



State of the art of the regulatory framework through the analysis of the technologies developed within the AEROFLEX project

Ignacio Lafuente^a, Carlos Luján^a, Marta Tobar^{a*}, Estrella Martínez^a

^aIDIADA Automotive Technology S.A, L'Albornar S/N PO Box 20, Santa Oliva 43710, Spain

Abstract

The AEROFLEX - *AEROdynamical and FLEXible Trucks for Next Generation of Long Distance Road Transport* – project, contract No. 769658, started in October 2017 with the objective of developing and demonstrating new technologies, concepts and architectures for complete vehicles that are energy efficient, safe, comfortable, configurable and cost-effective. Example of the developments of AEROFLEX project are a distributed hybrid powertrain, aerodynamics devices for the truck and the trailer to improve the air drag performance, optimized loading units for the trailer and a new concept for the cabin of the truck.

One of the main pillars of the AEROFLEX project is the drafting of coherent recommendations for revising standards and legislative frameworks. These recommendations will be addressed to policy-makers, authorities and industry on standardization. At the end of the project, by 2021, these recommendations will be compiled in a handbook, which will be submitted to the European Commission.

This paper summarizes the results and outputs obtained so far regarding this regulatory analysis. It comprises the state of the art of the regulatory framework and a deep analysis of the the current boundaries and constraints within the European transport and logistics industry identified so far.

Keywords: regulatory framework; heavy-duty vehicles, AEROFLEX

* Corresponding author. Tel.: +34-977-166-016;
E-mail address: marta.tobar@idiada.com

1.1.1. Nomenclature

CEDR	Conference of European Directors of Roads
EC	European Commission
EU	European Union
GR	<i>Groupe des Rapporteurs</i> ; Working Party
GRBP	<i>Groupe des Rapporteurs sur Bruit et Pneumatiques</i> ; Working Party on Noise and Tires
GRE	<i>Groupe des Rapporteurs sur l'Eclairage</i> ; Working Party on Lighting and Light-Signalling
GRRF	<i>Groupe des Rapporteurs en matière de Roulement et Freinage</i> ; Working Party on Brakes and Running Gear
GRSG	<i>Groupe de Rapporteurs sur les dispositions générales de Sécurité</i> ; Working Party on General Safety Provisions
GRSP	<i>Groupe de Rapporteurs en Sécurité Passive</i> ; Working Party on Passive Safety
GRVA	<i>Groupe des Rapporteurs pour les Véhicules Autonomes</i> ; Working Party on Automated Driving
HCV	High Capacity Vehicle
NMLU	New Modular Loading Unit
NRA	National Road Authorities
SIAP	Smart Infrastructure Access Policy
UNECE	United Nations Economic Commission of Europe
WP	Work Package

2. Introduction

The aim of this paper is to illustrate the results achieved during the first half of the project regarding the analysis of the regulatory framework and the identification of the regulatory barriers related to the new technologies developed within the AEROFLEX project, acronym for Aerodynamic and Flexible Trucks for Next Generation of Long-Distance Road Transport.

This analysis will last till the end of the project and the final outcome of this work will be a Book of Recommendations addressed to the European Commission in terms of possible regulatory amendments that should be considered in case of implementing these solutions in the high capacity transport market.

2.1. AEROFLEX project background

There are three projects highly related to AEROFLEX: TRANSFORMERS, FALCON and FLUXNET. The first one is a Seventh Framework Programme (FP7) funded project led by VOLVO Technology AB. It is considered to be the direct predecessor of the AEROFLEX project. The other two projects, FALCON and FLUXNET, are funded by the Conference of European Directors of Roads (CEDR) under the Call 2015 “Freight and Logistics in a Multimodal Context”, also much related to AEROFLEX’s mission.

2.1.1. Transformers

The project TRANSFORMERS², acronym for Configurable and Adaptable Trucks and Trailers for Optimal Transport Efficiency, finished in 2017 after 4 years of research. This project research was co-funded by the European Commission (EC) and involved truck and trailer manufacturers, end users, suppliers and research institutes.

The main goal of this project was to achieve 25% energy load efficiency (in energy/km.tn) in a real-world application. To reach this objective, several key innovations were developed in parallel:

- A configurable distributed hybrid-on-demand driveline for truck-trailer combination
- Innovative complete vehicle aerodynamic measures
- Innovative loading efficiency measures

² TRANSFORMERS webpage: http://www.transformers-project.eu/mainmenu/home/#.XLV6ythS_Vg

The output from the TRANSFORMERS project (in terms of regulatory framework) was a list of recommendations, made in agreement with all partners, in order to amend Directive 96/53/EC of 25 July 1996 laying down for certain road vehicles circulating within the Community the maximum authorized dimensions in national and international traffic and the maximum authorized weights in international traffic as Directive (EU) 2015/719 of the European Parliament and of the Council of 29 April 2015 amending Council Directive 96/53/EC laying down for certain road vehicles circulating within the Community the maximum authorised dimensions in national and international traffic and the maximum authorised weights in international traffic. The three main recommendations were as follows:

1. To allow an extra tonne for alternative fuelled engine, battery or any other electric or energy saving device also for articulated vehicle combinations, in order to balance this additional tonne between the tractor and the (semi-)trailer.
2. To examine, in agreement with DG MOVE working groups, how good guidance could be provided on the loading and related load distribution of trailers and semi-trailers (impact on safety barriers, driving stability of the truck), and on the longitudinal load distribution, i.e. the balance of axle loads (impact on pavements and on bridges). The future version of Directive (EU) 2015/719 could provide some provisions on the height of the centre of gravity of the payload (impact on safety barriers, dynamic behaviour of the truck) and on the longitudinal load distribution, i.e. the balance of axle loads (impact on pavements and on bridges).
3. To include a bridge formula in Directive (EU) 2015/719, adapted to the European stock of bridges and allowing the current combinations complying with the Directive 96/53/EC revised in 2015. This should prevent future heavier or longer combinations from inducing increased load effects on the existing bridges.

All these recommendations together with the project's outcomes related to the new technologies are being used in AEROFLEX project.

2.1.2. FALCON

In 2015, the CEDR launched a call for Freight and Logistics in a Multimodal Context in order to understand what influences modal choice³. One of the two projects funded by this research programme was FALCON, acronym for *Freight And Logistics in a Multimodal Context* whose final report was released in November 2017, providing a detailed review of the factors influencing modal choice.

The objectives of the project were to provide the National Road Authorities (NRAs) with a handbook explaining the principles of freight markets, logistic strategies and multimodal transport as well as to compile Smart Infrastructure Access Policy (SIAP) to selected infrastructure network for future commercial vehicles. The project was divided into the following three parts:

- Part A: Understanding what influences modal choice
- Part B: How can infrastructure and infrastructure services affect modal choice?
- Part C: Fit for purpose road vehicles to influence modal choice - Performance Based Standards (PBS)

The results of the FALCON project Part A were used in WP1 and WP4 of the AEROFLEX project. WP1 described the transport market and its drivers. Here, the FALCON results on trends in long road haulage and the firms' mode choice criteria were summarized. WP4 described the state of the art regarding intermodal transport in Europe. Here, the description of intermodal transports and different stakeholders involved in the transshipment of goods are summarized from the FALCON project.

Regarding Part C, FALCON research was an analysis of the regulations regarding different topics for EU International and other countries with specific requirements or exceptions (EU members or non-members) such as Sweden, Norway, Netherlands, Germany, France, Belgium or United Kingdom. The topics analysed were vehicle dimension limits, axle load limits, weight limits, manoeuvrability and traction, brakes, exhaust emission, vehicle type noise and relevant infrastructure features for setting the base for a PBS scheme in Europe.

³ Further information about the call can be found:

<https://www.cedr.eu/strategic-plan-tasks/research/cedr-call-2015/call-2015-freight-logistics-multimodal-context/>

2.1.3. FLUXNET

FLUXNET, *Logistics in a multimodal context for robust infrastructures in vital regions*, is the other project funded by the CEDR through the same call for Freight and Logistics in a Multimodal Context.

While FALCON aims to provide NRAs with a clearly written handbook explaining the principles of freight markets, logistics strategies, and how multimodal transport works and can be influenced, FLUXNET aims to provide insight into the tools for NRAs that help to optimise the multimodal use of the infrastructure networks by the freight and logistic sector. Special attention is being paid to the connection between land use and infrastructure planning. The project aims to provide an overview of potential “living labs” that offer the possibility to further explore the potential benefits of integrating multimodal transport networks, liveability and spatial planning.

Its final results are not published yet, but they will be available in the near future.

3. Regulatory Framework state of the art

In this chapter, an overall review of the regulatory framework affecting AEROFLEX project is reviewed. It includes a summary of the whole vehicle regulatory framework, discussion groups and topics under discussion.

3.1. Vehicles and components regulatory framework

3.1.1. Regulations from the United Nations Economical Commission of Europe (UNECE)

The United Nations Economic Commission of Europe (UNECE) was established in 1947, in Geneva, to encourage economic integration and cooperation among its member countries. One of the main areas of work is Transport. Its main objective is to promote sustainable, safe and competitive transport through the development of freight and personal mobility by inland transport modes.

In 1958 the UNECE established an integrated global system for the mutual recognition of vehicle-related product and subsystem approvals. These regulations are accepted by all signatories to the 1958 Agreement [1] (all the countries from the European Union and some others not taking part in the EU) that have adopted each particular regulation within their respective regulatory systems.

Although voluntary, the UNECE regulatory process has been integrated directly into EU rulemaking by means of Regulation (EC) No 661/2009 *of the European Parliament and of the Council of 13 July 2009 concerning type-approval requirements for the general safety of motor vehicles, their trailers and systems, components and separate technical units intended therefor* [2]. Thus, UN Regulations are often mandatory under EU law.

3.1.2. Regulations and Directives of European Commission (EC) of the European Union

The European Commission (EC) is the executive body of the EU responsible for proposing legislation, implementing decisions, upholding the Union's treaties and the day-to-day running of the EU.

Regulations (EU) from the European Union are the most direct form of EU law - as soon as they enter into force, they have binding legal force throughout every Member State, on a par with national laws. National governments do not have to take action themselves to implement EU regulations. Regulations are passed either jointly by the EU Council and European Parliament, or by the Commission alone.

Directives (EU) and Directives (EC) from the European Union and the European Commission are addressed to national authorities, who must then take action to make them part of national law, and decisions, which apply in specific cases only, involving particular authorities or individuals.

The Directive 2007/46/EC of the European Parliament and of the Council of 5 September 2007 establishing a framework for the approval of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles (Framework Directive) regulates the vehicle type-approval in the European Union. It is the procedure whereby a Member State certifies that a type of vehicle, system, component

or separate technical unit, satisfies the relevant administrative provisions and technical requirements [3]. All the motor vehicles are classified in different categories according to the function for which it has been designed and the maximum permissible weight, among others. The technical requirements of all of them are laid down in different regulatory acts announced in an exhaustive list set out in Annex IV of the mentioned Directive, and in Annex XI for special purpose vehicles. The regulatory acts come from different regulatory bodies such as UNECE (Regulations), or European Union (Regulations and Directives). All of them are equally mandatory.

New Type approval and Market Surveillance: Regulation (EU) 2018/858 of the European Parliament and of the Council of 30 May 2018 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles, amending Regulations (EC) No 715/2007 and (EC) No 595/2009 and repealing Directive 2007/46/EC [4]. On 14 June 2018, the Official Journal of the EU published the new vehicle Type-Approval Framework Regulation, whose rules will be applicable from 1 September 2020.

This regulation introduces a new testing regime to ensure vehicles remain within homologation limits throughout their production lifetime and clarifies the responsibilities of national type-approval authorities, testing centres and market surveillance bodies, in order to make them more independent and prevent conflicts of interest. The EU Commission will also be able to carry out tests and inspections of vehicles to verify compliance, to trigger EU-wide recalls and to impose administrative fines on carmakers per non-compliant vehicle.

3.2. Local legislations of vehicle use and infrastructures

The regulation of the use of the vehicles such as traffic rules, driving licences or the general interaction between vehicles is done by means of the EU directives and the national regulations. Local bodies can be identified as Ministries that direct a public service, national/regional administrations or others.

3.3. Discussion groups

In this chapter, the discussion groups are identified and the latest changes and news are described.

3.3.1. UNECE working groups and its restructure

On June 2018, the creation of a dedicated GR working group on automated and connected vehicle under the WP.29 was announced. Before the creation of this specific group, all topics related to automated driving were managed in the “Informal Group on Intelligent Transport Systems/Automated Driving (ITS/AD)”. This informal group was created in 2015 and it belongs to the GRRF (Working Group on Brakes and Running Gear). Then, in June 2018 the ITS/AD informal group was converted into GRVA working group (Working Group on Automated Driving).

In alignment with this substitution, the following changes were considered:

- Re-allocation of all tyre-related activities under GRRF to GRB and renaming into GRBP
- Re-allocation of all tank vehicle safety-related activities under GRRF to GRSP
- Re-allocation coupling device-related activities under GRRF to GRSG
- Incorporation of all current activities of the IWG ITS/AD into GRVA

3.3.1.1. Modular Vehicle Combination (MVC) Working Group of the GRVA

This working group was created in 2014, as a subgroup of the GRRF Working Group, with the aim of setting a harmonized technical level so that countries that want to allow European Modular System (EMS) vehicles can rely on harmonized technical requirements in the various regulations and not make national requirements. Vehicle combinations according to EMS system can already be accepted for international traffic, however different national requirements make that difficult.

The idea was to discuss the necessary topics that should be considered in order to set this “harmonized technical level”. Some of the topics identified were:

- Truck intended for towing multiple trailers
- Trailer to be type approved for towing other trailers
- Dolly to become type approved

- Braking, steering and coupling systems in multiple trailer combinations
- Stability systems

Thanks to the discussions held in their meetings, it was possible to identify which regulation needed to be amended and why. First discussions were focused on UN Regulation No. 13 (brakes) [5], UN Regulation No. 55 (couplings) [6] and UN Regulation No. 79 (steering) [7].

3.3.1.2. Motor Vehicle Working Group (MVWG) – Subgroup on Masses and Dimensions

The first ever EU legislation on CO₂ emission standards for Heavy Duty Vehicles (HVD) has been recently proposed to reduce CO₂ emissions from the HDV sector in line with the objectives to the Paris agreement. Compliance with the future CO₂ emission standards for heavy-duty vehicles will entail the adoption of fuel-saving technologies such as improving the aerodynamic performance of the vehicles by reducing the air drag.

Aerodynamically shaped, elongated cabin and aerodynamic flaps fitted at the rear of trucks or trailers are currently available technology with potential for improving the aerodynamic performance. However they have not been deployed yet due to the harmonized maximum length of vehicles allowed by Directive 96/53/EC on Weights & Dimensions laying down rules on the maximum authorised dimensions of motor vehicles circulating on the roads of the European Union in cross-border traffic [8]. Directive (EU) 2015/719, revising Directive 96/53/EC, provided the possibility for the circulation of trucks with elongated cabins on the market, subject to certain conditions under which vehicles equipped with elongated cabins may exceed standard dimensions, without increasing the load capacity [9]. These conditions were:

- Demonstration of an improved aerodynamic performance of vehicles or their combinations
- Improving of drivers' visibility by reducing drivers' blind spots
- Reduction in damage or injury caused to other road users in the event of a collision
- Increase of the safety and comfort of drivers

Directive (EU) 2015/719 also proposed fostering the fitting of aerodynamic flaps at the rear of trailers/trucks to improve air drags. Directive (EU) 2015/719 requires that such elongated cabins and flaps are covered by EU type-approval rules. In addition, it requests that the Commission assesses the technical requirements needed in terms of type-approval for vehicles with elongated cabins and flaps. Finally, it also envisages a moratorium of three years after the implementation of the respective type-approval requirements to enforce the use of trucks with improved aerodynamics of cabins in cross-border traffic. In this context, as part of the 3rd Mobility package, the Commission proposed to advance the date from which on more aerodynamic and/or safer cabins may circulate on EU roads.

Following intensive discussions and different studies, the various stakeholders now seem to agree in principle that the first condition relating to aerodynamic performance could be considered as being achieved if the elongated vehicle cabin shape remains within the boundaries of a certain 3-dimensional surface adjacent to the frontal plane of the cabin, the dimensions of which would be described in the TA legislation ('envelope approach'). Additional design requirements could also be taken into consideration in relation to points b) (vulnerable road users), c) (reduction in damage or injury) and d) (safety and comfort of the drivers), resulting e.g. in certain constraints for rake angles of the elongated cabin surface.

Following this assessment, the Commission decided to work swiftly on the basis of the envelope approach and adopt amendments to Regulation (EU) No. 1230/2012 of 12 December 2012 implementing Regulation (EC) No 661/2009 of the European Parliament and of the Council with regard to type-approval requirements for masses and dimensions of motor vehicles and their trailers and amending Directive 2007/46/EC of the European Parliament and of the Council [10] through comitology with full participation of relevant stakeholders. The amendments will also provide for type-approval requirements of trucks/trailers with rear aerodynamic devices (flaps) beyond the currently permitted 500 mm and to provide requirements to ensure that these devices are safely attached to the vehicles. Finally, the amending proposal will also include provisions to take account of the increased laden mass of alternatively fuelled motor vehicles due to the electric battery or the hydrogen/natural gas containers.

4. Regulation frame vs. AEROFLEX

Among all the vehicles considered in the AEROFLEX fleet, all vehicles of group 1 and 2 can operate within Directive 96/53/EC (weights and dimensions for international traffic), except for 1.2 (Truck 6x2-ST3, (2x7.825 m)) and 1.4 (TR4x2-ST3 (14.9 m)). The rest of combinations are outside the scope of the directive; thus they cannot be type-approved.

4.1. Regulatory analysis for the e-dolly

One of the innovations of AEROFLEX is the electric dolly (Fig. 1). Although its design it is not frozen yet, there are some regulatory barriers that the e-dolly might face for its type-approval.

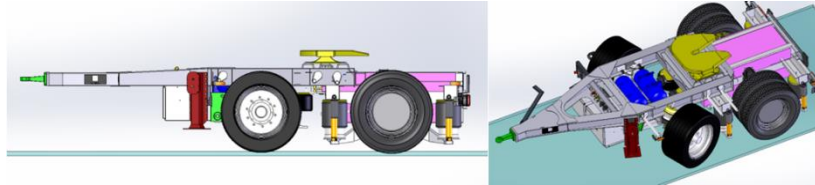


Fig. 1 AEROFLEX e-dolly design

The following list shows the main barriers identified in its preliminary analysis:

1. In terms of “Vehicle Type” it must be noted that a standard dolly (non-electric) is not a standard trailer. Thus it is out of the scope of the Directive (EU) 2007/46 and Regulation (EU) 2018/858 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles.
2. Dolly definition is included in Supplement 7 of the 01 series of amendments of UN Regulation No. 55 on the approval of mechanical coupling components of combinations of vehicles. It is defined as “a towing trailer designed for the sole purpose to tow a semi-trailer”. However, there are other configurations/scenarios that shall be introduced in this regulation, such as centre axle trailers capable of carrying loads and equipped with coupling to tow a trailer, link-trailers (semi-trailer equipped with a fifth-wheel) and semi-trailers equipped with couplings to tow a trailer.
3. Trailers are currently not included in the scope of UN Regulation No. 100 on specific requirements for the electric power train. Thus, at some point the regulation shall be updated in order to include the trailers themselves and the requirements for the batteries when they are placed on the trailer.
4. Directive 2006/126/EC on driving licences. Currently, driving licences of categories C1E and CE consider only combinations of vehicles formed by tractor vehicle + 1 trailer or semi-trailer. Modifications shall be made in order to include in the scope the option of driving combinations of vehicles with more than one trailer or semi-trailer (this means, including dollies, link-trailers and others).
5. Finally, there are several regulations that should be amended in others to include both dollies and e-dollies in the definitions and scopes.

4.2. Regulatory analysis for the aerodynamic devices

There are several aerodynamic devices that are being studied in the project: active devices for the truck, such as flaps or air deflectors, gap sealing devices, skirts extensions, passive measures such as adapted shapes, covered underbody, etc.



Fig. 2 Aerodynamic truck equipped with air deflectors, side skirts extensions and rear flaps

Although each solution has to be analysed separately, some of them have in common some issues or controversies. Some examples of these barriers are explained below:

1. Masses and dimensions. The subgroup Masses & Dimensions belonging to the Motor Vehicle Working Group is working on a new set of amendments for Regulation (EU) No 1230/2012 of 12 December 2012 implementing Regulation (EC) No 661/2009 of the European Parliament and of the Council with regard to type-approval requirements for masses and dimensions of motor vehicles and their trailers and amending Directive 2007/46/EC of the European Parliament and of the Council on requirements for motor vehicles and their trailers fitted with elongated cabs and aerodynamic devices.

This amendment would introduce new requirements such as:

- a. The aerodynamic devices have to be EC type-approved as a separate technical unit, and marked according to it.
- b. Foldable devices shall be retractable without exceeding some specific measures and without increasing the length of the loading area.
- c. It shall be possible to lock them in both the folded and in-use positions.
- d. Extra requirements for devices protruding > 500 mm:
- e. Devices designed to improve aerodynamic performance of cabs must be foldable without protruding more than 50 mm on each side of the vehicle.
- f. The device shall be covered with energy absorbing material, harness below 60 Shore.
- g. They shall not impair forward field of vision, cooling and ventilation, exhaust, etc.

Thus, all active and passive measures involving flaps or similar should meet all the requirements introduced by the amendment in order to permit its type approval.

2. CO2 emissions and fuel consumption. Annex VIII of Regulation (EU) 2017/2400 sets out the test procedure for the determination of the air drag on the vehicles. If the system is activated by a control unit, for the purpose of this regulation, the device is considered an active aero device.

Vehicles equipped with active aero device shall demonstrate to the approval authority the following requirements:

- a. The device is always activated and effective to reduce the air drag at vehicle speed over 60 km/h.
- b. The device is installed and effective in a similar manner on all vehicles of the family (this means vehicles with similar shape and device).

All requirement established in this regulation must be considered and fulfilled. All the data recorded during the test will be used on specific software that simulates de CO₂ emissions of the vehicle, also taking into account other parameters and data from the axle, engine, transmission, tyres and other components fitted on the vehicle tested.

3. Type approval of the unit. As said before, aerodynamic devices would be required to be type-approval as a separate technical unit.
4. Electromagnetic compatibility. All the sensors and actuators needed to activate and control the movable components of the truck or the trailer must not interfere or modify its electromagnetic compatibility. The specific requirements that vehicles, components and separate technical units intended to be fitted in these vehicles requirements are described in UN Regulation No. 10.

Electromagnetic compatibility may be checked in all driving conditions, or at least in the one declared as worst case. Any active aerodynamic device shall be activated accidentally by electromagnetic radiation. It shall be demonstrated that vehicle performance is not adversely affected by such transmitter installations.

5. Periodic roadworthiness tests. Currently, periodic inspections do not include inspections of aerodynamic devices. Thus, Directive 2014/45/EU on periodic roadworthiness tests for motor vehicles and their trailers may add requirements in order to check that the aerodynamic device continues working overtime, and are working correctly.

Moreover, in case of failure of the system, a positive locking in the mechanism could be demanded in order to guarantee the safety of the system.

4.3. Regulatory analysis for the smart loading units

Regarding the solutions presented to optimize the Smart Loading Units (SLU), there are different solutions that will be combined: New Modular Loading Units (NMLU) developed in Clusters 2.0, a combination of heavy- and light-weight palletized goods developed in TRANSFORMERS and software to optimize the loading named “PUZZLE”.

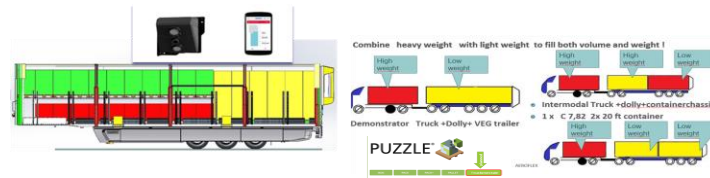


Fig. 3 Examples of PUZZLE applications

Here, there are several aspects that must be considered:

1. A sub-container is not part of the vehicle itself. Thus, it is not considered for the Type-Approval process. However, if this sub-container is intended to be used in multi-modality transports, there are several standards (EN and UIC standards) related to the intermodal transport related to codification, testing requirements and other specifications. Examples of these standards are listed below:
 - i. EN 13044-1: Intermodal Loading units – Makings for identification
 - ii. EN 283: Swap bodies – Testing
 - iii. EN 16973: Road vehicles for combined transport - Vertical transshipment
 - iv. EN 596-5: Railway specifications - Semi-trailer
 - v. UIC 592: Intermodal loading units – Vertical Transshipment
 - vi. UIC 596-6: Codification system in combined transport
 - vii. UIC 571-4: Wagons in combined Transport
2. Training of the drivers. Although it may seem that Platooning does not affect the driver, its responsibilities and its training do. For this reason, it seems appropriate to consider some regulatory gaps when talking about the common rules concerning the conditions to be complied with to pursue the occupation of road transport operator (Regulation (EC) 1071/2009) or the Driving Licences for commercial vehicle drivers (Directive 2006/126/EC).
3. Type of goods might be a limitation when considering smart loading units. UN Regulation No. 105 on uniform provisions concerning the approval of vehicles intended for the carriage of dangerous goods with regard to their specific construction features. The provisions of this Regulation apply to the construction of base vehicles of motor vehicles of category N and their trailers of category O1 intended for the transport of dangerous goods and which are subject to section 9.1.2 of Annex B to the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR). Smart loading units for ADR vehicles may be different from others dedicated to other goods and carriage.

4.4. Regulatory analysis for the front-end design

Regarding the innovative front-end design of the AEROFLEX project, if this new cab becomes an elongated cab, it will have to comply with the requirements set out in the amendment of Regulation (EU) No 1230/2012 concerning the requirements for certain motor vehicles fitted with elongated cabs and for aerodynamic devices and equipment for motor vehicles and their trailers. This Regulation allows the exceeding of the maximum length in vehicles with elongated cabs if the front fascia of the motor vehicle’s cab fully conforms to parameters of the three-dimensional cab envelope as set out in Appendix 5 of the Regulation and if the length of the loading area directly behind the cab does not exceed 10.5 m.

Otherwise, if the new front-end design only involves the introduction of absorbers or reinforcements, this amendment would not affect the design. However, it would have to fulfil all the requirements that current regulations establish for cabs. For example, the cab should comply with the uniform provisions for the protection of the occupants of the cab of a commercial vehicle (UN Regulation No. 29) or the front underrun protection

devices and their installation (UN Regulation No. 93).

5. Conclusions

This paper reviews the background of the AEROFLEX project in order to understand the influence of previous projects on the project itself and its objectives. For this reason, the main outcomes of TRANSFORMERS, FALCON and FLUXNET in relation to legislation have been presented.

Also, it is important to know the functions of the EC and the UNECE, as well of the key responsibilities of its Working Groups and the discussions that are being held at the present. Regulations are constantly evolving, and depending on the strategy of the EC and the UNECE, regulations may be adapted in pursuit of their own objectives. For this reason, it is difficult to analyse a new technology or concept in terms regulatory conflicts or gaps before the device exists physically. However, some general regulatory barriers can be predicted due to previous experience in the type approval of commercial vehicles and its systems and components.

From the beginning and until the end of the AEROFLEX project, several workshops will be held in order to share this knowledge with the different stakeholders (regulatory bodies, industry, end users, etc). The final goal of the project in terms of the legislation is to submit a Book of Recommendations addressed to policy makers in order to allow the implementation of AEROFLEX solutions and concepts. It is very important to align the strategies and opinions of all stakeholders involved in order to ease this process and enable the penetration of AEROFLEX solutions into high-capacity transport.

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