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ARAI
Progress through Research

Introduction to ARAI

About ARAI

- Established In 1966, ARAI is the Leading Automotive R&D Organization of the Country set up by the Automotive Industry with the support of Government of India
- State-of-the-art Laboratories are well equipped with the most advanced facilities for Testing as per latest regulatory as well as new product development requirements
- ARAI is certified for ISO 9001, ISO 14001 and OHSAS 18001; ARAI is also Accredited for its testing and Calibration scope as per ISO/IEC 17025 by NABL
- With right people, technology and tools to fulfill our commitments, ARAI is well equipped to take up future challanges. Tried, Tested and Trusted partner of the Industry, with motto of Progress through Research.

Branches of ARAI


ARAI – Kothrud – Pune

ARAI – HTC – Chakan – Pune


ARAI – FID – Chakan – Pune

Achievements

- Recognition by Department of Infrastructure Australia, to provide Test Reports in Compliance with ADRs (Australian Design Rules).
- BIS Recognition for Automotive Safety Components.
- Recognized 'Overseas Test Lab' by Land Transport Authority (LTA), National Environmental Authority (NEA) Singapore.
- Appointed as 'Technical Service Provider' by RDW, Netherlands for CoP Verification Audits.
- Best Corporate Award by SAEINDIA Foundation.
- Golden Peacock Environment Management Award 2016.
- Recognized as Scientific & Industrial Research Organization.

Vision and Mission

VISION:

- To become a world-class Mobility Engineering, Research and Innovation Institution
- To be a leading Global Automotive Certification, Testing and Evaluation Organization

MISSION:

- Create and Facilitate SAFE, SUSTAINABLE and SMART Mobility Solutions

ARAI'S SCOPE OF WORK

ACADEMY & TRAINING

TYPE APPROVAL

STANDARD FORMULATION

R&D AND ENGINEERING

TECHNOLOGY DEVELOPMENT

CONSULTATION

ENVIRONMENT FRIENDLY SOLUTIONS

Regulatory Mechanism

Government of India

MORTH
Ministry of Road Transport & Highways

MOHI&PE
Ministry of Heavy Industries & Public Enterprises

MOEF
Ministry of Environment & Forests

Ministry of Consumer Affairs

DGFT
Director General of Foreign Trade

State Ministries

Standardization

CMVR - Technical Standing Committee

Automotive Industry Standards Committee-AISC

Standing Committee on Emission Legislation – SCOE

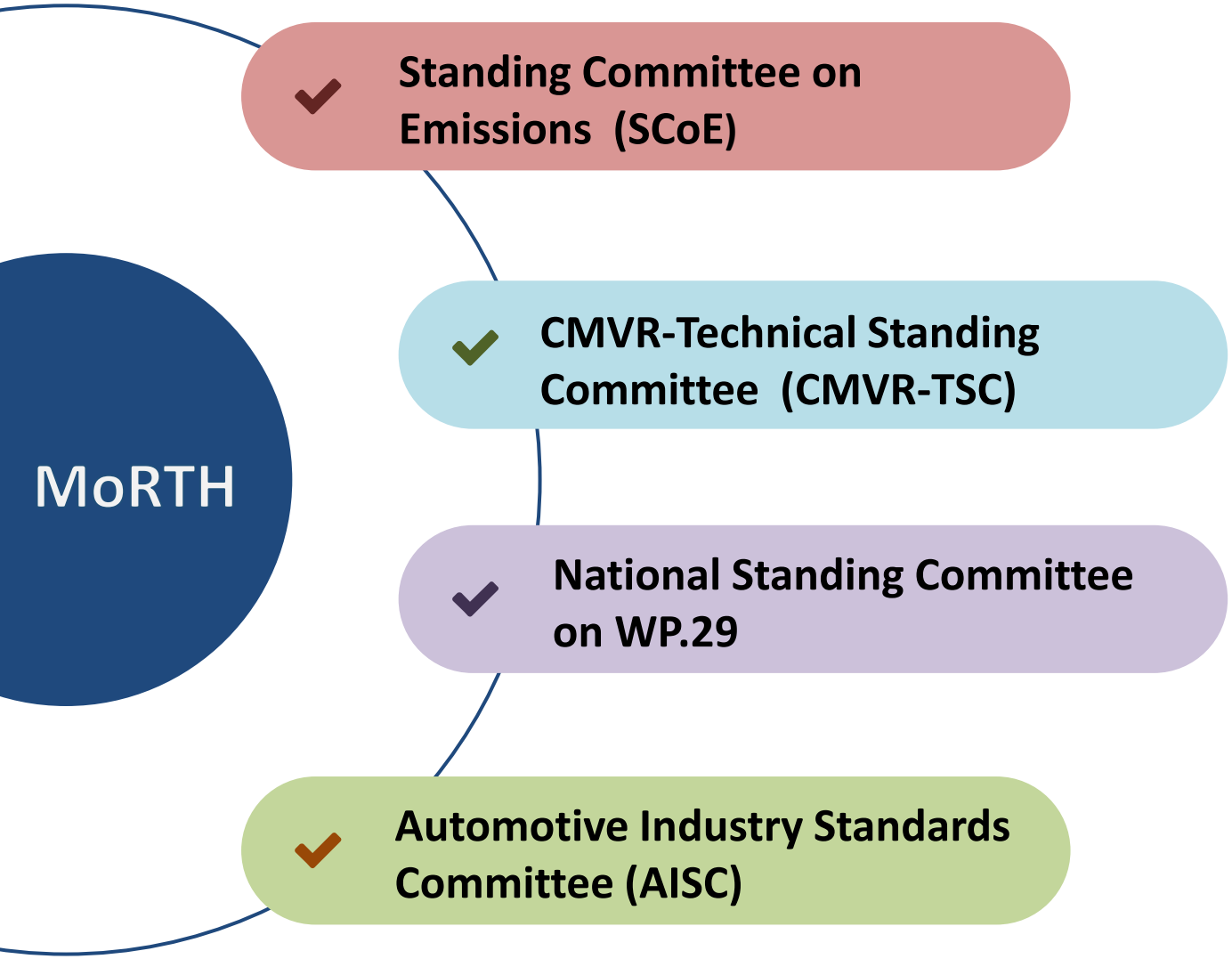
Bureau of Indian Standards – BIS

Type Approval / Certification Agencies

ARAI
Automotive Research Association of India

Other testing agencies identified by Govt. of India

National Committees - Composition



SCOE, CMVR-TSC, WP.29 Standing Committee

Chairman: Joint Secretary (MoRT&H)
Members: MoP&NG, MoHI&PE, MoEF, NATRiP, Test Agencies, SIAM, TMA & Others

AISC

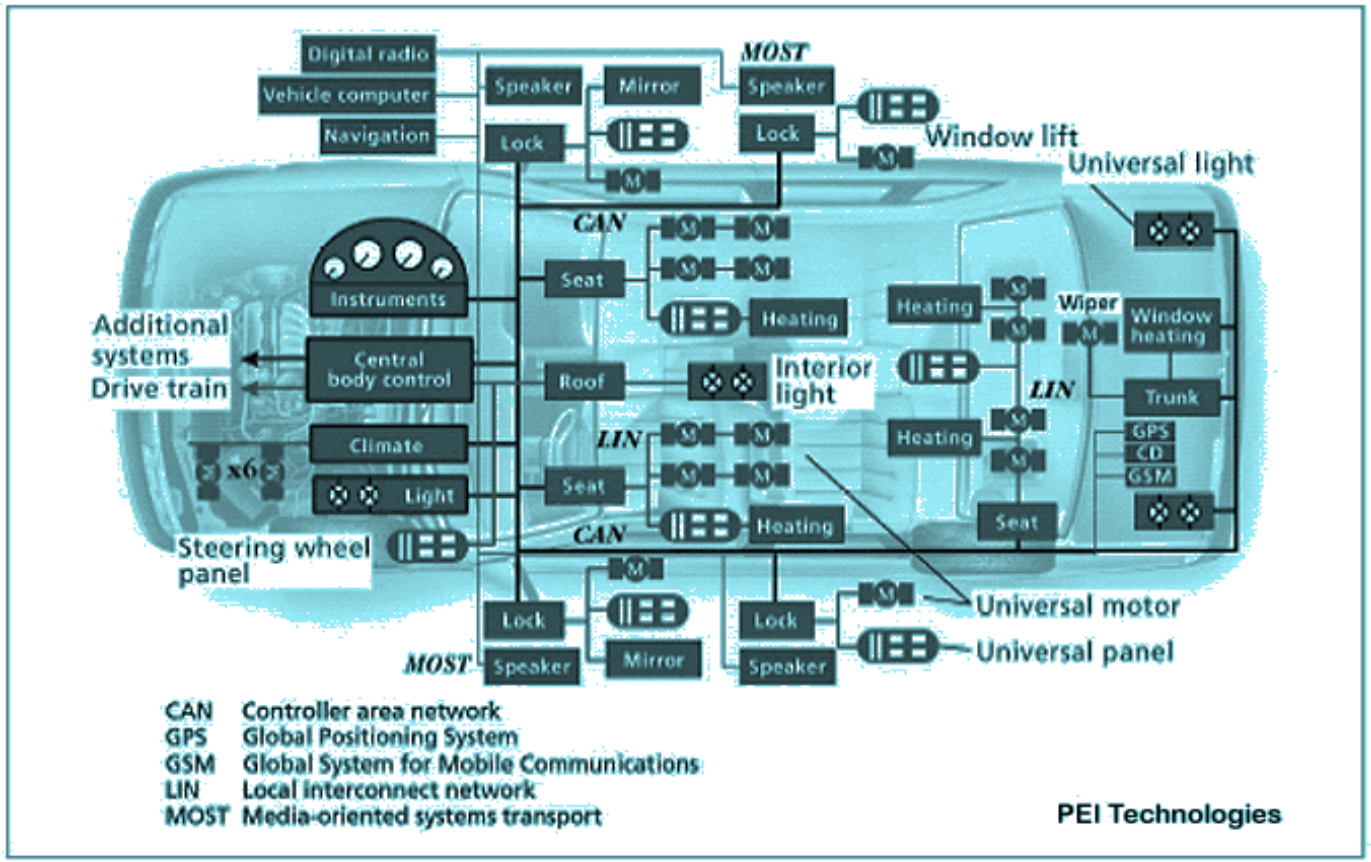
Chairman: Director (ARAI)
Members: MoRT&H, MoHI&PE, MoSSI, NATRiP, Test Agencies, BIS, SIAM, TMA, ACMA & Others

CYBER SECURITY & CONNECTED VEHICLES

TOPICS COVERED

- 1 – What is connected vehicle, Background and recent updates
- 2 – Detailed overview of Advanced Driver Assistance Systems (ADAS) standards and their harmonization with international standards.
- 3 – Proposed way forward based on various International practices
- 4 –ARAI Initiatives

What is a Connected vehicle



Modern vehicles comprises of Electronic Control Unit (ECU), Controller Area Network (CAN), Connectivity features to connect with Mobile phone applications, Remote Control access, self park, ignition on from remote place, data sharing with user etc.

These features help the user to commute from one place to another which ensures maximum safety of the user. These features are secured with cyber security regulations and various vulnerabilities that are tested at backend by the developers to avoid any sort of attack on the vehicle at the time of updates done over the air.

Background for Standard Formulaition

- Standards and Regulations pertaining to Advanced Driver Assistance Systems (ADAS), Autonomous and Connected Vehicles, Cyber Security etc., are taking shape internationally. WP.29 under UNECE is working extensively on UN Regulations.

- India participates actively in the meetings held under WP.29 and while making domestic standards and regulations widely refers to the UN Regulations and UN Global Technical Regulations. As part of continuous development in automotive regulations nationally, various subjects have been taken up for standard formulation.

- Subject such as Cyber Security have also been discussed in Inter-Ministry meetings of Government of India and directions were received to formulate requisite standards.

Subjects of Interest and Recent Updates

360 Degree View	**Park Assist**
Driver Monitoring	**Drowsiness Alert**
Blind Spot Detection	**Forward Collision Warning**
Electronic Stability Control	**Automated Emergency Braking**
Lane Monitoring and Keeping	**Adaptive Cruise Control**

Various panel are formulated for above subjects as indicated below;

Cyber Security and Management systems (CSMS)	Software Updates and Management systems (SUMS)
Lane Departure Warning Systems (LDWS)	Automated Lane Keep Assist systems (ALKS)
Advanced Emergency Braking Systems (AEBS)	Blind Spot Information Systems (BSIS)
Moving off Information Systems (MOIS)	Driver Drowsiness and Attention Warning System (DDAWS)
Event Data Recorder (EDR)	Artificial Intelligence (AI)

- These Technical Panels have come up with respective drafts of various Automotive Industry Standards (AIS). These standards are aligned with respective UN Regulations. Indian traffic conditions have been considered while drafting these standards.

Advanced Steering Command Functionalities (ACSF) (UN R 79)

A low-speed application which is activated by the system and / driver which keeps the vehicle within its lane, assists in remote control parking, reverse driving, safe halt in case of unavailability of the driver, by controlling the lateral and longitudinal movements of the vehicle for extended periods without the need for further driver input.

Current Status : Finalized draft AIS 193 for ACSF in line with the latest version (Revision 4 amendment 6) of UNR 79 is approved by CMVR-TSC. Currently the standard is under process of notification.

Lane Departure Warning System (LDWS)

Evaluation Parameters:

Lane marking visibility test

Optical Warning Signal Verification test

Vibratory warning signal test.

Lane Departure Warning System (**LDWS**) is a mechanism designed to warn the driver when the vehicle begins to move out of its lane (unless a turn signal is on in that direction) on freeways and arterial roads. These systems are designed to minimize accidents by addressing the main causes of collisions: driver error, distractions and drowsiness

Current status of AIS standard

Technical work by the panel is completed and finalized draft AIS 188 for LDWS is to be put up for approval in the next meeting of CMVT-TSC.

Reference Standard: UN R 130

Automated Lane Keeping Assist System (ALKS)

A system for low-speed application which is activated by the driver and which **keeps the vehicle within its lane for travelling speed of 60kph or less** by controlling the lateral and longitudinal movements of the vehicle for extended periods without the need for further driver input

Evaluation Parameters:

Hardware in loop (HIL)

Vehicle on-road operational test

Test with real end users

Current status of AIS standard

Panel has split the standard in 2 parts.

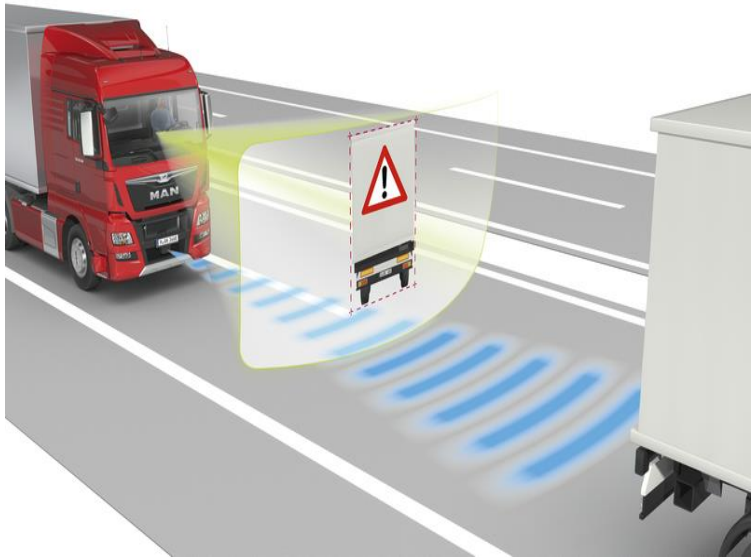
Part 1 deals with Emergency Lane Keeping system (ELKS) specifically for vehicles up to level 2 of automation.

Part 1 is to be put up for adoption in next meeting of CMVR-TSC.

Part 2 is for ALKS for level 3 and above.

Reference Standard: (EU) 2021/646 and UN R 157

Advanced Emergency Braking System (AEBS)



Evaluation Parameters:

Proximity sensors

Vehicle on-road as identified target

Auto actuation of Brakes by system

The advanced emergency braking (AEB) **detects critical proximity to a vehicle in front, warns the driver, and provides assistance with braking**. If the AEB system detects critical proximity to a stationary or moving vehicle ahead, it prepares the braking system for the possibility of an emergency stop.

Current status of AIS standard

Finalized draft AIS 162 for AEBS for heavy vehicles is approved by CMVR-TSC and is under process of notification. Draft AIS 185 for Light vehicles is due for approval by CMVR-TSC.

Reference Standard: UN R 131 and UN R 152

Blind Spot Information System (BSIS)

Evaluation Parameters:

Proximity sensors and cameras

Obstacle identified as target

Alarms and warning signals

Blind-spot monitoring uses a set of sensors mounted on the side mirrors or rear bumper to detect vehicles in the adjacent lanes. If the sensors detect something, they'll alert you via an audible and/or visual warning. Some vehicles even use a camera as the main part of the system or to complement the sensors.

Current status of AIS standard

Finalized draft AIS 186 on Blind Spot Information System is approved by CMVR-TSC and is currently under process of notification.

Reference Standard: UN R 151

Moving Off Information System (MOIS)

A system used to detect and inform the driver of the presence of pedestrians and cyclists in the close-proximity forward blind-spot of the vehicle and, if deemed necessary based on manufacturer strategy, warn the driver of a potential collision.

Evaluation Parameters:

Proximity sensors and cameras

Obstacle identified as target

Alarms and warning signals

Current status of AIS standard

Finalized draft AIS 187 on Moving off Information System is approved by CMVR-TSC and is currently under process of notification

Reference Standard: UN R 159

Driver Drowsiness and Attention Warning System (DDAWS)

A system used to detect and monitor behavior and fatigue levels of the driver. These systems are emerging to make the vehicles more intelligent for avoiding accidents on roads. To begin with the technology is applicable for M and N category of vehicles, with a maximum design speed of above 70 km/h.

Evaluation Parameters:

Human Behavior Monitoring Sensors and cameras

Karolinska Sleepiness Scale (KSS)

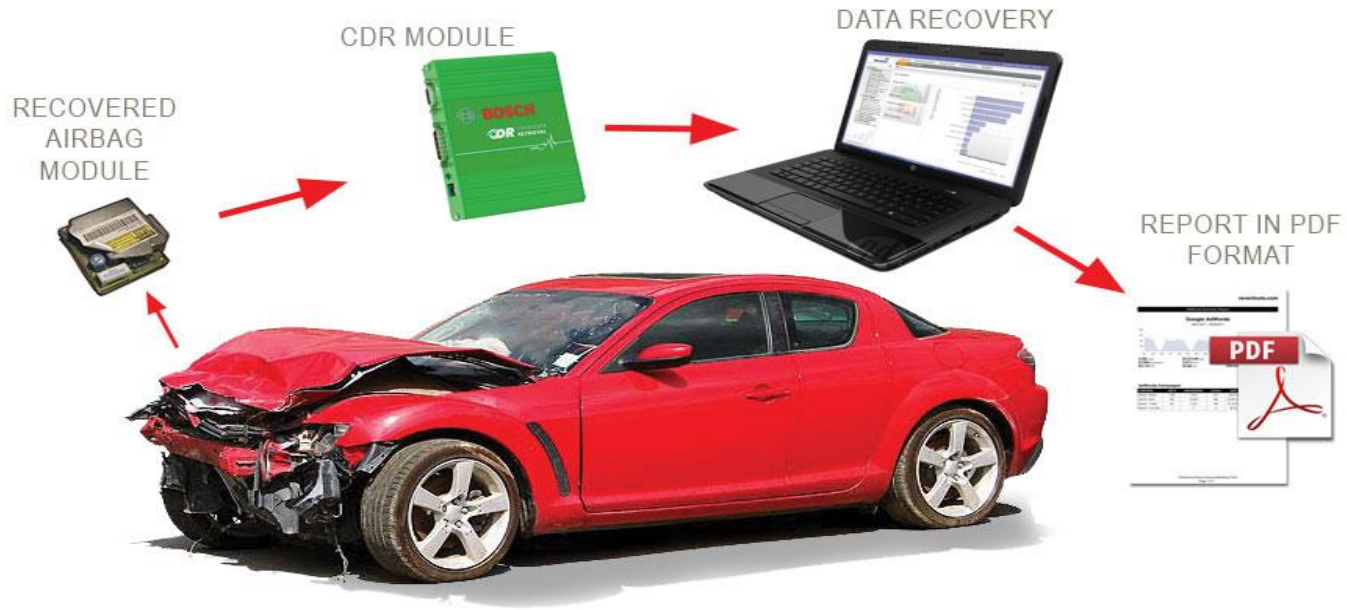
Warning signals for attentiveness

Current status of AIS standard

Finalized draft AIS 184 on DDAWS is approved by CMVR-TSC and is currently under process of notification

Reference Standard:
(EU) 2019/2144

Event Data Recorder (EDR)



Evaluation Parameters:

Pre Crash Velocity

Maximum Delta V (change in velocity)

Reconstruction of Crash Data

An event data recorder (EDR), similar to an accident data recorder (ADR) sometimes referred to informally as an automotive black box is a device installed in some automobiles to record information related to traffic collisions.

Current status of AIS standard

Current Status : Technical work by the panel is completed and finalized draft AIS 192 for EDR is to be put up for approval in the next meeting of CMVT-TSC.

Reference Standard: UN R 160

Cyber Security Management System (CSMS)

Why Cyber Security in Automotive?

- Recently, Cyber Security for non-computers, such as transportation, utility, home appliance and others has become a serious social concern.
- Intelligent modern vehicles have more Electronic Controller Units (ECU's) and more software code than ever, which comes with huge cyber risks – especially with the increased connectivity between vehicle, smart-phones & other in – vehicle electronics

Evaluation Parameters:

The testing parameters for this feature is basically a YES/NO criteria.

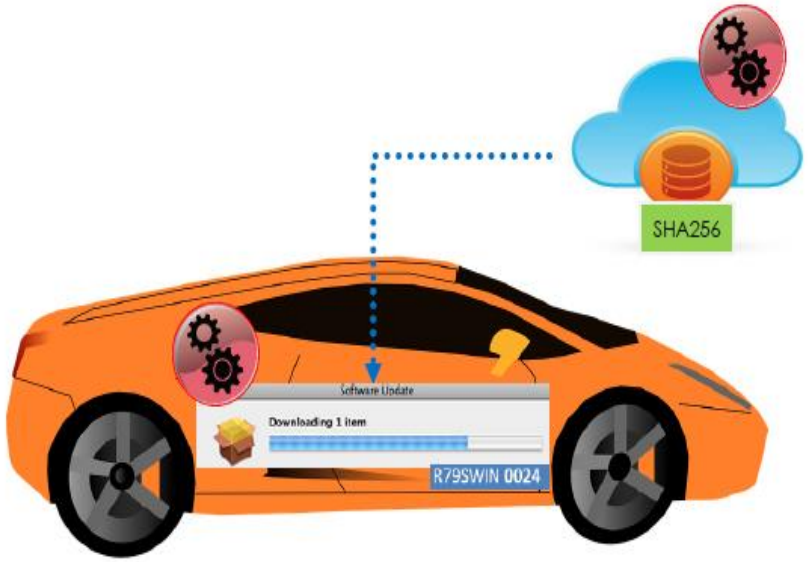
A list of cases are listed for ensuring the safety of this system. For instance firewall fitting for a system.

Current status of AIS standard

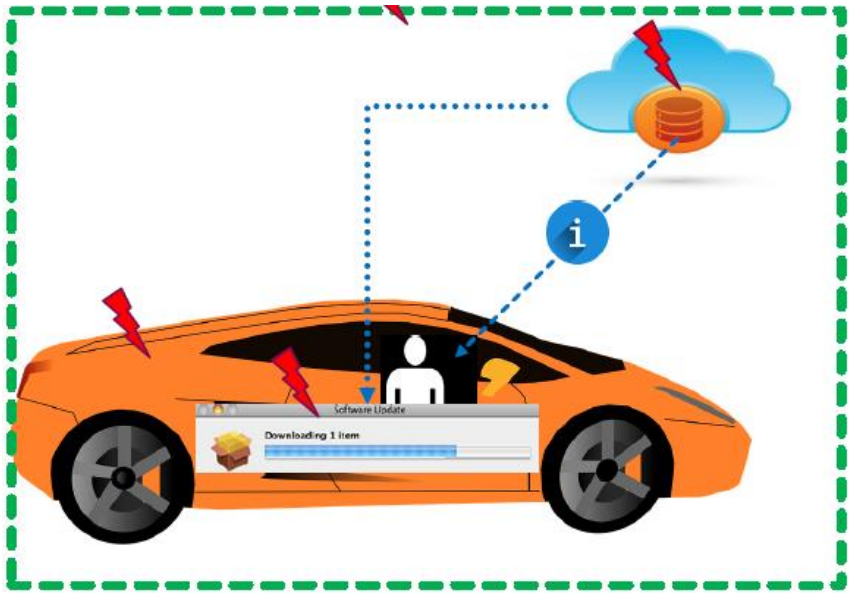
Finalized draft AIS 189 for CSMS is approved by CMVR-TSC and is currently under process of notification

Reference Standard: UN R 155

Software Update Management Systems (SUMS)



- Configuration control, Unique Identification and IVD
- RXWSIN
- Interdependencies of the updated system
- Identify target vehicles for update
- Assess the impact on configuration, Functions and parameters
- Assess the impact on Safe state



- Inform Vehicle owners of updates
- Record and Store info on each update
- Protect SW Update delivery mechanism
- Authenticity and Integrity of Software updates
- V & V of Software

Evaluation Parameters:

The testing parameters for this feature include testing of software patches, loop updates over the air through proper channel, Test for checking system do not go down during update.

Current status of AIS standard

Finalized draft AIS 190 for SUMS is approved by CMVR-TSC and is currently under process of notification

Reference Standard: UN R 156.

ARAI Initiatives and way forward

- ARAI has conducted workshops on Advanced Driver Assistance System (ADAS) Technologies in the past year, creating awareness amongst manufacturers and suppliers.
- Recently a workshop involving international experts was held for understanding Cyber Security and Over the Air (OTA) concepts.
- Participation in various forums of UNECE / WP.29 with respect to Autonomous and Connected Vehicles for understanding the recent updates in International market.
- Various Driver – in – loop (DIL), Hardware – in – Loop (HIL) equipment's and Software's have been arranged for Research and Development (R&D) along with Testing and Evaluation of Autonomous/ Automated and Connected vehicles.
- Identification of various Testing tools for Cyber Security compliance as per ISO 21434 / WP.29 is under process.
- Training various professionals for Cyber Security from TUV SUD covering ISO 21434 and ISO 26262.

Integrated Testing & Validation Approach

01

Indian Database & Use case:

Collecting data from Indian Roads, covering typical indian scenarios, such as traffic congestions, debris, potholes, Vulnerable Road User (VRU) etc.

02

Conversion to digital domain:

The data obtained from the field is to be converted and fed to system for colation and preperation for simulation

03

Lab level V&V with DIL:

Simulating the road data collected with Driver in Loop (DIL) for various vehicles and observing the behavior of vehicle and response of driver.

04

Vehicle Testing on Field:

Testing the ADAS equipped vehicle on field by defining various scenarios for validating the vehicle.

ARAI Testing Track for ADAS Features

Sr.No	Track features
1	3-lane road with varying lane markings
2	Inner city road
3	Round-about junction
4	Euro NCAP Junction
5	4 lane road
6	S curve
7	Flyover
8	Four lane 4-way junction
9	Parking lot
10	Rural road
11	Mini S curve
12	Under Pass
13	Iron Bridge
14	Over Head Barrier
15	Boom Barrier
16	Drain Mesh
17	City Pot Holes
18	Detachable Speed Breaker
19	Single Speed Breaker
20	Inflatable Tunnel
21	Man hole covers
22	Bus stop
23	Traffic Signals

Contact Details

Pratik Nayak
Email: nayak.apx@araiindia.com
Mob: 8310739815
The Automotive Research Association of India
S.No. 102, Vetal Hill, Off Paud Road, Kothrud, Pune 411 038 (India)
Tel# 020-3023 1153 / 6762 1153, www.araiindia.com


Thank You
External Interface Protection & Monitoring
In-Vehicle Network Protection & Monitoring
In-Vehicle State-of-Health-Monitoring
Security Field Monitoring
Over-the-Air Software- and In-Vehicle Update