

Paper number: ITS EU-TP0057

LEGALISATION FOR AUTOMATION: MIND THE GAP

Why the autonomous city taxi also need to pass (future) legislation

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Abstract

The RDW is the Netherlands vehicle authority. As a governmental body, the RDW face new challenges in the type approval of vehicles. New intelligent products are also the result of new stakeholders (like technology companies, road authorities and telecom companies). These new products also need – in the end – to pass the type approval. But legislation is missing. A type approval authority as the RDW only wants those products in legislation that ‘deserve it’ (proven benefits in safety, traffic flow, or environmental). We foresee new legislation: why have a complex admittance procedure when vehicles become ‘ever changing’, and driverless? Is the type approval going to shift from admittance to in-use compliance? And is safety shifting from in-vehicle (e.g. ABS) to the interaction between vehicles and the environment? This paper presents a proposal how to look at future admittance and compliance for autonomous vehicles to bridge the gap.

This paper contributes to the Congress theme “Delivering future cities now” by incorporating autonomous taxis.

Keywords: European legislation, ITS, governmental, city, cities, taxi, automated, Netherlands, Dutch.

Content of this paper

This paper focusses on the governmental effort to legalize automated driving. First, the research method will be discussed. Second, the RDW is explained, being the public body in the Netherlands that has the task of admitting vehicles to the Dutch roads. Third, for better understanding, the current European regulations for vehicle admittance are shortly explained. The paper then works towards a proposal how

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to look at future admittance and in-use compliance for autonomous vehicles in general, and specific for autonomous taxis.

This paper is not a scientific paper. It is a representation of the quest for answers and regulatory solutions.

RDW

First, the RDW needs to be introduced. RDW is a non-departmental public body (NDPB) that is funded by fees. RDW was formed in 1949 and serves the public interest. The Dutch government has assigned a number of tasks to the RDW. Among others: the licensing of vehicles, monitoring the technical condition of vehicles, the registration of vehicles and their owners, providing information, and issuing driving licenses. RDW is also the type-approval authority for the Netherlands. RDW tests and certifies new vehicles and parts thereof. Clients are manufacturers from all over the world. The knowledge gained is used to co-develop European vehicle regulations.

Current regulations

Current legislation is based on European directives. These are increasingly related to agreements that are made in the context of ECE (Brussels) and EU (Geneva). RDW participates in these consultation structures. The basis of the current regulations is the Vienna Convention of 1968. This Convention on Road Traffic is an international treaty designed to facilitate international road traffic and to increase road safety by standardizing the uniform traffic rules among the contracting parties.

Vehicles are built by manufacturers, are imported, or are the result of self-building. They all must conform to the same European regulations: the Framework Directive. This is the base. Directive 2007/46/EC establishes a harmonised framework containing the administrative provisions and general technical requirements for approval of all new vehicles within its scope and of the systems, components and separate technical units intended for those vehicles, with a view to facilitating their registration, sale and entry into service within the 28 Member States.

If the regulations can not be met, there is a possibility of limited admission. The basis for this is article 20 in the Framework Directive that addresses new technologies or concepts which are incompatible with existing regulations. If it can be demonstrated that the new technologies ensure at least an equivalent level of safety and environmental protection than the systems they replace, a Member State can grand a

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provisional approval. This approval is valid only in its territory. The Council and the European Parliament may also ask the Commission to put forward a proposal if they consider it necessary.

Mind the gap

The problem with the current regulations is that it focusses heavily on the admittance of vehicles. Everything is described, sometimes even what kind of materials a manufacturer has to use. The idea is that a vehicle passing the admittance will stay the same its whole lifetime. With Periodical Technical Inspections (PTI), this is checked. With the exponential increase of software, and the possibility of software updates, a vehicle becomes “ever changing”. Current regulations can’t cope with this.

A second problem (or challenge) for developing traffic-safe software is that a human driver can act within the bandwidth of traffic rules on one hand, and staying safe on the other hand. For instance accelerating above the speed limit to avoid getting hit by a vehicle from a side street.

So how do we get autonomous vehicles such as taxis on the road? What kind of future legislation is needed? I start with a broader scope: foreseen new development in the lifetime of a vehicle, and a proposal how to deal with an ever changing vehicle like the autonomous taxi: Performance Based Requirements.

The Vehicle chain

The RDW follows a vehicle throughout its lifetime. We call this the vehicle chain:

- Development
- Regulations
- Production
- Type Approval
- Registration and sales
- Driving licenses
- Use
- Demolition

Explanation: development is always ahead of legislation. Only after regulation a manufacturer can produce. For admittance to the roads, an approval is needed as a conformity check. Vehicles then may be registered and marketed. To us a vehicles a driving license is needed. Then the operating phase, including maintenance and regular checks follows. Finally, the vehicle is scrapped.

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De RDW foresees 58 new developments in the lifetime of a vehicle. 19 developments are of interest for this paper:

Vehicle chain:	Open topics:
Development	Co-creation with new stakeholders
Regulations	linking vehicle, infrastructure and behavior
Production	Virtual testing
	Software testing
	Worst case testing on a closed testtrack
Type approval	New vehicle category for autonomous taxis
Registration and sales	From ownership to use
Driving Licenses	A licence for the car
Use	SAE levels 3, 4 and 5 (autonomous taxis)
	Dynamic data
	Cyber security
	Privacy
	Connected vehicles and infrastructure
	Surveillance / compliance
	Software updates
	Liability and insurance
	Vehicle as a sensor for traffic flow
	Dynamic accident registration
Demolition	vehicles remain the property of the manufacturer

Performance Based Requirements

To cope with an ever changing vehicle, and to cope with traffic safe behaviour, regulation needs to be general enough to enhance innovation, but specific enough to ensure a level playing field for manufacturers. This paper proposes using Performance Based Requirements.

Within the current legislation the first step is already taken: Real Driving Emissions (RDE). After “Dieselgate” it was concluded that the admittance test for emissions did not fulfill its intention. Even worse, it led to immoral behaviour of manufacturers. With RDE, it is not only the admittance test, but there are also compliance tests on sold vehicles (in practice).

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With the use of requirements there will be a transition from the waterfall method in the vehicle chain from admittance to compliance, to opportunities for an iterative method. Instead of compliance rules made by the government, the manufacturer can put forward his “acceptable means of compliance” to state that he fulfills the requirement.

As an example two acceptable means of compliance for a highway pilot:

- Requirement: during operation of autonomous mode on highways the vehicle behaves as a human driven car, predictable for other road users, and obeying traffic laws.
- Means of compliance 1: the manufacturer uses an expert driver during iteration phase 1, a redundant system is build in during iteration phase 2, in iteration phase three 500 drivers are selected, and the final version of the highway pilot is a software update to all suitable vehicles.
- Means of compliance 2: as above, but instead of a redundant system another manufacturer uses connected technology.

Software developed to meet Performance Based Requirements still needs an admittance and in-use compliance procedure. The RDW already has experience with admitting large scale testing of autonomous systems on open roads¹. Taking this into account, the future procedure for software can be as follows:

1. Virtual testing: testing the software in a set of difficult traffic situations.
2. Behaviour testing on a closed test track: software exams (‘driving test’), and purposely inflict risks based on the risk analysis to see if the vehicle stays road safe.
3. Admittance to open roads (with in-use compliance).

The admittance can be standardized for systems that function independent of infrastructure, or tailor-made when systems are dependent on infrastructure (such as an autonomous taxi on a specific infrastructure (geo-fenced use)).

Requirements have yet have to be determined, but will most likely include contain items like security, functionality, usability, maintainability, reliability, and portability.

The next chapter shows what needs to be done to get an autonomous taxi admitted for use on public roads, as if the regulations were in place.

¹ See Bordeaux paper ITS-1656

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The autonomous taxi

The admittance of an autonomous taxi can include the following steps:

- For the hardware side of the vehicle: these items are admitted via the current regulations (chassis, tires, windows, etc).
- For the dedicated infrastructure: a geo fenced, high definition map is made. This map includes 'points of interest': spots where the vehicle encounters risky situations.
- For the software side of the vehicle (the digital driver): these items follow the proposed admittance procedure of virtual- and behaviour testing based on the dedicated infrastructure.
- For in-use compliance: the company responsible for the safe use of the vehicle provides acceptable means of compliance for the use-phase of the taxi.

Conclusion

For the 'hardware' part of vehicles the current regulations are still sufficient. These regulations are the result of more than 110 years of experience and knowledge of the automobile industry. For the software part of vehicles however the current regulations fall short. To be able to use the advantages of software in vehicles Performance Based Requirements (PBR) are proposed. A next step is to introduce PBR to the other vehicle authorities in Europe. The RDW participates in European working groups.

The first step is to present this way of thinking. This paper is part of this first step.

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