



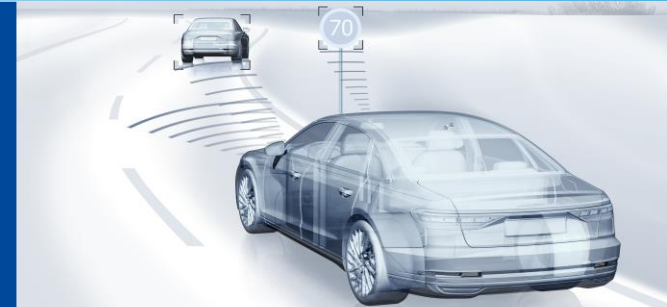
Advanced Driver Assistance Systems in the driver license exam in Germany

Tino Friedel

TÜV | DEKRA arge tp 21, Germany



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1974

Driver Assistance Systems: none



Picture: www.auto-motor-und-sport.de

2008

Driver Assistance Systems: ABS, ESP, rear-view camera, parking assistant



Picture: Wikipedia

2020

Driver Assistance Systems: adaptive cruise control, lane centering



Picture: www.faz.net

Changes in vehicle operation

35 Years

12 Years



No assistance



Only warnings and momentary assistance



Continuously longitudinal and lateral guidance of the vehicle

Future vehicles for training and testing



Picture: www.auto-motor-und-sport.de

	SAE LEVEL 0™	SAE LEVEL 1™	SAE LEVEL 2™	SAE LEVEL 3™	SAE LEVEL 4™	SAE LEVEL 5™
What does the human in the driver's seat have to do?	You <u>are</u> driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			You <u>are not</u> driving when these automated driving features are engaged – even if you are seated in “the driver’s seat”		
	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	

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These are driver support features

These features are limited to providing warnings and momentary assistance	These features provide steering OR brake/acceleration support to the driver	These features provide steering AND brake/acceleration support to the driver
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These are automated driving features

These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met	This feature can drive the vehicle under all conditions
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Example Features

<ul style="list-style-type: none"> • automatic emergency braking • blind spot warning • lane departure warning 	<ul style="list-style-type: none"> • lane centering OR • adaptive cruise control 	<ul style="list-style-type: none"> • lane centering AND • adaptive cruise control at the same time 	<ul style="list-style-type: none"> • traffic jam chauffeur 	<ul style="list-style-type: none"> • local driverless taxi • pedals/steering wheel may or may not be installed 	<ul style="list-style-type: none"> • same as level 4, but feature can drive everywhere in all conditions
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What does the human in the driver's seat have to do?

SAE LEVEL 0™

You are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering

You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety

SAE LEVEL 1™

SAE LEVEL 2™

SAE LEVEL 3™

SAE LEVEL 4™

SAE LEVEL 5™

You are not driving when these automated driving features are engaged – even if you are seated in “the driver's seat”

When the feature

These automated driving features



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These are driver support features

These features are limited to providing warnings and momentary assistance

These features provide steering **OR** brake/acceleration support to the driver

These features provide steering **AND** brake/acceleration support to the driver

The

traffic jam chauffeur

local driverless taxi
pedals/steering wheel may or may not be installed

same as level 4, but feature can drive everywhere in all conditions

What do these features do?

Example Features

- automatic emergency braking
- blind spot warning
- lane departure warning

- lane centering **OR**
- adaptive cruise control

- lane centering **AND**
- adaptive cruise control at the same time

Paradigm shift

Level 0:
Technology as a fallback for **human**

changes to

Level 1 and 2:
Human as a fallback for **technology**



What do novice drivers need to know today?

- Driving task becomes **increasingly complex**
- Drive manually still remains important



- In **addition**, automated driving functions require **new skills**

New skills necessary

- Adequate mental models about relevant systems
 - Purpose of the system and system limits
 - Need for permanent monitoring in Level 2
- Knowledge of action
 - Safe intervention and overriding of the system if necessary
- Awareness of the side effects of system use
 - Monitoring reduces attention and situational awareness



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New skills necessary

How do we test them in Germany?



Theoretical driving license test

Knowledge of...

- suitable and unsuitable situations for the use of systems
- general system limits
- typical override situations
- actions to safely override the system

Theoretical driving license test

While driving, you are using the Adaptive Cruise Control (ACC) system. The speed is set to 100 km/h.
What must you be prepared for ahead of the bend?



The ACC will cause my vehicle to accelerate here



I will have to adjust my speed to the situation



The ACC will prompt me to reduce my speed

Theoretical driving license test

What can limit the function of a lane departure system?



A dirty roadway



Missing lane markings



Missing guard rails

Practical driving license test

For these systems the examiner decides on the use:

Active and **continuous** takeover of the **longitudinal and/or lateral guidance**

- Adaptive Cruise Control
- Active Lane Keeping Assist (lane centering)
- Active Lane Change Assist
- Active Parking Assist
- Semi-automated driving (Level 2)

One-Time Use
of **one to two systems**
during test drive

Practical driving license test

For these systems the examiner decides on the use:

Active and continuous takeover of the longitudinal and/or lateral guidance

- Adaptive Cruise Control
- Active Lane Keeping Assist (lane centering)
- Active Lane Change Assist
- Active Parking Assist
- Semi-automated driving (Level 2)

Information about the systems the vehicle is equipped with by specific data sheets

Datenblatt für den Verbau von Fahrerassistenzsystemen im Prüfungsfahrzeug		
Name der Fahrschule		
Zugehöriges zum Prüfungsfahrzeug		
Fahrzeughersteller		
Typ		
Handelsbezeichnung		
Fahrzeug-Identifizierungsnummer		
Amtliches Kennzeichen		
Angaben zu Fahrerassistenzsystemen (FAS)		
	verbaut	nicht verbaut
Geschwindigkeitsregelung Das FAS soll eine vom Fahrer eingestellte Geschwindigkeit enthalten.	<input type="checkbox"/>	<input type="checkbox"/>
Adaptive Geschwindigkeitsregelung* Das FAS soll eine vom Fahrer eingestellte Geschwindigkeit und einen vom Fahrer eingestellten Mindestabstand zum vorausfahrenden Fahrzeug enthalten.	<input type="checkbox"/>	<input type="checkbox"/>
Notbrems-Assistent Das FAS soll bei einer drohenden Unterschreitung des Abstands nach vorn zu Verkehrsteilnehmern oder Gegenständen warnen und bei drohender Kollision ggf. einen (Teil-) Bremsvorgang einleiten lassen.	<input type="checkbox"/>	<input type="checkbox"/>
Ablahge-Assistent Das FAS soll beim Abweichen von einer Spur oder von einer Kollisions- mit Verkehrsteilnehmern neben dem Fahrzeug warnen.	<input type="checkbox"/>	<input type="checkbox"/>
Spurhalte-Assistent Das FAS soll vor einem ungewollten (teilw. aktiven) Überfahren der Fahrstreifen bzw. Fahrbahnbegrenzung warnen.	<input type="checkbox"/>	<input type="checkbox"/>
Spurhalte-Assistent mit Lenkeingriff Das FAS soll vor einem ungewollten (teilw. aktiven) Überfahren der Fahrstreifen- bzw. Fahrbahnbegrenzung warnen und ggf. selbstständig eine Korrektur der Fahrtrichtung einleiten.	<input type="checkbox"/>	<input type="checkbox"/>
Aktiver Spurhalte-Assistent* Das FAS soll das Fahrzeug kontinuierlich mittig auf dem Fahrstreifen positionieren (kontinuierliche Überführung).	<input type="checkbox"/>	<input type="checkbox"/>
Spurwechsel-Assistent Das FAS soll beim Fernsteuernwechsel vor einer Kollision mit Verkehrsteilnehmern auf dem benachbarten Fahrstreifen warnen (Überführung bei Befreiung des Browsers).	<input type="checkbox"/>	<input type="checkbox"/>
Totwinkel-Assistent Das FAS soll bei Fahrzeugen warnen, die sich von hinten im „Toten Winkel“ befinden (auch ohne Aktivierung des Blinkers).	<input type="checkbox"/>	<input type="checkbox"/>
Spurwechsel-Assistent mit Lenkeingriff Das FAS soll beim Fernsteuernwechsel vor einer Kollision mit Verkehrsteilnehmern auf dem benachbarten Fahrstreifen warnen und ggf. selbstständig eine Korrektur der Fahrtrichtung einleiten.	<input type="checkbox"/>	<input type="checkbox"/>
Aktiver Spurwechsel-Assistent* Das FAS soll beim Fernsteuernwechsel die Querführung des Fahrzeuges übernehmen.	<input type="checkbox"/>	<input type="checkbox"/>
Park-Assistent Das FAS soll beim Parken oder Rangieren vor einer Kollision warnen.	<input type="checkbox"/>	<input type="checkbox"/>
Aktiver Park-Assistent* Das FAS soll beim Parkvorgang die Querführung übernehmen, ggf. teilautomatisierte Ausführung (Quert- und Längsführung).	<input type="checkbox"/>	<input type="checkbox"/>
Rückfahrkamera Das FAS soll beim Rückwärtsfahren durch ein Kamerasystem bei der rückwärtigen Verkehrsbeobachtung unterstützen.	<input type="checkbox"/>	<input type="checkbox"/>
Verkehrszeichenerkennung Das FAS soll zu Verkehrszeichen Informationen, die vom Fahrzeug erkannt werden.	<input type="checkbox"/>	<input type="checkbox"/>
Teilautomatisiertes Fahren in Stop-Situationen* Das FAS soll in Stop-Situationen zwischen definierten Vorzeichen die Quer- und Längsführung übernehmen.	<input type="checkbox"/>	<input type="checkbox"/>
Teilautomatisiertes Fahren* Das FAS soll die Quer- und Längsführung bis zu einer vorgegebenen Geschwindigkeit übernehmen.	<input type="checkbox"/>	<input type="checkbox"/>
Bemerkungen		
Ort	Datum	Unterschrift
* Bei diesen Systemen entscheidet der amtlich anerkannte Sachverständige oder Prüfer für den Kraftfahrzeugverkehr über den Einsatz der Systeme (vgl. Anlage 7 FeV).		

Practical driving license test

Two assessment principles in the use of driver assistance systems:

1. Requirements for manual driving remain the basis for decision-making

- Candidate must constantly monitor the system
- Candidate is solely responsible
- Irrelevant for assessment whether the misbehavior occurs during system use or manual driving

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Copyright © 2021 SAE International These are driver support features		
These features are limited to providing warnings and momentary assistance	These features provide steering OR brake/acceleration support to the driver	These features provide steering AND brake/acceleration support to the driver
<ul style="list-style-type: none"> • automatic emergency braking • blind spot warning • lane departure warning 	<ul style="list-style-type: none"> • lane centering OR • adaptive cruise control 	<ul style="list-style-type: none"> • lane centering AND • adaptive cruise control at the same time

Practical driving license test

Two assessment principles in the use of driver assistance systems:

2. For systems that are not voluntarily controlled (e.g. automatic emergency braking), the **examiner decides** whether the candidate has acted incorrectly

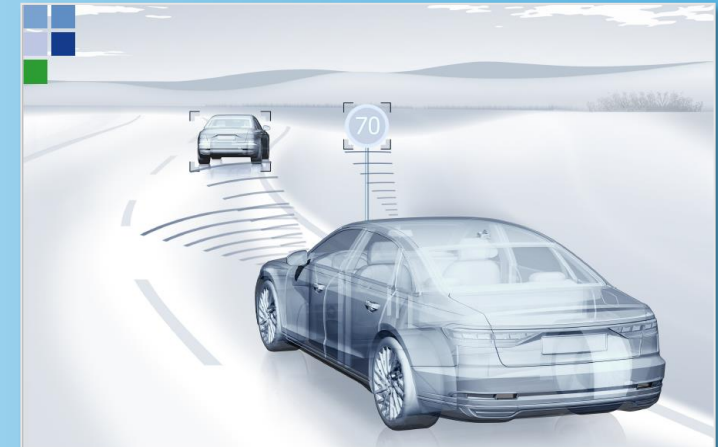
- Action of the system is just an indication
- Misbehavior may have preceded – but does not have to

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Guidelines

Guidelines for both examiners
as well as for driving teachers



**User information
for the assessment of the use of
driver assistance systems
and semi-automated driving functions
in the practical driving test**

Documentation in digital test protocol



Outlook

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	These are driver support features			These are automated driving features	
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Thank you very much

... for your attention!



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