Acceleration of internationalization of standardized testing methods for highly automated driving through formation of an alliance

IEEE
2nd December 2019
Munich
**TÜV SÜD, a German-founded 3rd Party Service Provider**

- **150+ YEARS OF SAFETY, SECURITY & SUSTAINABILITY**
- **1,000+ LOCATIONS WORLDWIDE**
- **€2.5 BILLION IN ANNUAL REVENUE**
- **24,500+ EMPLOYEES**
- **41% OF REVENUE OUTSIDE GERMANY**
- **574,000 CERTIFICATES**
- **100% INDEPENDENT & IMPARTIAL**
- **1-SHOP SOLUTION PROVIDER**

Protect People, the Environment and Property against the adverse Effects of Technology.

Prove of Safety, Quality and Sustainability.
Changing of the future mobility set-up

… from car centric towards driver centric view and intermodal mobility

Today

- Individual vehicle
- Vehicle safety – focusing on hardware (one dimensional)
- Periodical (homologation & PTI)

Future

- Intermodal mobility in connected environment (e.g. X2X)
- Vehicle-, software-, data- and process safety (multi dimensional)
- Continuous (digital & remote)
Automated Driving: Technology vs. Regulation Roadmaps
Technology develops faster than regulations and standards!

Technologies by OEMs
- L3: Audi, 2018
- L3/L4: GM, 2019
- L3/L4: VW, 2020
- L3/L4: PSA, 2021
- L4: Volvo, 2022
- L4: Ford, 2025
- L4: Renault, 2025
- L4: Daimler, 2025

Regulations for „L3 / L4“ on UN ECE level
- 08/18 UN R0
- 09/19 CS/OTA Draft
- 09/20 FuReq Draft
- w/o AV

Standards for “L3 / L4” on standardization level
- 09/18 ISO26262 2nd ed FDIS
- 01/19 ISO SOTIF/PAS
- 01/20 ACSF Draft
- 12/20 VMAD Draft
- 05/21 ISO Test scenario AV Publication
- 03/22 ISO SOTIF Publication
- w/o AV Content
- Management Standard no direct relevance for AV

ECE Rxx for AV in discussion but not planned/defined yet
ISO26262 3rd ed. with AV not planned yet

ISO Cybersecurity Publication
08/21

AI Risk Management Publication
04/22

ISO/IEC
Highly and fully automated vehicles systems and mobility services to the market is both a technological and regulatory challenge

Source: Rand Corporation
Highly and fully automated vehicles systems and mobility services to the market is both a technological and regulatory challenge.

Automated vehicles that accurately detect, recognize, anticipate, and respond to the movements of all transportation system users could lead to breakthrough gains in transportation safety.

Source: USDOT

<table>
<thead>
<tr>
<th>Controlled test facility with a 'Digital Twin'</th>
<th>Public Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type Approval Tests</td>
<td>Audit (simulation)</td>
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- Do the sensors give the right output?
  - Drive a vehicle along a test route with known targets
  - Compare with ground truth

- Does the ADS make the right decision based on data received?
  - Simulation of scenarios, with randomisation

- Does the vehicle at a system level perform appropriately?
  - Physical testing

Source: CATAPULT
Problems and challenges of automotive technology

- Growing complexity of potential risks and testing needs
- No measuring stick for what tests should be conducted and how they should be conducted
- Lack of global harmonization of standards, regulations and approaches regarding testing
- Need to match rapidly evolving technologies with a process for creating standards that is equally rapid and flexible
- Difficulty with comparability and replicability of tests across facilities, geographies and physical/virtual boundaries
- Issues with test data portability and compatibility
- Validating simulation fidelity, Optimizing simulation and physical testing
- ....
Our Vision

- Create a global community comprised of advanced mobility testing service providers and companies, organizations and agencies in need of such services.
- Learn, develop and share best-practices to ensure consistent, replicable and reliable testing.
- Maintain a global directory of physical, virtual and cyber-physical testbeds and support and promote their audited capabilities.
- Promote the rapid evolution of globally harmonized standards and certifications to ensure reliable deployment of advanced mobility systems and services.
Building a global community for smart mobility testing

September 2018
WAVE Conference
Shanghai, China

April 2019
SAE WCX
Detroit, USA

May 2019
Committees Meeting
Munich, Germany

August 2019
Committees Meeting
Tianjin, China

October 2019
Committees Meeting
Munich, Germany

To be continued…
Our Mission
To develop and grow an international portfolio of advanced mobility testbeds and service providers that meet the highest quality implementation and operational standards.

Executive Committee
Chairman: Alexander Kraus (TÜV SÜD)
Vice Chairman: Prof. Dr. Zhixin Wu (CATARC)
Secretary: John W. Tintinalli (SAE)
Consultant: Dr. Joachim G. Taiber

Technical Leadership Committee
Chairman: Dr. Lin Li (A NICE CITY)
What is the scope of IAMTS?

1. Provide an overview about dedicated shared use smart mobility testbed facilities world wide.
2. Provide access to certified high quality data linked to dedicated testbeds and road systems (public or private) which can be utilized for AV testing and certification.
3. Allow testbed operators to get their facilities certified by independent auditors to achieve a minimum quality standard in terms of AV testing capabilities which will benefit testbed users.
4. Identify key knowledge required for a successful AV testing ecosystem.
A smart mobility testbed means the complete cyberphysical mobility test ecosystem, including but not limited to tools, scenarios, roads, communication and energy related infrastructure, simulation models, physical testing methods and test objects.
How does IAMTS contribute to standards development

Contribute expertise, global perspectives and data

IAMTS Database

Technical Working Groups (examples)

- Virtual and Physical Test Methods
- Test Scenarios
- Test Data Formats
- Directory...

Development of standardized certification process

Whitepapers, Best Practises and Specifications, published by IAMTS Executive Committee (CATARC, SAE, TÜV SÜD, DIN)

Handover to standards committees of suitable SDO’s*

* Standard Development Organizations
Technical Project Priorities and Working Groups

Working Group 1: Global Differences and Harmonized Test Library
- Working Group Leader: CATARC
- Participants: TÜV SÜD, A NICE CITY, AVL, Velodyne

Working Group 2: Qualification and Directory of Global CAV Testbeds
- Working Group Leader: TÜV SÜD
- Participants: CATARC, A NICE CITY, Tilke, 3D Mapping, Circuit Booking, Hart Consult, CAR

Working Group 3: Correlation between Physical and Simulation Testing
- Working Group Leader: AVL
- Participants: CATARC, A NICE CITY, Tilke, 3D Mapping, SAE, ITIC, Retrospect, TÜV SÜD, Hart Consult
Contact us

USA

**John Tintinalli**  
Director of Innovation & Business Development, SAE International  
Secretary IAMTS  
[secretariat@iamts.org](mailto:secretariat@iamts.org)

Europe

**Alexander Kraus**  
Senior Vice President Automotive  
TÜV SÜD Mobility  
Chairman IAMTS  
[Alexander.kraus@tuev-sued.de](mailto:Alexander.kraus@tuev-sued.de)

China

**Prof. Dr. Zhixin Wu**  
Deputy General Manager China Automotive Technology and Research Center (CATARC)  
Vice Chairman IAMTS  
[zhaoshuai@catarc.ac.cn](mailto:zhaoshuai@catarc.ac.cn)
Let’s create safety and trust in tomorrow’s world of smart mobility together.

sustainable. integrated. leading.