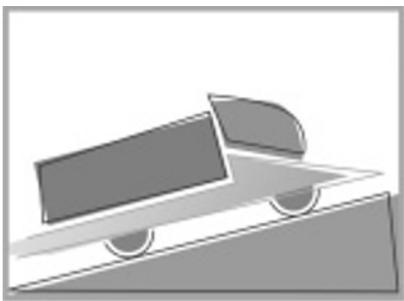


**Homologation und Zulassung  
zukünftiger Drive-by-Wire-Systeme  
- Status und notwendige  
Modifikationen der Vorschriften**

# Typ Approval and Registration of Future Drive-by-Wire Systems

**Status and Necessary Modifications to the Regulations**



**PEIT**  
POWERTRAIN EQUIPPED WITH  
INTELLIGENT TECHNOLOGIES

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The vision of accident-free traffic requires substantial improvements in the area of traffic safety. In the EU project known as PEIT (Powertrain Equipped with Intelligent Technology) intelligent technologies with drive-by-wire and the corrective actions resulting from this in the elements of the power train of commercial vehicles that are relevant for safety such as the transmission, engine management, brakes and steering are being developed; these elements form the basis for tapping into safety potentials that have not been attainable previously. A special taskforce from the PEIT project has been discussing the options and standards for future typ approval of the developed systems.

## **1 Options and Standards for Typ Approval**

Typ approval and the registration throughout Europe of future, intelligent drive-by-wire vehicles is currently only possible using special authorizations for an exemption. The taskforce from the PEIT project mentioned above has been discussing the standards for future standardization and

the necessary modifications to relevant EEC directives from the European Economic Community and ECE regulations from the Economic Commission for Europe.

Within the scope of the European PEIT research project (IST-2000-28722) and under the guidance of Dr. Gernot Spiegelberg and Dr. Ansgar Maisch (Daimler-Chrysler), an intelligent powertrain is being developed based on drive-by-wire technology

without relying on mechanical backup levels [1-3]. The redundant system architecture of the power train includes the following mechatronic components: steering, front and rear axles including the brake system, engine and transmission, a prioritized coordination level as well as the driver's requirements level including the supportive assistance systems.

The national typ approval of such a complete system with complex, electronic control-based on the current regulations is only possible with unnecessarily high costs, because there are strong interactions between the vertical systems of the brake, steering and drive; these interactions require a horizontal approach for registration of the complex, electronic control for typ approval.

International typ approval of this type of complete vehicle is currently impossible. Starting from the identified differences in the PEIT vehicle in comparison to "conventional vehicles," necessary changes for obtaining a horizontal regulation regarding complex electronic control systems were discussed, represented within the scope of the project, and have already been presented to the EU Commission.

## 2 Basic Requirements

Independently of the technology used, all road vehicles must meet the basic requirements of industrialized nations as they are formulated, for example, in § 30 par. 1 of the German Road Traffic Licensing Regulations (known as StVZO in German):

"Vehicles must be built and equipped so that

- their normal operation does not damage, or endanger, disable or encumber any person to an extent that is more than preventable

- the occupants, particularly regarding accidents or injuries, are protected to the extent possible and that the extent and results of injuries are kept to a minimum."

In order to ensure the safety and verifiability of the entire system including all subsystems, the entire process, which should ensure the safety of the system and the fulfillment of the relevant portions of the regulations from the European Economic Community and the ordinances from the Economic Commission for Europe, must also be described. To this end, a design manual should be prepared and gradually updated; this manual should describe safety goals, hardware and software architectures, interfaces, risk analyses and FMEAs among other things, and clearly stipulate the interfaces and responsibilities between the manufacturer and the supplier. In addition,

the complex electronic system, the safety plan as well as safety strategies including the necessary processes for modifying the system must be described in detail and verifiably documented.

### 2.1 Brake System

ECE R 13 is the applicable regulation from the Economic Commission for Europe for the international typ approval of the brake system in motor vehicles and trailers. In accordance with an existing recommendation for drafting further development on the use of complex electronic systems in this regulation, Annex 18 of the currently valid ECE regulation, ECE R 13.09, for safety-relevant, complex x-by-wire control systems is interpreted as being an approach for a possible horizontal regulation.

### 2.2 Steering System

EC Regulation no. 70/311/EEC of the European Economic Community in supplemented version no. 1999/7/EC serves as the basis for the typ approval of vehicle steering systems. This regulation is the equivalent of ECE Regulation no. ECE R 79. Against the backdrop of future, complex electronic systems, a revised version of ECE R 70 was subsequently discussed in the GRRF team. This pending update (to be decided on in the near future), which could be published by the end of 2004, represents a basic prerequisite for the typ approval of future x-by-wire steering systems with certain automatic action options. Until that time, the typ approval of such x-by-wire steering systems is only possible with an authorization for exemption in accordance with Article 8.2c of EC Guideline no. 70/156/EEC based on individual guideline no. 70/311/EEC.

## 3 Summary

The relevant, vertical ECE regulations for the braking and steering systems that are so critical to safety in vehicles are currently being discussed in the relevant committees; the goal of this is to enable, if applicable, the requirement for typ approval of future x-by-wire electronic systems using a horizontal approach without relying on mechanical backup levels. The first and already existing horizontal regulation represents an ECE regulation, ECE R 10, which must also be considered for electromagnetic compatibility. The activities already being conducted to update the relevant ECE regulations are facilitating the future type-approval of safety-critical, complex electronic systems in vehicles. Currently, however, the typ approval of such drive-by-wire systems for steering is only possible with an exemption authorization in accordance

with Article 8.2c of Framework Directive no. 70/156/EEC.

The aspects of typ approval described were undertaken within the scope of the European PEIT Project (IST-2000-28722) by a team consisting of the German Technical Monitoring Associations, the German Federal Office for Motor Traffic and Daimler-Chrysler with acting chair Dr. Ulrich Seiffert (from the Technical University in Braunschweig, Germany). More information on the European Research Project known as PEIT has been published on the Internet at the following web address: [www.peit-eu.net](http://www.peit-eu.net).

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## Acronyms

EC	European Community
EEC	European Economic Community
ECE	Economic Commission for Europe
FMEA	Failure Mode and Effect Analysis
IST	Information Society Technologies
PEIT	Powertrain Equipped with Intelligent Technology