Safety First for Automated Driving (SaFAD), etc.
2. What are the core regulatory requirements autonomous driving systems have to meet to be certified as “safe”? A cross-domain perspective to: “What does “safe” mean to autonomous mobility?”
3. How can “safety” be measured? What must be defined in (technical) standardization and (legal) regulation? Could regulation concentrate on core concepts leaving the details to technical standardization?

Focus I: Attaining and Certifying Safety in AD - Regulatory Perspective

Focus II: Attaining and Certifying Safety in AD - Industry and Standardization perspective

2.2 EVENT STATISTICS

Figure 4 summarizes the facts about the event and the feedback received from the participants. In particular, 221 registrations were made for the virtual event. The participants were from 129 different companies/institutions. The live stream had in total 185 unique views. Throughout the four-hour event, there were 150 concurrent viewers. Last but not least, 73 questions were asked by the audience, of which 25 were addressed (see Section 3 and Section 4 for the summary of answers). Twelve participants provided feedback after the event, where 83% of them said “yes” when asked whether the event met their expectations. The participants also rated the event with five stars out of six.

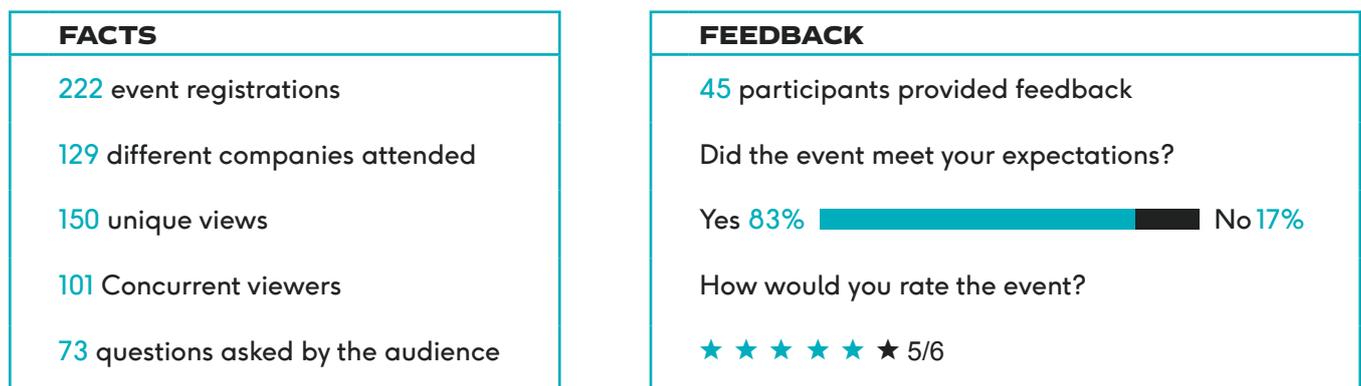


Figure 4: Facts about the event and feedback from participants

3 | FOCUS I: ATTAINING AND CERTIFYING SAFETY IN AD - REGULATORY PERSPECTIVE

3.1 TALK 1

Regulation as a key to safety – Overview of the legal framework, incl. current drafts
Benedikt Wolfers - Founding Partner, PSWP

With a draft law for autonomous driving planned by summer 2021, Germany could be the first country in the world to introduce a comprehensive legal framework for autonomous driving functions at SAE-Level 4.

In his presentation, Dr. Benedikt Wolfers gave an overview of vehicle regulation in the old and new - increasingly automated – world of driving. In the old world, the regulatory framework is characterized by the difference between vehicle provisions (homologation law) and driver provisions (road traffic law). While international regulations harmonize the provisions for vehicles, the provisions for drivers - on a global level - are only governed by the Vienna Convention on Road Traffic, yet primarily standardized by national, non-harmonized rules. In the new world of autonomous vehicles, these legal concepts will inevitably merge: provisions for automated vehicles will capture provisions formerly designed for drivers, and provisions for drivers to use automated vehicles will capture provisions formerly designed for vehicles.

However, today, the UN and EU international legal framework is not yet developed in a way that allows for SAE-Level 4 driving functions. Consequently, this area of non-harmonized legal material is open to national legislation.

Using this regulatory gap, Germany has decided to first advance a national strategy. In 2017, it was the first country to establish a legal framework for SAE-Level 3 vehicles. In May 2020, the Federal government provided a draft AV law on SAE-Level 4 vehicles, covering road traffic and homologation law.

The draft law provides for approval and use of driverless cars on SAE-Level 4 (so-called „people-mover“ or „robot“) in defined operating areas. The operating areas have to be defined by the manufacturer, approved on a general level by the National Type Approval Authority (KBA) and, before individual operation in any city, specifically adopted and allowed by the competent state authority.

Despite autonomous driving, however, there is a need for „technical supervision“, that is (still) a natural person who can enable or disable driving manoeuvres for the vehicle and who is available during operation as the person responsible for ensuring compliance with road traffic laws.

In a concluding outlook, Wolfers then outlined that national law initiatives in the field of automated driving do not hinder the harmonization and internationalization of AV regulation, but rather act as a driver for innovation and SAE-level 4 projects, thereby promoting harmonized international standards.

Addressed questions:

Q1

When referring to the second phase where the details of international rules are foreseen to be developed – which year is this expected?

Answer by Benedikt Wolfers:

The second phase where the details of international rules are foreseen to be developed is expected to start in 2022 and to be concluded by 2025/2026.

Q2

In the “old world” international regulation rules have not been successfully adopted by the US. Are there lessons learned or strategies for better adoption of the “new World” international rules to the US? This might be crucial as significant portion AD companies are located in the US.

Answer by Benedikt Wolfers:

The US are participating in the working group of the UN/ECE on autonomous driving. The US’s participation in the framework of the UN/ECE is a novelty and enables a seamless adoption of the international rules in the US.

3.2 TALK 2

UN/ECE perspective to attain safety in AD by regulation and standardization

Richard Damm - Chair of the UNECE Working Party on Automated/Autonomous and Connected Vehicles (GRVA)

Summary

Automated and connected driving is a key technology of the future. It will influence vehicle fleets and our future mobility. The World Forum for the Harmonization of Vehicle Regulations of UNECE focuses on preparing harmonized requirements for automated and connected vehicles on a global level.

Working groups have been installed to address the challenges linked to the technology. New approaches are discussed that allow a safe and secure deployment of AD. This includes discussions on functional requirements, assessment methodologies, security issues, vehicle data and performance over vehicle lifetime. Richard Damm will give a brief overview of the AD-related regulatory activities at the UNECE.

Addressed questions:

Q3

When referring to the second phase where the details of international rules are foreseen to be developed – which year is this expected?

Answer by Richard Damm:

It is difficult to predict when exactly the second phase of the development of international rules will start. It is currently envisioned to start drafting international rules at the end of 2021 or at the beginning of 2022.

Q4

Are there other informal working groups planned under the WP.29?

Answer by Richard Damm:

The work done on UN/ECE level with regards to autonomous and automated driving is closely linked to WP.29. Currently, no further plans exist to link an (informal) working group to the WP.29. However, there is a formal working group linked to the GRVA. In addition to that, there are four further working groups that give functional requirements, assessment methods, the EDR and DSS idea as well as cybersecurity requirements.

3.3 TALK 3

Safety in AD - The U.S. regulatory perspective
Jonathan Morrison - Chief Counsel of NHTSA

Summary

Jonathan Morrison, Chief Counsel of the U.S. Department of Transportation's National Highway Traffic Safety Administration (NHTSA) outlined how the United States is successfully using both federal law, self-certification and voluntary initiatives such as AV 2.0 to foster the development of AV technologies. Mr. Morrison also discussed NHTSA's plans for possible regulatory action in the future and how Federal and State governments are working across agencies with OEMs and technology companies to keep pace with the development of innovative technologies and address the safety concerns of the present and our future.

Addressed question:

Q5

How can compliance oversight through post-marketing purchasing and testing realistically be done in the future, when the AV software is frequently updated through over-the-air updates?

Answer by Jonathan Morrison:

This question highlights the difference between the systems of type-approval and self-certification. In a type-approval system, the vehicle obtains approval in its initial state and might be updated over the air in the future. By contrast, in a self-certification system, the vehicle could be updated over time. Each update would require a notification to the approval agency and the consumer.

3.4 PANEL DISCUSSION ON SAFETY IN AD

Addressed questions:

Q6

Insight into the results of the pole: Is it recommendable that single nations make their own regulations for autonomous vehicles before international laws are defined? – From the participants, 62% voted yes, 38% voted no – what is your opinion?

Answer by Benedikt Wolfers:

As long as the national legislator is willing to step back as soon as international rules on autonomous and automated driving have been adopted, it is recommendable for the national legislator to adopt a national framework in the meantime.

Answer by Richard Damm

The car industry must have enough room for maneuver to develop the technology within every national, regional or international framework. However, the framework for autonomous cars and automated driving has to become more rigid at some point. In this regard, it is not at all contradictory to let national legislators take the lead until international regulations have been adopted. Combining these two levels appears to be a good way forward.

Answer by Armin Gräter

It would be preferable to come quickly to an international regulation on autonomous cars and automated driving. Yet, it is clear that it is very difficult to accelerate the process of agreeing on global regulation and it is vital that, eventually, the regulation is detailed and thorough. Yet, it is helpful for OEMs that some national legislators already provide some rules and regulations. Germany, for instance, has already come up with a framework for introducing prototypes and a test fleet.

Q7

Will an OEM be fully liable as the drivers are now, or would it extend to Tier 3 suppliers?

Answer by Richard Damm:

If there is no regulatory framework, the liability question would have to be assessed on a case-by-case basis, analyzing for each individual case whether there is a manufacturer's responsibility or a supplier's responsibility.

The situation is much clearer if a regulatory standard exists. Suppose the manufacturer fully applies to the regulatory standard. In that case, it comes to whether liability thresholds for insurer values should be increased and what level of insurance is needed for automated functions.

Answer by Jonathan Morrison

In the US, every State has its own liability laws. Generally, however, human drivers are personally liable. Yet, as things shift to automation, the notion of product liability becomes ever more important. Eventually, it will still depend on a case-by-case analysis which liability concept applies and to whom responsibility will be assigned to.

Q8

Let's stay on the topic of liability and bring in the industry perspective; we have heard how far the liability should extend; what is your stance on that?

Answer by Armin Gräter:

The responsibility for an accident caused will depend on a case-by-case analysis. It must however be emphasized that every producer is responsible for their product and therefore for its failures. Instead, the problem added by the concept of automatic driving is determining if and how much responsibility is left with the driver and what kind of responsibility can be assigned to a control tower in a fleet of shuttles in a city, for instance.

These questions must be addressed on a regulatory level but equally, necessitate early and thorough testing of such technologies.

Q9

What do you think are the biggest obstacles to harmonizing regulatory requirements (US vs. Europe)?

Answer by Jonathan Morrison:

The participation in WP.29 is contributing to addressing obstacles to the harmonization of the regulatory requirements.

One of the biggest obstacles will be finding a way to prove and demonstrate the safety of autonomous driving technologies. It will be extremely challenging to design an obstacle course that captures the intricacy and the infinite complexity that is faced in real driving situations.

Lastly, it should be recognized that once international standards have been agreed upon, it will be much more difficult for the industry to develop their systems and comply with those standards and, in turn, might result into fewer resources used to innovate and improve safety technologies.

Q10

I would like to know Jonathan, when we talk about translating international standards into national law - is a homologation system better suited to do so than a self-certifying system? – There is a big system difference between the US and Europe, and NHTSA deals with the federal state system in the US. and the federation law, which cannot say what safety is. In Europe and in Germany, the concept of safety is not much different from one state to another.

Answer by Jonathan Morrison:

Once federal safety standards have been adopted in the US, state laws that contradict them would be pre-empted. The EU system of type-approval, however, seems to bear the problematic of “rushing” into regulation in order to allow certain technology on the roads. However, the EU system of type-approval seems to bear the problem of “rushing” into regulation to allow certain technology on the roads. Yet, this risks freezing the innovation as, if regulation is adopted at an early stage, it might not necessarily understand the specific needs for safety and the appropriate matrix.

Answer by Armin Greater

Practically, there are also some commonalities.

The NHTSA has published guidelines, which the car industry (e.g. BMW) also followed up in much detail with the safety assistance report.

Observing the approaches in Europe and in the UNECE bodies, BMW recognizes that some parts cannot fully fall under a regime of self-certification. A considerable effort is made to realize the ALKS homologation, Still, it already becomes clear that if BMW only tried to fill the room of possible performance tests under the ALKS regulation, it would end up with a big room of tests, which it cannot fulfill under classic homologation. Thus, the technical service looks into every test so that obviously and automatically they come to similar solutions because there is no other possibility in this context.

Q11

Every OEM has its own safety argument for developing autonomous control. Even the companies' effort to reach consensus is focused on standards that each one applies to their own development process. Do you see it possible to agree on quantified safety and security, albeit looking at these different development processes?

Answer by Armin Greater

11 companies and 5 OEMs and suppliers have published a Safety First for Automated Driving white paper, setting up common standards and requirements for safety and safety architecture.

In addition to that, the white paper will be published as a technical report at ISO. The worldwide technical community is invited to participate and come to a common framework in that regard.

Answer by Jonathan Morrison

The NHTSA has established the ADS 2.0 guidelines, pointing out what they see as safety-critical systems and working with encouraged developers to make sure they are working adequately. They have also followed very closely the responsibility side of safety and some of the functional safety standards that have been developed and are also following with interest the UL4600 project.

As a regulator, however, the US really needs to focus on performance. Therefore, they are looking at establishing a metric to objectively measure the safety of a human driver or an automated driving system.

Answer by Benedikt Wolfers

This question demonstrates the importance of harmonizing technical standards; to develop a sound business concept.

4 | FOCUS II: ATTAINING AND CERTIFYING SAFETY IN AD - INDUSTRY AND STANDARDIZATION PERSPECTIVE

4.1 TALK 4

Worldwide Regulation Approaches from an Industrial Point of View

Armin Gräter - Technical Product Manager Regulation Automated Driving, BMW Germany

Summary

Autonomous driving is a fascinating topic, but expectations are high, and reality doesn't often meet them. But independent from expectations and timing, the transport of today and tomorrow will differ considerably, whenever tomorrow will be. Owned and shared mobility will coexist; first applications of higher automation will come with private cars on motorways, prototypes show today already later solutions for trucks and shuttles. For a successful implementation, several fields of action must go hand in hand. The technology needs to be mature, but physical and digital infrastructure contributions will be necessary. Societal acceptance will go hand in hand with a regulatory framework that supports fast innovation. But the key question to be answered to reach trust in the technology from regulatory bodies as well as from the society as a whole is answering the question, how safe a SAE Level 3/4 system has to be? Based on recommendations of the German Ethics Commission in 06/2017, the answer is: Maximizing the evidence of a positive risk balance of automated driving solutions compared to the average human driving performance. This is a perfect approach to keep the overall requirement on safety clear, understandable and solution-neutral. With the white paper 'Safety first for automated driving' from 11 worldwide action industrial partners, a first important step was reached last year to drive global harmonization and create a unified foundation. Its essential mindset derives from 12 principles which comprise all aspects necessary to achieve the safety goals and reflect worldwide regulation approaches. The main goal is to avoid that independently developed ecosystems increase the complexity so that harmonizing a unified legal framework will not happen. Such a kind of consolidation of activities is necessary to create a global standard. The first publication of "Safety First for Automated Driving" contributed to the goal of a global standard. it will continue to broaden its footing as an open platform, now in the process of being established worldwide as ISO Technical Report 4804. Further details on BMW's approach on safety for SAE Level 3 ADS can be found in the BMW Group Safety Assessment Report, publicly available on the NHTSA webpage on Safety Assessment Reports.

Addressed Questions

Q12

In your opinion, are the current measures in road infrastructure enough to enable L3 ADS – both for highway and urban operational domains?

Answer by Armin Gräter:

The understanding of the importance in the past decade has changed significantly. In the early prototype of Automated Vehicles (about 10 years ago), the aim was to build a completely independent car from the road infrastructure. Today, this understanding has changed. High-definition road maps, digitalized traffic lights, precise global position systems (GSP) and similar are seen as complementary to in-vehicle sensors (e.g., camera, LiDAR, radar, etc).

Q13

Do you think that the average human driving performance is determined by the accident number per driven miles in a given ODD or whether more sophisticated metrics are needed to capture the diverse nature of human drivers? In short: what does driving 10% better than the average human driver mean?

Answer by Armin Gräter:

The question about a human driver's performance (e.g., accident rate) has been an important subject in the past years. One difficulty in answering this question is selecting the type of driver (e.g., average driver, professional driver). Furthermore, different countries have different accident rates. One can, of course, select the country with the lowest accident rate and set this as the target safety margin for automated vehicles. One thing is clear, the second generation of automated vehicles will have even higher levels of safety targets – as the target safety levels is set based on the actual accident statistics.

4.2 TALK 5

Strategy to harmonize global Requirements for ADs

Barnaby Simkin - Leading NVIDIA's strategic engagement with regulatory and standards bodies

Summary

A number of Authorities around the world have published national guidelines that describe the functional requirements and assessment methods for Automated Driving Systems. Although many of these guidelines contain common principles, they are far from harmonized. To support global harmonization, the UNECE is developing a common set of guidelines that is expected to inform authorities how to amend or create national requirements for Automated Driving Systems. This presentation provides recommendations on how the UNECE guidelines can be drafted, so that in the future, with more experience, it will enable the consolidation of requirements and infrastructure and support the development of Regulation under either the 1958 or 1998 Agreement.

Addressed Questions

Q14

To my knowledge, China is also developing a set of standards for automated driving. Do you know how far they are with their development?

Answer by Barnaby Simkin:

China is also involved in developing the UNECE guidelines. At the moment, they have a national framework for testing on public roads in China. China has stated that in 2020 they will have approximately 20-25 new standards for advanced driver systems and 100 new standards for automated driving systems by 2025. They will probably introduce a new framework based on the UNECE guidelines and fill the framework with unique Chinese standards related to automated driving systems

Q15

Do you think that OpenSCENARIO 1.0 should be the common standard SDL? Or should the community wait for OpenSCENARIO 2.0, given this is at least a year away, and tool support will take even longer?

Answer by Barnaby Simkin:

I recommend waiting for OpenSCENARIO 2.0. The work that has been done so far by ASAM has been very impressive. It seems to have a large community and it's widely accepted within the industry. I am very confident that the OpenScenario will be used as a description language for individual databases held by the OEMs or governments. But by the time we have government-held databases or regulatory body-held databases, I think the deadline for completing OpenSCENARIO 2.0 will be in line with those dates. We also need to remember that those databases need to be populated and this is a whole exercise in itself. Considering the work that needs to be done to create these databases, we should wait for OpenSCENARIO 2.0.

4.3 TALK 6

Testing and approval of Autonomous Vehicles from a technical service perspective

Christian Gndt - VP Automated Driving, TÜV Süd

Summary

The fast introduction of automated vehicles on global markets requires uniform regulatory requirements worldwide. To date, the regulations differ from region to region; the development of uniform mandatory international requirements is just at the beginning. The UNECE WP.29 working group has done pioneer work and provided a base for further internationally applicable regulations by adopting and agreeing on the first UNECE regulation for an automated lane-keeping system (ALKS).

Using this UNECE regulation for ALKS as an example, this presentation considers the development and creation of a uniform regulatory base by international partners and what requirements the new regulation demands from the automated driving function and the stakeholders.

The presentation focuses on the proof of the functionality, the dynamic driving task and the safety concept of the automated driving function, and with which test methods - simulation and proving ground tests - can be used. Furthermore, the presentation gives an overview of how vehicles with automated driving functions can already be approved for public road traffic using current regulatory frames.

Addressed Questions

Q16

Is there any reason for limiting the L3 ALKS (Automated Lane Keeping System) to 60km/h? What would be the efforts (from a regulatory perspective) for doing the same exercise for L3 ALKS up to 130km/h?

Answer by Christian Gndt:

The main reason for the speed limit is that the possible dangerous situations that can occur are less critical.

Q17

In the slide – “Technology vs Regulation Roadmaps”, it looks like there are no alignment activities between Technology, Regulation, and Standardization activities? Is this the reality?

Answer by Christian Gndt:

From an organizational point of view, these are different inputs. However, there is an alignment and this alignment is crucial to tackling the overall safety of these vehicles. For example, regulations coming from the UNECE often refer to ISO standardizations and the current state-of-the-art. Furthermore, the expert communities of UNECE and ISO activities are typically the same. You have the same people who are part of the ASAM group working in the ISO Groups. Also, in our organization, TÜV SÜD, we have a few experts involved in standards and regulations and they are in different working groups. This also helps to combine the strings together and align standards and regulation, for example.

4.4 PANEL DISCUSSION ATTAINING AND CERTIFYING SAFETY IN AD - INDUSTRY AND STANDARDIZATION PERSPECTIVE

Addressed Questions

Q18

Is it sufficient to use simulations for autonomous vehicle testing?

Answer by Armin Gräter

No, it's not sufficient. The question is, “how do we use simulations for proving the safety of a system?” Safety validation without simulation will not succeed in covering this complex technology because you will end up in millions of scenarios in which you have to test the vehicle. The way forward is to build up a validation framework based on a scenario database but make clear and prove to the technical services that it makes absolute sense to show that the validation and simulation fit reality.

Answer by Barnaby Simkin

I couldn't agree more. Simulations are great, but there is no replacement for real-world data, especially when you're testing perception quality- That's why you should use software reprocessing or real-world data to evaluate your perception stack. And with track testing, it's probably more beneficial to test those relatively simple systems, such as transition demand or risk maneuver, where you can benefit from those with high-level of fidelity, compared to simulations.

Answer by Christian Gndt

From the perspective of a technical service, even if we talk about higher levels of automation, I think that there will be no way to validate these systems without simulations. But the crucial question is if these simulations are trustworthy and we have to develop requirements, KPIs. In the end, the simulation results will become legally binding. Therefore, everything related to simulations has to be checked (what is the trustworthiness of this method?).

Answer by Barnaby Simkin

We see similar methods in the assessment of electronic stability control systems, where you can validate a system via simulations. Still, these are relatively simple systems, and we do need to develop a standardized set of physical track tests of physical tests that can first validate the subsystems. Moreover, validating the vehicle without the automated driving system, maybe then validate them together as a whole. This can be already standardized. There is interesting work done on this – IAMTS (International Alliance Mobility Testing Standardization).

Q19

Can they be standardized, or should they be standardized? For instance, the test benches, where you test emissions, are also standardized, which is essential.

Answer by Barnaby Simkin:

Summary: It may be difficult. To validate a system, do you need to have specific tests that will really scrutinize the type of simulations that you're using? These types of tests may be different from the tests used to validate the performance of the automated driving systems in critical scenarios.

Answer by Christian Gnandt

Summary: I think it's important that the metrics we are currently developing are independent from the tool chains. Because everyone is using a different kind of simulation approach, which is fair enough, but the metrics to judge the trustworthiness of simulations should be standardized, and there should be a common understanding. If we are lucky, they even come from the regulatory bodies.

Answer by Armin Gräter

Summary: It's true what you all have said, but we are quite far away from this reality because we are starting the process of how to do this in the future and looking at LKS. At the moment, we have very few scenarios only, so it's a conventional thing. I hope many of you will agree that this is not the future regulatory framework that we need for this kind of more complex situation and functionalities. I would suggest that it's good to start with LKS functionalities to test how this would run in the future, more complex surroundings. We are looking at the LKS tests, doing them on track. Some of the tests will not be able to be executed on test tracks anymore, so we have already come to the limits of showing it on test tracks. Then the idea is to try out how this works in a combination of tool validation and standardized interfaces between the tools and then to show in some cases that the reality is simulated well in the simulation tool. With the validation of the simulation tool, we have the confidence that it will reflect reality.

Q20

We have just seen the problems of ALKS validation methods. When we look at this new draft law from Germany on Level 4 AD, there is an Annex 1 with two pages on test and validation methods. So that's very interesting. Barnaby, what do you think about that, if you compare the details of ALKS on validation methods to this draft law? You think that will not work at all? Is it too short?

Answer by Barnaby Simkin:

Summary: Maybe it is because there is less simulation on the market at the moment. Germany is very interested in publishing a framework for Level 4 vehicles and in a relatively short timeframe. In order to meet those deadlines, they need to give some freedom to the manufacturer to demonstrate how their simulation tool is validated without specifically defining those validation methods in their framework. Giving some freedom to the manufacturers and then, perhaps when they have more experience provided by the manufacturers, they can input that information into the work that UNECE is doing - giving some trust back to the manufacturers, which is beneficial, giving them freedom.

Answer by Barnaby Simkin:

When you use average driving statistics to evaluate your driving system, you do take into account impaired driving, distracted driving, and similar. Thus it may not be an accurate representation of a human driver. With using a human driver model approach, you're taking into account the performance of an attentive driver and humans are very good at driving when they are paying attention. Suppose we are comparing the driving systems to those cautious drivers. In that case, there will be a significant performance compared to the real-world data used to release the accident statistics. I am not necessarily in favor of either approach. I think the accident statistics are also a very good way to validate risk assessments through in-use monitoring. You compare the performance of vehicles on the road to real-world data and have that validation as well.

Answer by Armin Gräter

A potential drawback of using a human driver model is the risk of not taking all "parameters" into account. For example, the automated system may never run into this situation because the driving strategy is more conservative than the human driver. Furthermore, the better the driver, the more risks he will take, which is again not reflected in this model. On the other hand, comparing the ADS to the average driver statistics (e.g., accident rate) is a simpler way to approach the problem.

Answer by Christian Gnant

I am familiar with the human driver model comparison concept from different joint projects and it's difficult to have objective safety metrics compared to human drivers. The reason for this is that it always depends on what you're looking at, which kind of situation.

Answer by Armin Gräter

BMW's idea is to show the positive risk balance by using a simpler but more feasible approach. That is comparing the performance of the automated driving vehicle to the accident statistics: i.e., taking traffic representing the accident occurrence in the country. Complex approaches requiring too many details may result in getting lost in the problem of comparing it to something that is not comparable.

We decided positive risk balance process, err in conformity to the process of getting the release of a new vaccine. So we are just in the covid crisis and we are just discussing how they come to the market. And all the people are talking about is the speeding up on the process of getting it to the market and releasing it but it needs a long time because this process is running as its running. And it's showing that there is a rest, residue risk still there when the product/vaccine is in the market. So it is accepted that there will be a fatal accident with the automatic driving system. It must be accepted it will happen. We don't know when and who will be the first. It is a pity if you're the first, but it will happen. It must be clear that is not avoidable. This is, even with a system perfectly functioning, working in 10 to -8 kilometers per hour. Hours per kilometer sorry. These safety quotas are so high, but even in the first hour it can happen. We know how statistics and probability are so yes, I agree, but we cannot avoid.

Q22

At level 3, busy human drivers are expected to intervene in emergency situations. Wouldn't it make more sense to display a prediction to the driver who can then check for conformity? What do you think about this approach?

Answer by Barnaby Simkin:

Even in emergency situations, when a level 3 system requests the driver to take over control and say an unplanned transition, the system should still be in control and bring the vehicle to a stop or perform an emergency maneuver to avoid those potential collisions.

Answer by Armin Gräter

I'd like to fully agree, and we have already investigated the specific accidents that happened there. If drivers were inattentive and then surprised by a dangerous situation, they typically acted completely wrong. So, you see that in sharp curves, if the speed is too high, they usually tend to oversteer than to understeer. It would be much safer to understeer than oversteer but people are wrong cause they are not used to the situation. So what we have decided to do for BMW is that we will not take control of the driver back because it's much safer if the car does what I can do and it can do the things in the emergency what the best driver can do like emergency braking, emergency steering, at a very high level. And we make the steering wheel very hard so that the driver has no chance to steer against it because he will do wrong. So, it is better to have the automatic reaction of the system instead of the driver who is not alert of the situation doing something wrong.

Answer by Barnaby Simkin

You can see it in the past regulation where they have introduced requirements to check the driver is attentive when they assume manual control. Attentive is defined that the driver's eye gaze is primarily looking at the road ahead or mirrors and this is, it is a way of confirming the driver's attentive, it is still very difficult very difficult task about so of, high level semantic understanding of the driver's intention and if they are aware of the driving environment when they take over.

Answer by Benedikt Wolfers

And they are resuming responsibility where the driver would like to own the situation.

Q23

Does it have to do anything with these different driver profiles, Barnaby you mentioned them in your talk. Because I was wondering how it makes sense to define different profiles for drivers when they actually should actually be bottom line the safest. Does it have anything to do with the cases we just discussed or is that a different topic?

Answer by Barnaby Simkin:

Slightly different topic. This is defining the driver modules used to determine a minimum threshold of performance in critical situations and this is more related to understanding the typical driver module during a takeover and maybe looking into either the time it takes to physically take back control of the system is one point but also immensely take back control. You could be disengaged from the driving task for the last 45 -50 minutes and then take over control and be aware of the driving environment and understand why the system is requesting to take over. That's a lot of information and okay maybe people with more experience with these systems will be better in doing it and there could be some intelligent HMI to the systems to help reengage the driver but if this is the first time of using the system you suddenly Wake up you need to wake up pay attention, the road you need to take back control. And this could be more difficult but as said, the system should always be able to cope with the situation. So, if the driver does not take back control or is not deemed to be attentive or aware of the driving environment, then you can suppress any override of the driver until he is fully engaged.

5 | SURVEY RESULTS

5.1 CONTRIBUTORS

In total, 8 contributions were made to the post-event survey. A summary of the contributors' workplace, their role, company/institution, and experience is summarized in Figure 5, under Survey Question (SQ1-SQ4). Contributors' workplace was from four different countries. Concerning their current role in the company, the distribution is as follows: 25% research, legal and consultant-oriented (e.g., Ph.D. student, Professor), 12,5% have managing roles. Furthermore, 25% work in a Tier 1 company, 25% work in a research institution or university, 12,5% in a Tier 2 company, 12,5% for OEM, 12,5% for a law firm and 12,5 for a consultancy. Finally, 25% of the contributors are involved in the development or research of SAE L3 AD, whereas 25% in SAE L4 AD, 12,5% in SAE L2 AD, 12,5% in security and 25% are not involved currently.

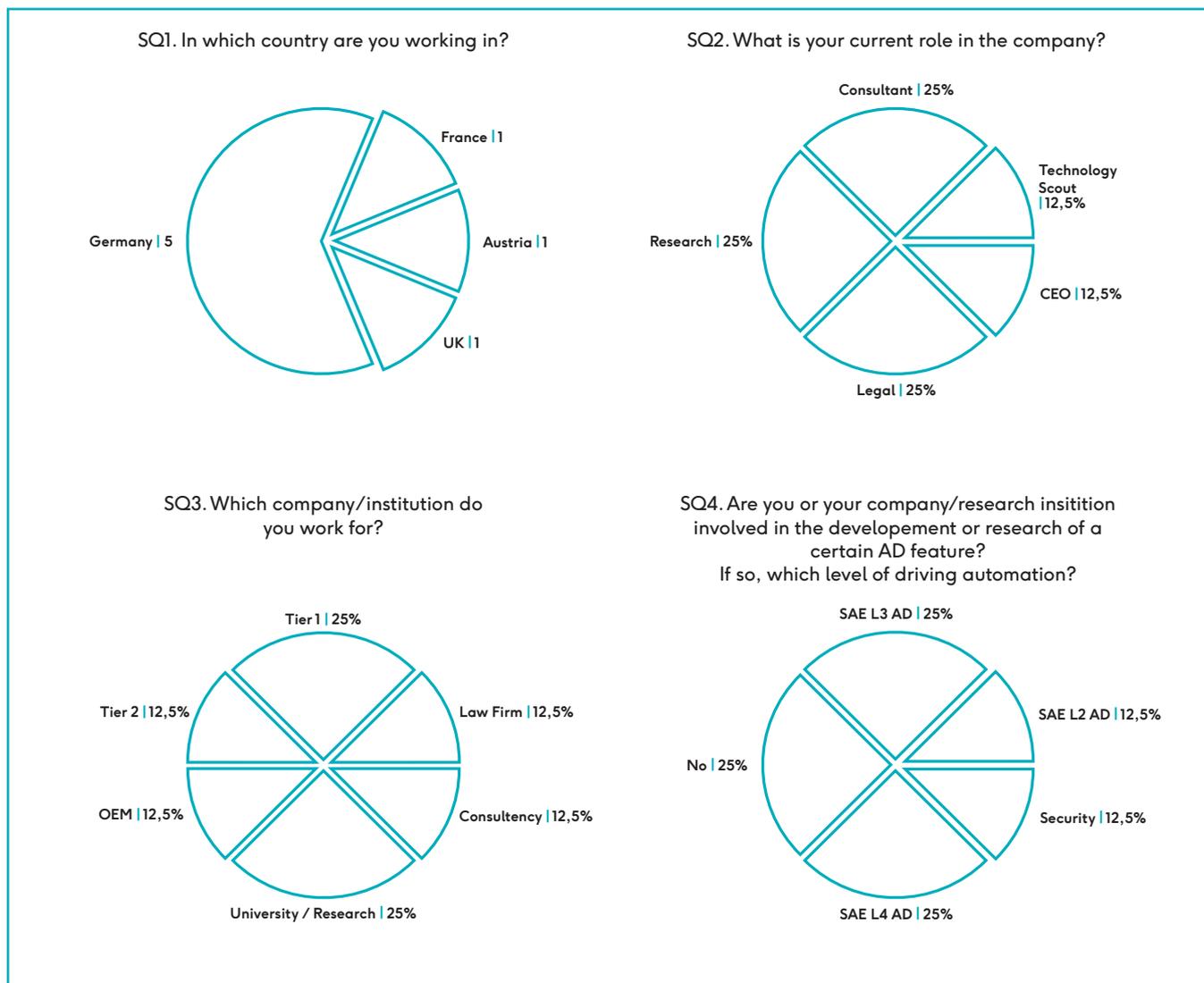


Figure 5: Information about the contributors of the survey

5.2 SUBJECT: GENERAL AD

The topics discussed during the Chapter Event often focused on challenges faced during the development of future SAE L4 ADS1. Therefore, it is essential to have a common understanding of when SAE L4 ADS are expected to be on public roads and which ODD SAE L4 AD is bringing the most value. The results of the questions are summarized in survey questions SQ5-SQ7.

SQ5

When do you expect SAE L4 AD features to be available in the Highway operational design domain?

Results

Figure 6, left side presents the results. The majority expect SAE L4 AD to be on public highway roads between 2023-2025 (37,5%). Others expect them to be available in 2020-2022 (12,5%), 2026-2028 (12,5%), or later than 2028 (12,5%). Last, 25% did not know.

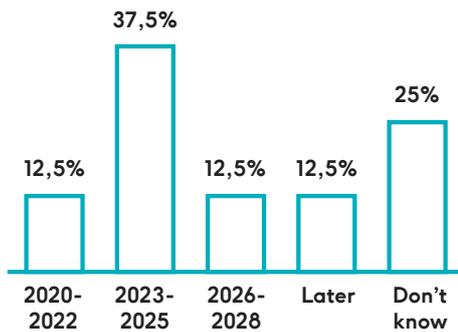
SQ6

When do you expect SAE L4 AD features to be available in the Urban operational design domain?

Results

Figure 6, right side depicts the results. Most contributors (37,5%) expect SAE L4 AD to be available on public urban roads later than 2028. Others expect them to be available in 2023-2025 (12,5%), 2026-2028 (25%). None of the survey participants believe that SEL L4 AD will be available on public urban roads in 2020-2022. Last, 25% do not know.

SQ5. When do you expect SAE L4 AD Features to be available in Highway operational design domain?



SQ6. When do you expect SAE L4 AD features to be available in the Urban operational design domain?

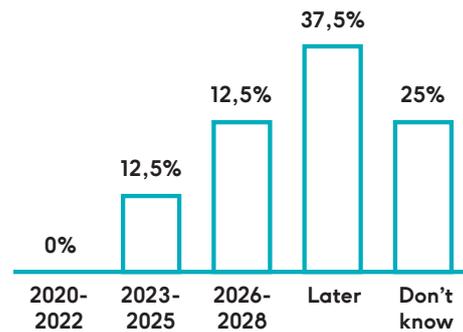


Figure 6: General questions about AD part I

SQ7

In which of the operational design domains do you think SAE L4 AD series production vehicles to first be used in?

Results

Figure 7 outlines the results. Here, a significant portion (25%) of the contributors believe that SAE L4 AD will first be used in the highway or Parking lot ODD. Warehouse ODD third with 12,5,%, and 12,5% did not answer this question

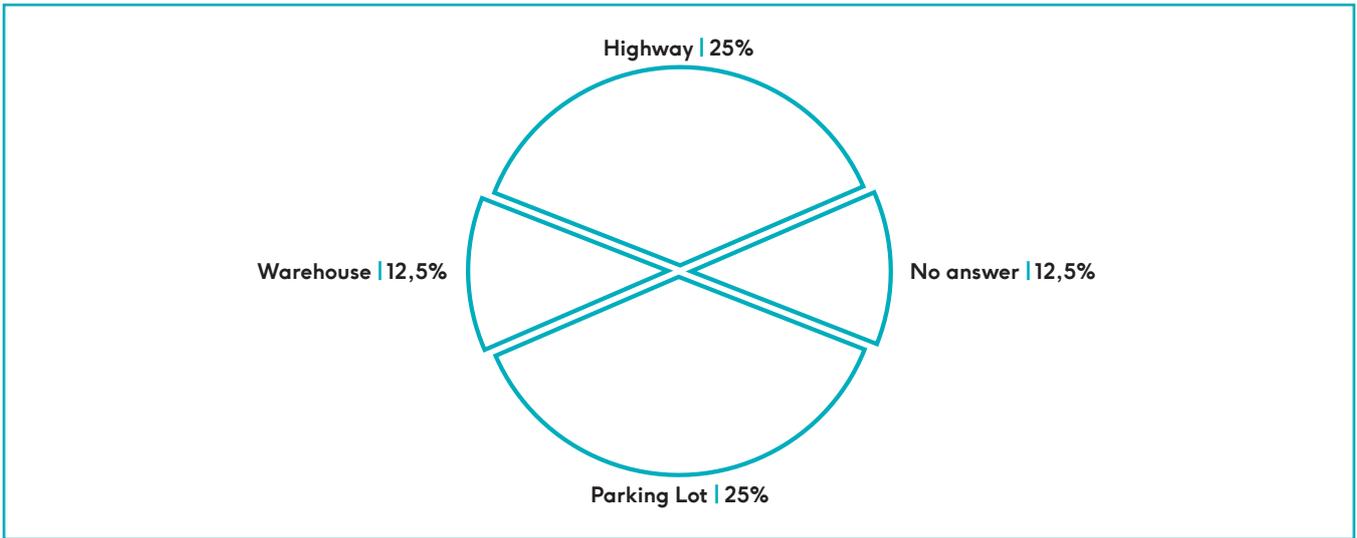


Figure 7: General questions about AD part II.

5.3 SUBJECT: THE AUTONOMOUS

It is essential for an initiative to continuously receive feedback from contributors on the selected approaches and vision. Hence, we asked the following questions SQ8 and SQ9.

SQ8 Do you think the approach proposed by The Autonomous is feasible?

Results:
 Figure 8 depicts the results. The majority (88%) of the survey participants believe that The Autonomous approach is feasible, whereas 12% do not.

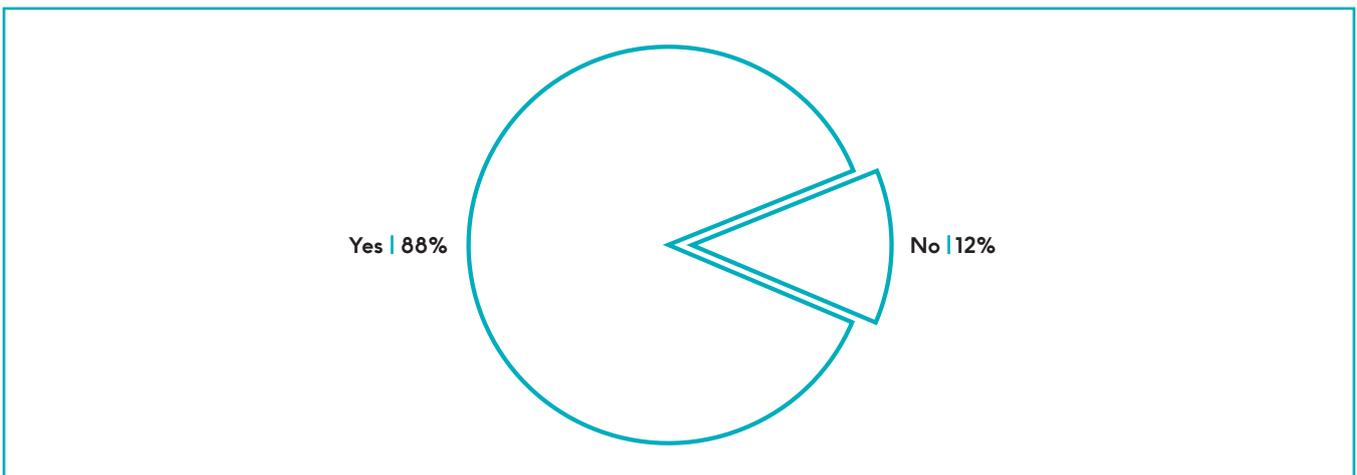


Figure 8: Answers to SQ8.

For the sake of transparency, opinions (positive and negative) from the survey contributors are summarized below.

PARTICIPANTS

justifying their answers

Yes:

This “club” of experts could help if The Autonomous does not fall into the trap where business development becomes its primary objective. The Autonomous could be a pan-company forum for future standards; it may become one renowned player in international standardization.

Yes:

Collaboration among OEMs and suppliers is a good idea. At the same time, it would be better to provide royalty to the best solution provider, which will motivate them to work towards the common goal of collaboration to find the single best solution.

SQ9

In your opinion, what do you think the main challenges will be for forming The Autonomous ecosystem?

Results:

The list below summarizes the main challenges indicated by the participants.

- Members, and acceptance of the forum’s findings. Like I cited RAND above, in the future, citing The Autonomous could be a thing.
- Inviting the right experts to spread the latest knowledge on regulations and requirements as well as sharing this knowledge over the long term between the participants.
- Time, money, infrastructure, technology, regulations, people’s mindset

5.4 SUBJECT: AUTOMATED DRIVING & REGULATION

SQ10

In your opinion, do you think AD regulation is given enough emphasis/awareness today?

Results:

Figure 9 outlines the results. Here, a significant portion (75%) of the contributors believe that AD regulation is given enough emphasis/awareness. 25% do not think so.

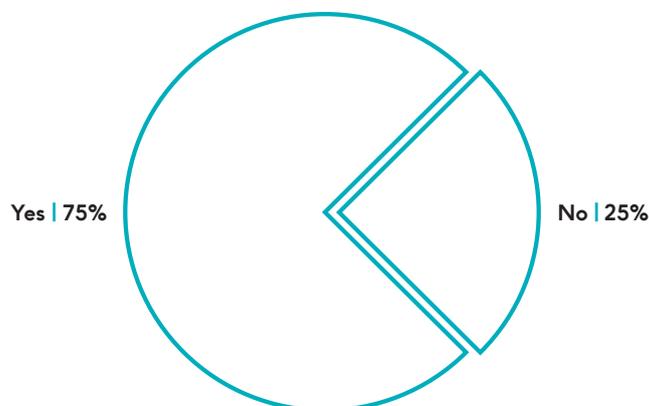


Figure 9: Results of SQ10.

PARTICIPANTS

justifying their answers

Yes:

As technology reached the point where AD becomes real, authorities - especially those in countries with OEMs - have woken up and are now seeking both understanding of problems and adapted means of regulation

Yes:

There are several committees dealing with that topic (UNECE EU, and National Committee's as well as the self-certification market authorities). It is not the regulation work that makes the entry into the market so long to wait for, it is the technology to be good enough to have customer value.

Yes:

More Collaboration is required between OEM's and suppliers. New standards for development and for testing are required.

Also, the AD development is more focused in US and China, they are way ahead; this needs to be implemented in other major countries too.

No:

There are ethical and moral considerations, an antagonistic lobby from industry groups and public backlash against surveillance capitalism.

SQ11

In your opinion, what is the key challenge to be tackled in the context of automotive driving regulation?

Results:

- Multi-tiered approach to homologation, depending on ODD
- Communication between participants of mixed traffic situations
- Object detection and response (OEDR) of suddenly appearing obstacle
- Safety
- Security
- Connectivity
- Legislation will be required to maintain the integrity of systems, issues surrounding ownership of vehicles will have to be considered. This is something that requires societal acceptance.
- Technically there is the issue of algorithmic and system auditability and further, in consequence of insertion of malware into code, the ability to repair a system - ie unlearning behavior.

SQ12

In your opinion, what country is at the most advanced stage of AD regulations at the moment?

Results:

25% of the participants answered USA, based on the permissions for deployment in several states. Also, China and Germany are mentioned among the countries who are most advanced. Another opinion is, that this question is hard to answer, as there are many exemptions in countries but none with firm regulations.

SQ13

Based on the previous answer, what best practice (from a regulatory perspective) would you recommend using in the rest of the world?

Results:

- With lack of national guidance, the international guidance on AD should be applicable.
- Finalizing the regulations that have been worked on in UNECE and EU. Then implement them.
- Collaboration with those advanced countries for the development
- Getting formal acceptance from the USA that they will comply with universal standards.

SQ14

In your opinion, what are the core regulatory requirements AD systems have to meet to be certified as “safe”? you recommend using in the rest of the world?

Results:

- „safe“ according to RAND were millions of miles. „safe“ for humans is passing a drivers license test. I think both could do.
- Safety First for Automated Driving
- Define a proper ODD in which the vehicle needs to operate and then regulations should be made considering those.
- That subsequent to type approval a vehicle may not be modified by an owner.

6 | APPENDICES

A LIST OF ABBREVIATIONS

| | |
|----------------|--|
| AD | Automated Driving |
| ADAS | Advanced Driving Assistance Systems |
| ADS | Automated Driving System |
| AI | Artificial Intelligence |
| ANSI | American National Standards Institute |
| ASIL | Automotive Safety Integrity Level |
| AUTOSAR | Automotive Open System Architecture |
| AV | Automated Vehicle |
| CD | Commission Draft |
| CNN | Convolutional Neural Network |
| CPS | Cyber-Physical System |
| DNN | Deep Neural Network |
| ECU | Electronic Control Unit |
| FO/FD | Fail-Operational/Fail-Degraded |
| FuSa | Functional Safety |
| ISO | International Standardization Organization |
| L1 | SAE Level 1 |
| L2 | SAE Level 2 |
| L3 | SAE Level 3 |
| L4 | SAE Level 4 |
| L5 | SAE Level 5 |
| NN | Neural Network |
| ODD | Operational Design Domain |
| OEM | Original Equipment Manufacturer |
| PAS | Publicly Available Specification |
| SAE | Society of Automotive Engineers |
| SaFAD | Safety First for Automated Driving |
| SOTIF | Safety of The Intended Functionality |
| TR | Technical Report |
| UL | Underwriters Laboratories |
| V&V | Verification and Validation |

B COMPLIANCE GUIDELINES

Ensuring safety is the key to gaining acceptance of autonomous mobility on a broad scale. The Autonomous will start this critical discussion by gathering together the complete autonomous mobility ecosystem and facilitate a mutual exchange of ideas by offering various workshops on key topics (Safety & Security, Safety & AI, Safety & Architecture, Safety & Regulation), panel discussions, and keynote speeches. At The Autonomous, we are committed to ensuring that all discussions take place in full compliance with the rules of competition law. In order to allow for an open exchange of ideas within the limits of the law, this Guideline sets out practicable rules for The Autonomous. Compliance with this Guideline is obligatory for all organizers and participants.

1. Permitted topics: Topics which may be covered in discussions, workshops and meetings organized by The Autonomous include:

- 1.1. General technical and scientific developments relevant to autonomous mobility;
- 1.2. Legislative proposals and/or regulatory measures and their impact on the autonomous mobility ecosystem;
- 1.3. The political environment;
- 1.4. Current economic developments and general developments in the industry (if publicly available);
- 1.5. Exchange of freely available information e.g. economic data available online or in annual reports.

2. Non-permitted topics: Participants may not discuss, agree, share information on, or in any other way coordinate their behavior regarding competitively sensitive issues, including:

- 2.1. Current and future prices, including selling prices, purchase prices, price components, price calculation, rebates, and intended changes in prices;
- 2.2. Terms and conditions of supply and payment for contracts with third parties;
- 2.3. Market sharing, including discussions on the division of sales territories or customers (e.g., by size, product type, etc.);
- 2.4. Co-ordination of bidding towards third parties, including information on customers' commercial expectations and the firm's proposed response, as well as information on proposed bids (whether a bid will be submitted, for which lots, etc.);
- 2.5. Boycotts against certain companies, e.g., agreements not to work with certain customers or suppliers, or to exclude specific companies from discussions on the establishment of a technical standard;
- 2.6. Information about business strategies and future market conduct, such as planned investments or the commercial launch of new technologies or products (if not publicly available). In particular, agreements to delay a new technology or to fix the commercial terms of its introduction are prohibited;
- 2.7. Detailed information on financial performance, such as recent information on profits and profit margins on a non-aggregated basis (if not publicly available);
- 2.8. Information on internal research and development projects. This comprises estimations about the feasibility of specific technical solutions or the costs attached to the implementation of a specific solution.

3. Measure to ensure compliance: In order to ensure compliance and to contribute to an open discussion, The Autonomous will implement the following measures:

3.1. Attendance by legal counsel: All discussions and workshops will be attended by in-house or external legal counsel. Legal counsel may break off or adjourn the discussion in case of doubts with regard to competition law compliance.

4. No Reliance: The purpose of this Guideline is to briefly summarize the competition rules applying to discussions at The Autonomous. It, however, cannot address the full complexity of the applicable law and does not constitute legal advice to participants and their respective firms as to their obligations under competition law. At The Autonomous, we encourage participants to familiarize themselves with the rules of competition law. Should any participant have doubts as to the legality of any discussion in the course of The Autonomous, she/he may:

- 4.1. raise such doubts to the legal counsel attending the discussion. The legal counsel shall record any such request in the minutes;
- 4.2. leave the meeting if the discussion continues without the participant's doubts having been resolved. The legal counsel shall record the name of the participant as well as the exact time of the participant's departure in the minutes.

C STANDARD SETTINGS GUIDELINE

Ensuring safety is the key to gaining acceptance of autonomous mobility on a broad scale. To address security concerns in connection with autonomous driving, safety proves to be the main concern and challenge for mass adoption. These current challenges and associated investment costs cannot be mastered by a single OEM, Tier 1, or Tech company. Just like in aviation, autonomous driving needs to set common technical and ethical standards, legislation, and a process to learn from past incidents and avoid future ones. At The Autonomous, our mission is to establish a global safety reference, created by the global community, which facilitates the adoption of autonomous mobility on a grand scale. We are committed to ensuring that this process takes place in full compliance with the rules of competition law. To this end, this Guideline supplements The Autonomous' Compliance Guideline, by setting out practicable rules for standard-setting processes at The Autonomous. Compliance with this Guideline is obligatory for all organizers and participants.

1. Openness and transparency: The Autonomous follows an open and transparent approach to participation in its panels, workshops, and other working groups. The establishment of a global safety reference will follow the following principles:

- 1.1. Unrestricted participation: involvement is open to all industry stakeholders. Active involvement may only

be limited if absolutely necessary (i.e., to prevent inefficiency) and based on objective and non-discriminatory criteria;

1.2. Transparency: all attendees of The Autonomous, as well as all other stakeholders concerned, will be informed of any announcement, progress, and outcome;

1.3. Review and comments: Stakeholders not participating in the process will be able to review and comment on the result of the standard-setting process. Any agenda referring to activities of The Autonomous will be disseminated to participants in due course prior to the execution of the activity. Participants shall have the right to comment or to contribute to such an agenda.

2. Non-exclusivity, free access

2.1. No obligation to comply: Participants are free to develop alternative standards or products that do not comply with the evolving standard;

2.2. Free access to standards: Any developed standards will be accessible for all interested stakeholders (whether or not they participated in The Autonomous) on fair, reasonable, and non-discriminatory terms.

3. IPR Policy

3.1. Definitions:

3.1.1. "Affiliate": any subsidiary or holding company of a participant, any subsidiary of any of its holding companies and any partnership, company, or undertaking (whether incorporated or unincorporated) in which a participant has the majority of the voting rights or economic interest.

41

3.1.2. "Essential": an intellectual property right is essential where it would be technically (but not necessarily commercially) impossible, taking into account normal technical practice and state of the art generally available at the time of adoption of the standard, to implement the respective standard without making use or infringing the IPR in question.

3.1.3. "FRAND terms": fair, reasonable, and non-discriminatory terms.

3.1.4. "Implement/Implementation": (i) to make, market, sell, license, lease, otherwise dispose or make use of equipment; (ii) repair, use or operate equipment; or (iii) use methods – as specified in the respective standard.

3.1.5. "Intellectual Property Rights" or "IPR": any copyright, Patent, registered design, and any application thereof. IPR does not include trademarks, trade secrets, moral rights, right of know-how, and confidential information.

3.1.6. "Patent": any patent, utility model, or any application for such.

3.2. Scope of Application: Participants owning any Essential IPR shall be free to exploit such IPR outside the scope of The Autonomous at their absolute discretion and any revenues or other benefits, which the participant may receive from such exploitation of such Essential IPR, shall be for the participant's own account.

3.3. FRAND commitment

3.3.1. Save in the case of any Essential Patents identified in accordance with Section

3.4.4, a participant will give an undertaking that it is prepared to grant licences to anyone wishing to Implement the standard to which the Essential

IPR relates:

(i) on FRAND terms;

(ii) to all its Essential IPR relevant for the respective standard;

(iii) to the extent necessary to permit the Implementation of the respective standard.

3.3.2. The undertaking pursuant to Section 3.3.1 may be made subject to the condition that those who seek licenses agree to reciprocate.

3.3.3. Where a participant has elected not to declare or has failed to declare any Essential IPR for a given standard in accordance with Section 3.4.4, the participant shall be deemed to have given the undertaking in accordance with the terms of Section 3.3.1.

3.3.4. Both, the participant who has given an undertaking pursuant to Section

3.3.1 or who is deemed to have given an undertaking pursuant to Section 3.3.3, and any beneficiaries of such undertaking wishing to acquire a license in accordance with Section 3.3.1, acknowledge and agree that: (i) They will act in good faith, in order to negotiate a license agreement; (ii) If both parties have not been able to agree on an Essential IPR license, each party has the right to pursue the matter before the national courts to resolve the matter.

3.3.5. Each participant will ensure that its Affiliates and its Affiliates' successors in title will give an undertaking pursuant to Sections 3.3.1 to 3.3.4 above. If a participant or its Affiliate transfers ownership of Essential IPR

that⁴² is subject to an undertaking pursuant to Sections 3.3.1 to 3.3.4 above, such undertaking shall include appropriate provisions in the relevant transfer documents to ensure that the undertaking is binding on the transferee and that the transferee will similarly include appropriate provisions in the event of future transfers with the goal of binding all successors-in-interest.

The undertaking shall be interpreted as binding on successors-in-interest regardless of whether such provisions are included in the relevant transfer documents.

3.4. Declaration of Essential IPRs

3.4.1. Prior to any official adoption of any standard or part thereof, each participant shall provide a written declaration of the Essential IPR relevant to the subject matter. Such declaration shall list:

- (i) all potentially relevant Essential IPR held by the participant or its Affiliates;
- (ii) filing and registration number, application date and if published the title of the respective Essential IPR;
- (iii) terms (i.e., explicitly (non-FRAND terms as opposed to clause 3.3.1, but without specifying royalty rates on any other royalty terms)) on which the participant or its Affiliate is prepared to grant licenses to other participants or any third parties; and (iv) statement whether the declaration is made subject to the condition that those who seek licenses agree to reciprocate.

3.4.2. In the absence of a declaration of any Essential IPR, the participant will be deemed to have given the undertaking for that Essential IPR associated with the relevant standard or part thereof, in accordance with Section 3.3.3.

3.4.3. Any declaration may identify such Essential Patents, for which the participant or its Affiliate are unwilling or unable to enter into an undertaking to license on FRAND terms in accordance with Section 3.3.1. The declaration shall:

- (i) identify any such any Essential Patent, by way of filing number, date, and if published, optionally its title;
- (ii) describe in sufficient detail the reasons why the participant or its Affiliate are unwilling or unable to enter into an undertaking to license on FRAND terms in accordance with Section 3.3.1.

3.4.4. Where a participant, in accordance with Clause 3.4.3, has identified an Essential

Patent, which the participant, or its Affiliates, is unwilling or unable to license in accordance with Clause 3.3.1, the participant will lose its right to participate and to receive undertakings pursuant to Clause 3.3.1 from other participants in relation to the respective standard or part thereof to which an Essential Patent relates, if:

(i) any other participant informs the Chairman within a reasonable period, in writing, that it does not accept that the reasons in the relevant declaration (as required in accordance with Clause 3.4.3(ii)) are reasonable and justified; and

(ii) based on its duly justified non-acceptance of these reasons pursuant to Clause 3.4.4(i), wishes that the aforesaid participant shall not be able to rely on its right to participate and to receive undertakings pursuant to Clause 3.3.1 from other participants.

3.5. Disputes concerning ownership of Essential IPR: If two or more participants claim ownership of the same Essential IPR, the participants claiming ownership shall:

- (i) negotiate and resolve the question of ownership in good faith and
- (ii) if no solution is found pursuant to section 3.5.1, have the right to pursue the matter before the national courts to resolve the dispute.

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E FEEDBACK

In our continuous effort to develop The Autonomous as an open platform and space for dialogue among different stakeholders, we welcome all feedback and interest in making safe autonomous mobility a reality. We highly value any comments, ideas, or suggestions you may have to help improve the outcome of this report or contribute to the initiative.

Please do not hesitate to contact us at: [contact@the-autonomous.com].