TÜV SÜD / HAD at a glace

automated, connected and safely on public roads

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Mehr Wert.
Mehr Vertrauen.

TÜV SÜD at a glance

150+
years of safety & sustainability

1.000+
locations worldwide

€ 2,6
billion annual turnover

25.000+
employees*

41 %
sales outside Germany

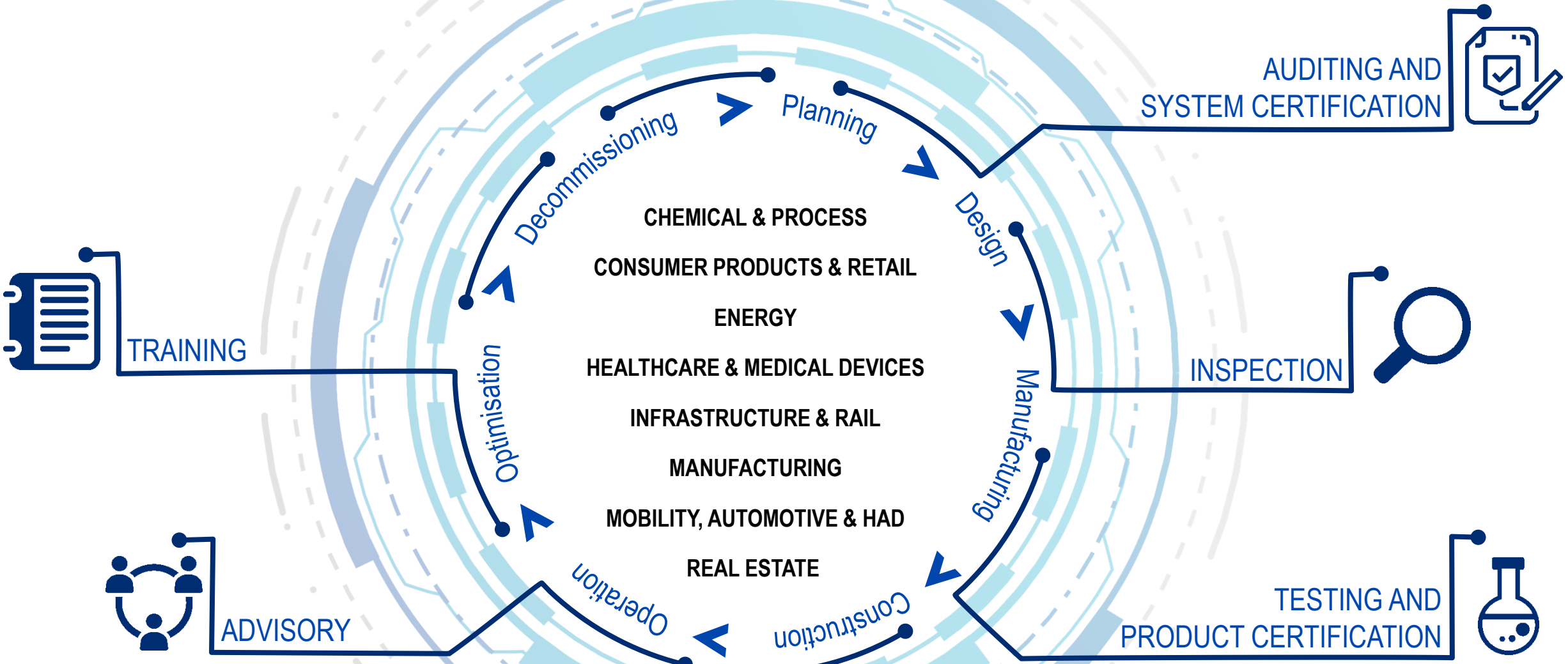
574.000
certificates

100 %
Independent & objective

1
everthing from on source

*Status 31.12.2019
^according to customer location
Note: figures are rounded up or down.

Adding value across the business lifecycle



Enabling access to global markets

Over 1,000 TÜV SÜD locations in about 50 countries

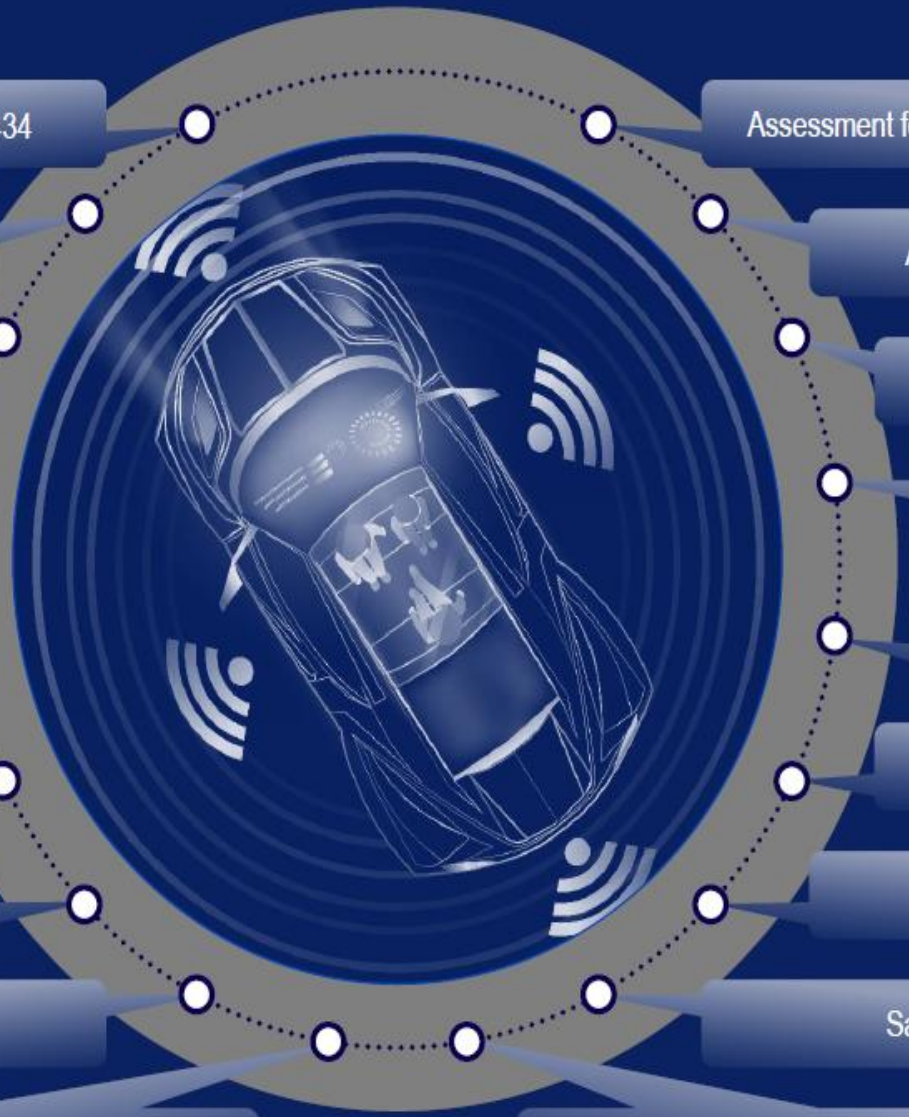
Germany (HQ)
Argentina
Austria
Bahrain
Bangladesh
Belgium
Bosnia & Herzegovina
Brazil
Canada
China
Croatia
Czech Republic
Denmark
Egypt
Finland
France
Hungary
India
Indonesia
Ireland
Italy
Japan
Malaysia
Mexico
Netherlands
Oman
Philippines
Poland
Portugal
Qatar
Romania
Saudi Arabia
Singapore
Slovakia
Slovenia
South Africa
South Korea
Spain
Sri Lanka
Sweden
Switzerland
Thailand
Turkey
UAE
United Kingdom
USA
Vietnam

Our global team for automated & connected driving

Business Line Structure - Automated and Connected Driving

- Test & Validation
  - Physical Testing
  - Virtual Methods
- Technical Affairs
- Software & System Quality
  - Functional Safety
  - Cybersecurity Connectivity

Overview product portfolio for automated & connected criving



- HAD | UNECE-R155 Cybersecurity ISO/SAE 21434
- HAD | UNECE-R156 Software Update ISO 24089
- HAD | UNECE-R157 ALKS
- HAD | AV – Permit
- HAD | Technical Advisory & Trainings
- VM | AV - Simulator
- VM | Virtual Validation Readiness Check
- PT | AV – Testing
- FS | Functional Safety Certification Product/System
- Assessment for Automotive Mngt. Systems | CS
- Assessment for Automotive Components | CS
- Readiness Index Automotive Cybersecurity | CS
- SOTIF V&V Readiness-Check | FS
- HARA for Full Automation | FS
- Safety Culture | FS
- Safety Review, Audit, Assessment | FS
- Safety Analysis Method Coaching | FS
- SOTIF – Process Fitness Check | FS

HAD: Highly Automated Driving
VM: Virtual Methods
PT: Physical Testing
CS: Cybersecurity
FS: Functional Safety

Our product categories

Our mission is to bring vehicles, systems and components for automated and connected driving on public roads in a safe and secure way.

Series Vehicles

We provide

- Assessments
- Audits
- Approval recommendation

that you can receive type approval and self-certification to operate your series vehicles on public roads.

UN-R155 Cybersecurity
UN-R156 Software updates
UN-R157 Lane Keeping System

National specific series

Single Vehicles

We provide

- Assessments
- Audits
- Permit Recommendation

that you can operate a single vehicle on public roads.

Show case vehicle

Test vehicle

Data collector

Advisory

We support you to leverage your knowledge by tailor-made technical advisory trainings and workshops.

Training

Workshop

Technical advisory

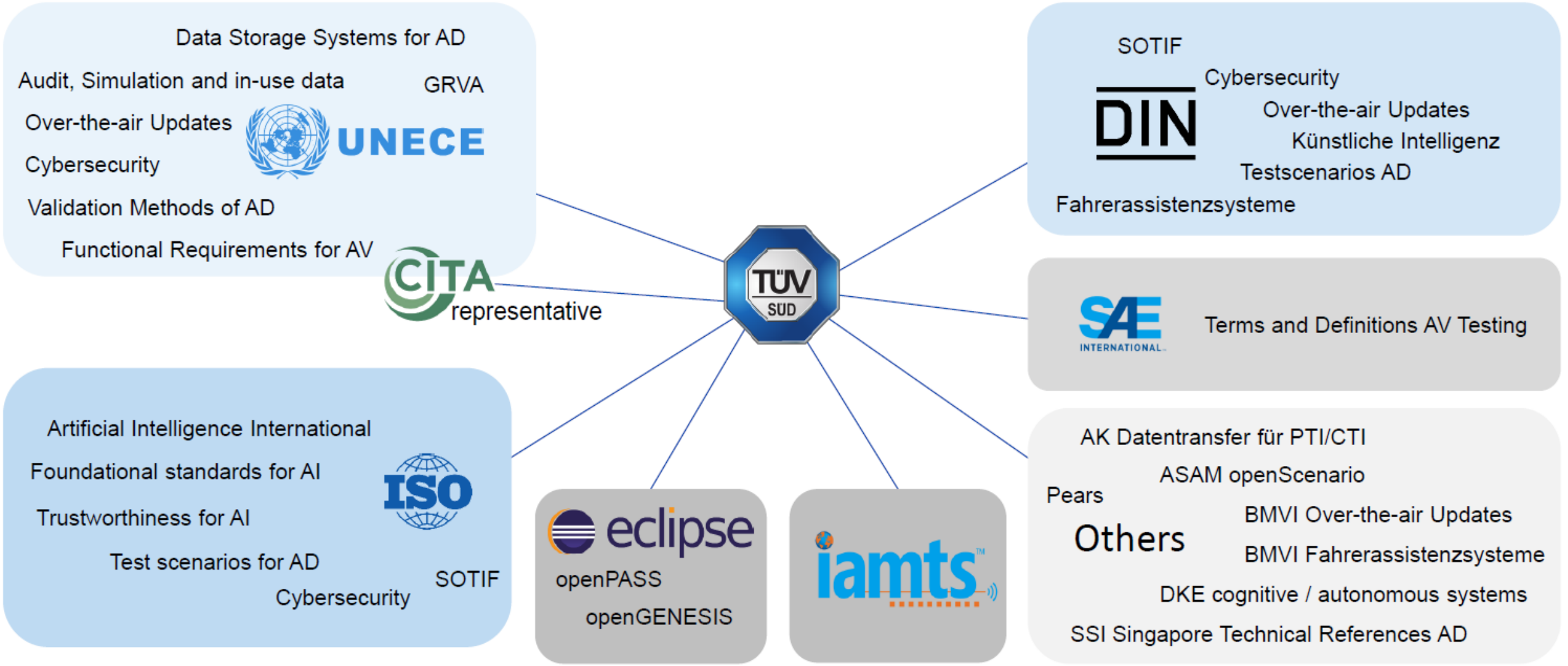
Reports

SAE J3016 Automation Levels

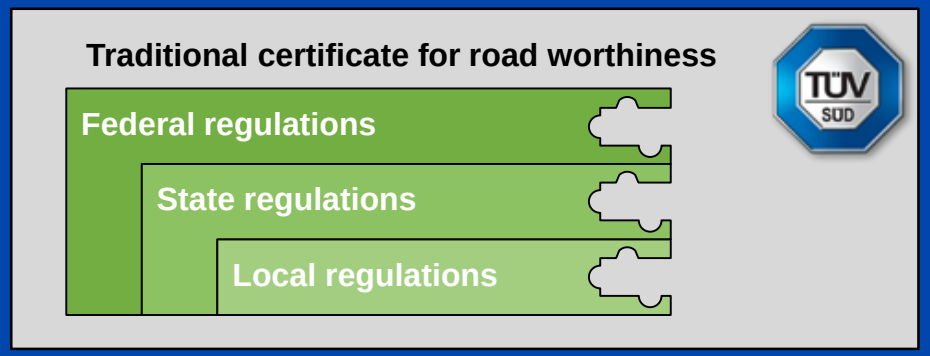
SAE Level	Description	Meaning	Execution of steering and acceleration/decelleration	Monitoring of driving environment	Fallback performance of dynamic driving task	System capability (driving modes)
Human driver monitors the driving environment						
0	No Automation	Feet- & Hands-on	Human driver	Human driver	Human driver	n/a
1	Driver Assistance	Feet- or Hands-off	Human driver and system	Human driver	Human driver	Some driving Modes
2	Partial Automation	Feet- & Hands-off	System	Human driver	Human driver	Some driving Modes
Automated driving system monitors the driving environment						
3	Conditional Automation	Eyes-off	System	System	Human driver	Some driving Modes
4	High Automation	Brain-off	System	System	System	Many driving Modes
5	Full Automation	Driver-off	System	System	System	All driving Modes

Source: 2014 SAE International

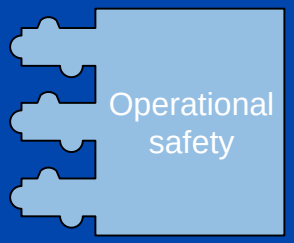
TÜV SÜD Activities in Regulations & Standards for Automated Driving

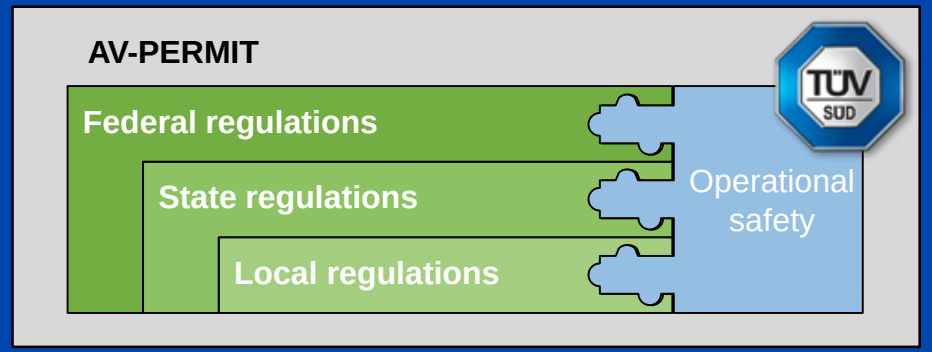


Approach of TÜV SÜD AV-PERMIT



Operational safety includes:
- Road traffic regulation
- Functional safety
- Cybersecurity





AV-PERMIT: Use the principles of operational safety to close the regulatory gap and to provide concise Assessment

Connection of AV-Permit and UNECE-R157

automated & connected vehicle safety =

vehicle safety + functional safety + cyber security

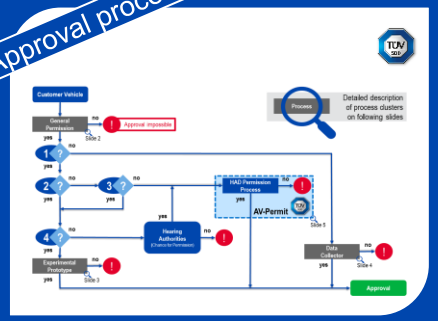
Automated Vehicle

Risk Assessment	Clarification of local regulation	HARA	TARA
Gap Analysis	Pre-inspection	Coverage analysis	Deviation analysis
Validation / Testing	Vehicle approval tests	Vehicle reaction tests	Security tests
Report & Documents	Final inspection	Safety reporting	Security reporting

complete assessment report → Authorities

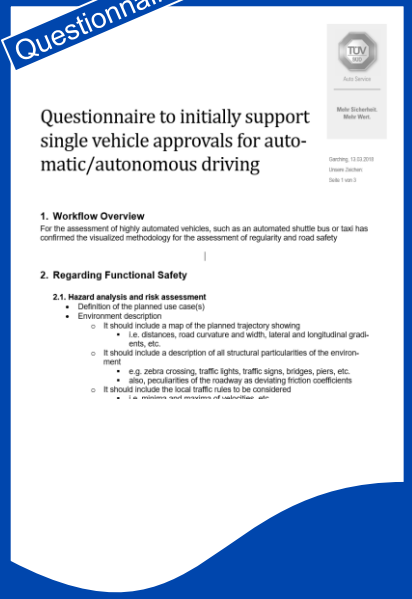
AV-PERMIT Deliverables

Technical consulting



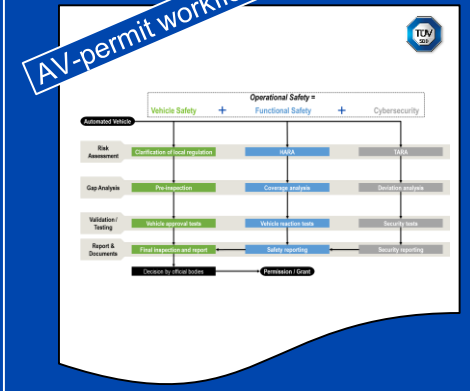
- Consulting on approval
- Which regulation is relevant and when?
- Relevance of Standards

Getting started



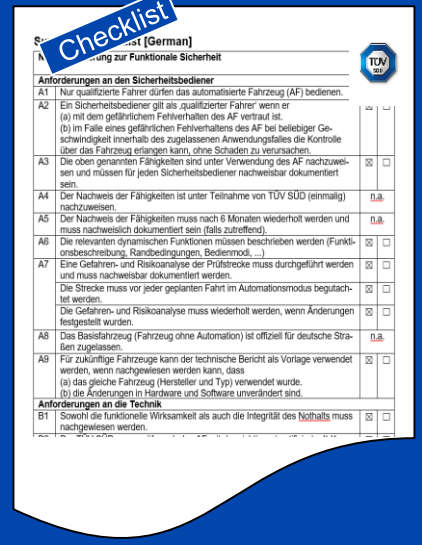
- Questionnaire
- Preparation check list
- List of necessary documents

Workflow



- Evaluation procedure
- Assessing risk, Gap analysis, validation & testing, reporting

REQ-check list



- Technical safety concept
- Safety requirements

AV-PERMIT

- Technical report: assessment of road worthiness and operational safety
- Basis for decision by official bodies

AV-PERMIT Use Cases

Automated Bus Shuttles

Image source: Deutsche Bahn AG

AV Testing Vehicles

Image source: Waymo LLC

AV Conversions and Data Collectors

Image source: GM Cruise LLC

Thank you for your attention!

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Some References of TÜV SÜD

Projects

- First automated bus shuttles in Germany, operating as regular bus line on public roads
- Automated bus shuttles in geo-fenced and closed environment
- Assessments for data collector vehicles, with open loop automation in “shadow mode”
- Test vehicle assessments for supplier and technology companies
- Assessments of fleet testing for Level 3 automation
- Safety assessment of traffic simulation vehicles, used for testing purposes
- … and much more …

Other TÜV SÜD divisions

Ensuring safety of highly automated driving

As part of the PEGASUS research project promoted by the Federal Ministry for Economic Affairs and Energy (BMWi) in Germany, we are working with 16 industrial and research partners to formulate method and test requirements to ensure safety of highly automated driving functions for highway deployment.

NEW MOBILITY

Digitalising homologation through simulations

In a partnership with NVIDIA Corporation and AVL GmbH, we are defining parameters such as safety requirements, potential critical driving scenarios, and evaluation criteria necessary to establish simulation as a test method in vehicle approval.

NEW MOBILITY

Shaping the future of AV development

To propel Autonomous Vehicle (AV) development, we have participated in the development of the first national regulatory framework, Technical Reference 68 (TR68), for fully autonomous vehicle launched by Singapore. We were in the working groups for operational / functional safety, cyber security and vehicular data.

NEW MOBILITY

Establishing safety of AI-based systems

Working with the German Research Centre for AI (DFKI), we are developing an open platform 'openGenesis' to certify AI-based systems used in autonomous driving. A 'roadworthiness test' will be developed to validate safety of the underlying algorithms.

DIGITAL TRANSFORMATION

Committing to cyber security via the Charter of Trust

We have signed the Charter of Trust - a global cyber security alliance by Siemens and other leading organisations. Its 17 members aim to build trust in digital technologies. We contribute by protecting critical systems and sensitive data, helping our customers ensure their business continuity.

DIGITAL TRANSFORMATION

Developing standards for BIM

We are helping to develop a public German Building Information Modelling (BIM) Standard for high-rise to empower design, construction and operation of more than 31,000 assets. Contributing through BIM advisory, we are developing use cases, best practices for processes and templates.

DIGITAL TRANSFORMATION

Realising Industrie 4.0 transformation

To drive industry-wide transformation, we developed the Smart Industry Readiness Index with the Singapore Economic Development Board which was rolled out in countries in Asia, Europe and US. Together with the partners, we have launched a 'Prioritisation Matrix', a computational tool for identifying priority digital initiatives.

DIGITAL TRANSFORMATION

Achieving safety beyond compliance

We tested and certified Huawei's smartwatches according to TÜV SÜD Wearables certification, going beyond current compliance requirements to ensure that the products maintained high standards of safety while meeting consumers' expectations of performance and marketability.

GLOCALISATION

Globalising quality management approach

We provided integrated auditing and certification of management systems to about 400 companies within Würth Group across 80 countries, with the aim to improve their management systems and quality, and strengthen their company brand identity while increasing economic efficiencies.

GLOCALISATION

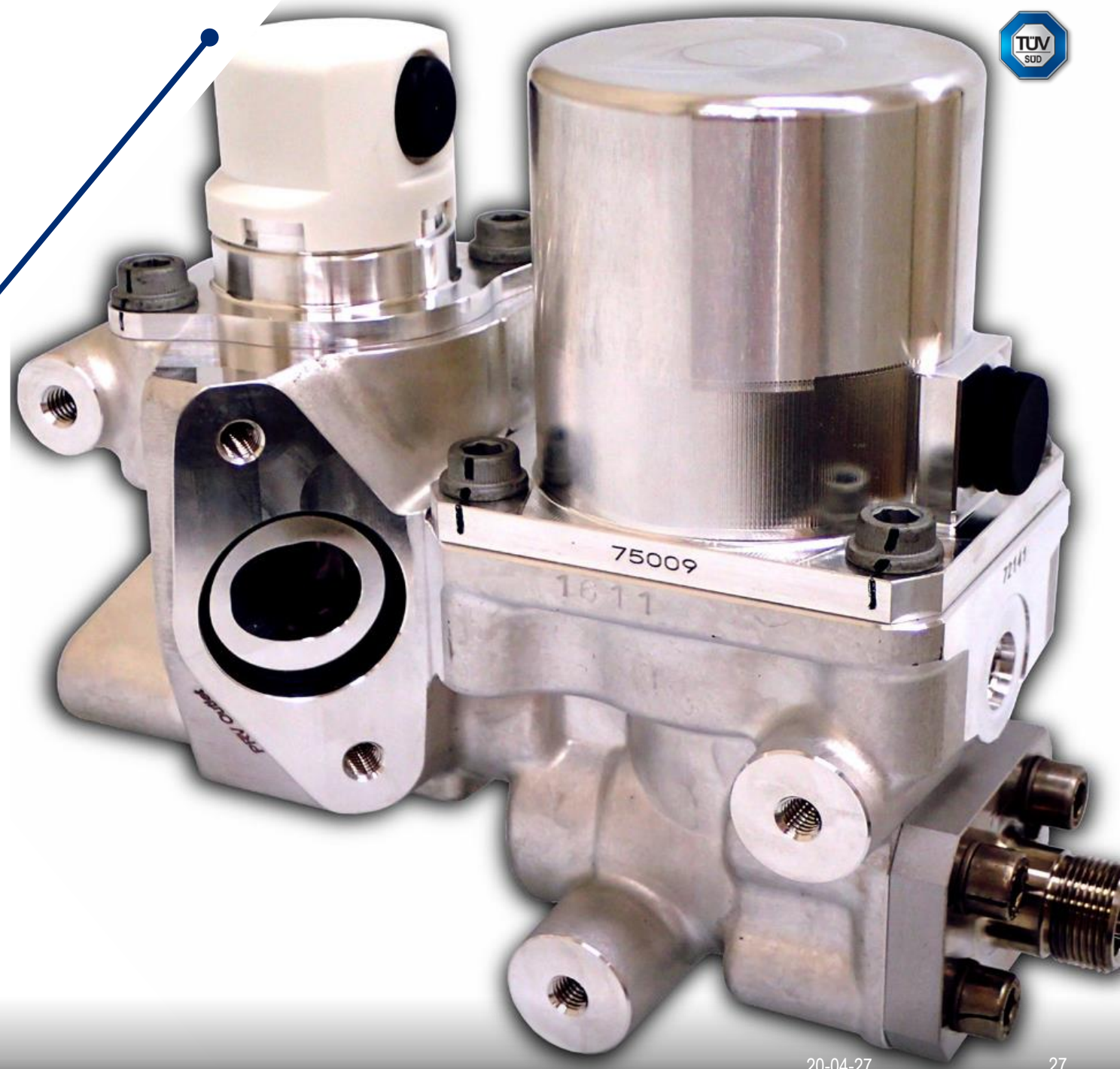
Implementing nationwide periodical vehicle inspections

With our German expertise, we are the only company in Turkey to have successfully implemented a modern system for vehicle inspection nationwide. We created a network of 189 test centres and 81 mobile test stations in just 18 months. Through this, congestion and air pollution were reduced while road safety was improved through significant reduction of traffic accidents.

GLOCALISATION

Navigating EU approvals for high tech products

We partnered with Kawasaki Heavy Industries in its efforts to achieve compliance with European Union regulations related to components used in hydrogen-powered motor vehicles. Since 2014, this partnership has enabled Kawasaki to successfully certify its components and positioned the company to gain critical market share with major OEMs in the automotive industry.



GLOCALISATION

Ensuring product quality of AM components

With Deutsche Bahn, we developed the “Additive Manufacturer Certification Scheme” for Additive Manufacturing (AM) suppliers of spare parts and finished components. The scheme ensures a high-end manufacturing readiness level which helps to achieve consistent and reproducible product quality throughout the rail industry’s process chain.

NEW MOBILITY

Bringing safe sanitation to all

To bring safe sanitation to 2.3 billion people worldwide, we have partnered with the Bill and Melinda Gates Foundation on several projects to support the 'Reinvent the Toilet' challenge. Through ISO standards development, we are enabling the commercialisation of innovative ideas that could benefit billions.

SUSTAINABILITY

Energy storage solutions for smart grids

Testing and certification of power devices against conformity requirements are fundamental to building reliable smart grids. Together with China Energy Storage Alliance, we have developed a battery energy storage system guideline to support the safe handling of energy storage technology.

SUSTAINABILITY

Mitigating operational risk of offshore wind farm

From monitoring of manufacturing, transport, erection / installation and commissioning of the entire offshore wind farm to operational release approval from the responsible German authority, our experts ensured that all components conform to given requirements in order to mitigate operational risk in the certification of a new offshore wind farm, Nordsee One.

SUSTAINABILITY

Uncovering energy saving potential

Working with KISCO to achieve their energy efficiency goals, we implemented our technically advanced methodology for Industrial Energy Efficiency and collaborated with iDRS to minimise the impact of fluctuating energy consumption.

SUSTAINABILITY