

New Capabilities / Development / Conferences

- Structural Dynamics Lab is now ISO/IEC 17025 Accredited – Raising Testing Standard
- Canister Ageing Bench for Fuel Vapour ageing as per AIS 175 WLTP and GTR 19
- Testing Facility for Automotive Camera Monitoring System
- First Ever Global Autonomous BAJA hosted by ARAI along with Innovation showcase event iTELLIMOBILITY
- Seminar on Hydrogen – Emerging Technology Scenario for ICE Applications
- Implementation of Official Language Policy in ARAI
- ARAI Journal of Mobility Technology (Volume 5, Issue 2, April-June 2025)

□ Structural Dynamics Lab is now ISO/IEC 17025 Accredited - Raising Testing Standard

Structural Dynamics Lab (SDL) of ARAI has achieved ISO/IEC 17025:2017 Accreditation for performance, durability and vibration testing across multi-diversified sectors.

This international certification is a recognition of technical competency, rigorous quality management and unwavering commitment to accurate, reliable testing.

This ISO 17025 Accredited Testing Capabilities now includes:

- Railway and Metro Systems — Bogie Frames, Axle Boxes
- Structural Components — Reinforcement Coupler Bars
- Electronic and Mechanical Components — Vibration Testing for performance and durability

This Lab has established competency of bogie frame / axle box (railway / metro application) validation as per EN13749/UIC515/UIC615 by conducting laboratory static and fatigue tests using up to 18 servo-hydraulic actuators simultaneously. Axle Box validation by conducting laboratory cyclic tensile test, low cycle fatigue test and high cycle fatigue test as per IS 16172.

SDL is also equipped with 6,000 kgf electro-dynamic shaker integrated with environmental chamber for vibration testing. Now, this facility is also ISO 17025 Accredited for conducting validation as per following standards:

- IEC 61373:2010 - Railways
- JSS 55555:2020 - Defence
- JIS D 6101:1995 - Automotive
- IEC_60068_Part2_Sec6:2007: Defence, Aerospace
- IEC_60068_Part2_Sec78:2020: Defence, Aerospace

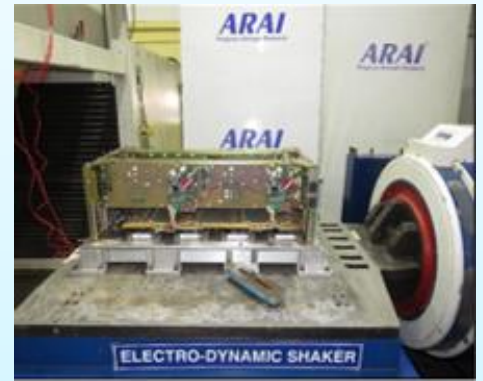
For any further information and testing requirement, please reach us on info@araiindia.com; shinde.sdl@araiindia.com (+91-20-6762 1510)



Driver Seat



Dine Table



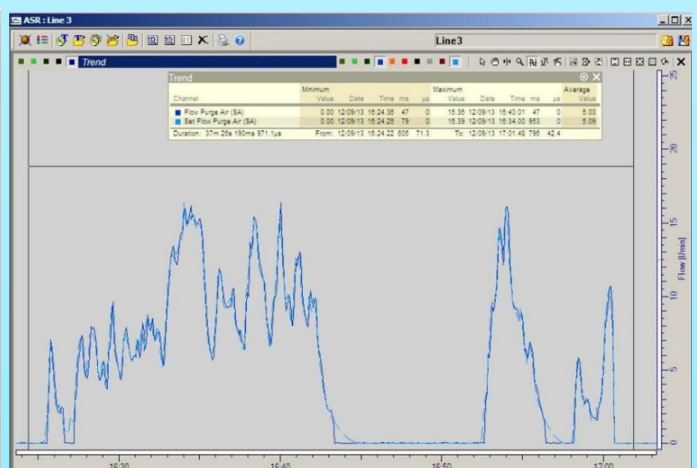
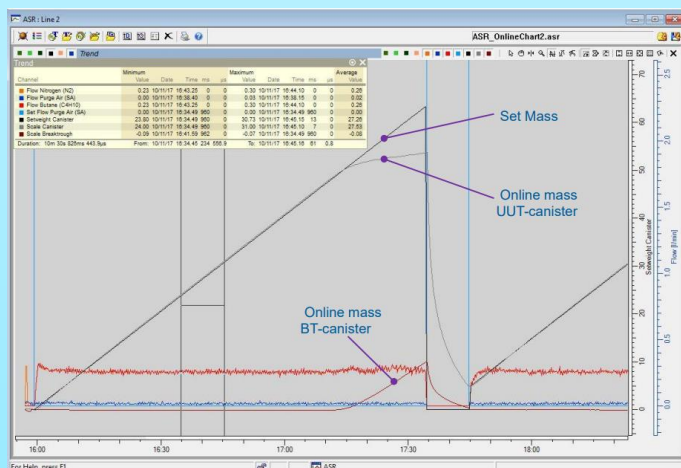
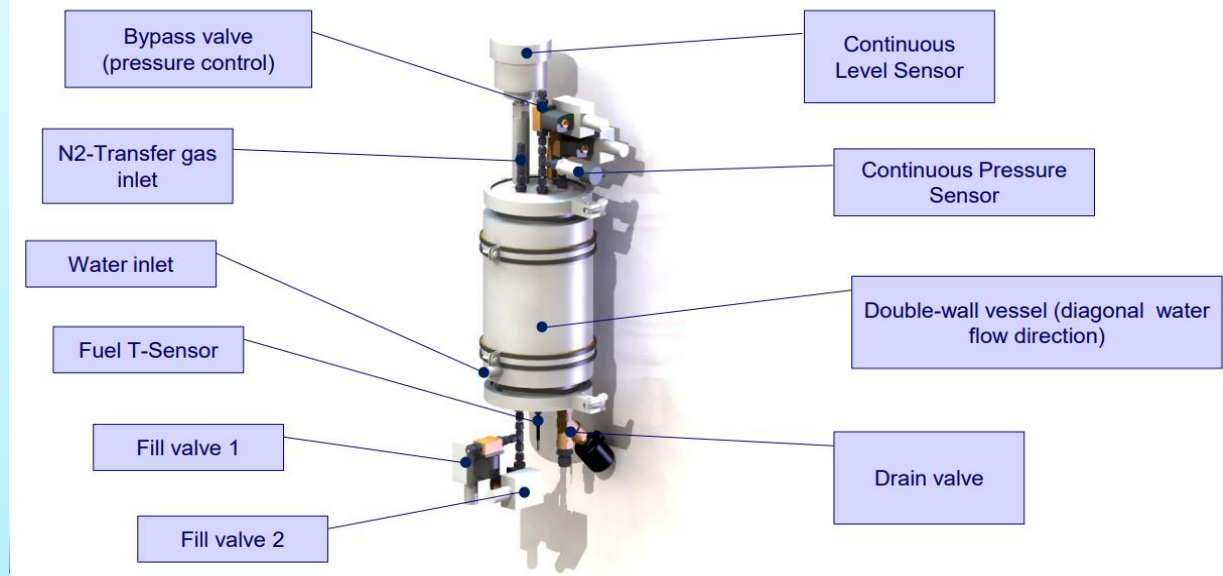
Electrical Control Units



Bogie Frame Testing for Railway/Metro

❑ **Canister Ageing Bench for Fuel Vapour ageing as per AIS 175 WLTP and GTR 19**

Canister ageing bench has been installed in Emission Certification Lab (ECL), ARAI-HTC, Chakan, where ageing of canister can be carried out through fuel vapour. This facility is compliant to AIS 175 WLTP and Global Technical Regulation (GTR) 19 with capability for ageing the canister by Gasoline fuel with Ethanol content up to 85% (E85). This is a major step towards enhancing ARAI's emission certification capabilities well in advance of implementation of WLTP regulation in India. As such, this facility will be used for domestic certification and export testing as well.



Specifications:

- Canister Loading with Fuel Vapour and Butane
- Fuel Vapour Loading Rate up to 300 g/h (selectable)
- Butane Loading Rate up to 220 g/h (selectable)
- Fuel Evaporation Unit
- Fuel adaptability: Gasoline fuel with Ethanol content up to 85 % (E85)
- Operating Temperature: 10 to 40 Deg C
- Gasoline Density Measurement (GDM) Sensor
- UUT Weighing Scale: Weighing Capacity 6.2 kg
- ATEX Proof Installation
- Online trend data information
- Online 1Hz data ASCII export
- Combined MS Excel report

Test Standards:

The system is compliant and can perform Automatic Test Sequence as per following standards:

1. INDIA - AIS 137 Part 1,2, 3 and AIS 175
2. UN ECE GTR-19 (WLTP EVAP)
3. ECE Regulation No. 83 Annex 7 (Type IV Test)
4. Europe Directive 70/220/EEC, 715/2007/EC, 692/2008/EC, 1151/2017/EC, 1154/2017/EC, 168/2013/EC
5. EPA CFR 40 Part 86.153-98
6. EPA CFR 40 Part 1066 (referring to EPA Part 86)
7. CARB CCR 13 Part 1976, LEV 1-3
8. CHINA GB 18352.5-2013, Beijing 6 (Draft)
9. JAPAN JASIC 11-3-49 Part 8

Applications:

- Canister aging / stabilization as per AIS, ECE, CARB regulations as above
- Canister working capacity evaluation
- Standard canister conditioning
- Puff-Loss Simulation
- Leak check procedure
- Combined-System for flexible use of Butane/N₂ or Fuel Vapor/N₂ mixture with Real fuel aging (300 Cycles) followed by 5 cycles of Butane/N₂ for BWC determination
- BWC validation

❑ Testing Facility for Automotive Camera Monitoring System

Automotive CMS Testing Facility is set up in Safety and Homologation Lab (SHL) at ARAI – Kothrud. It is equipped to perform full validation and performance testing of camera-based indirect vision systems in accordance with National and International standards (**AIS 001, ISO 16505 and ECE R46**). These standards define minimum safety and quality requirements for replacing traditional mirrors with electronic displays. AIS 001, ISO 16505 and ECE R46 provide comprehensive framework to assess **image quality, system latency, field of view, ergonomics, durability, and operational reliability**, all of which are systematically tested in this facility.



Fig 1: CMS System

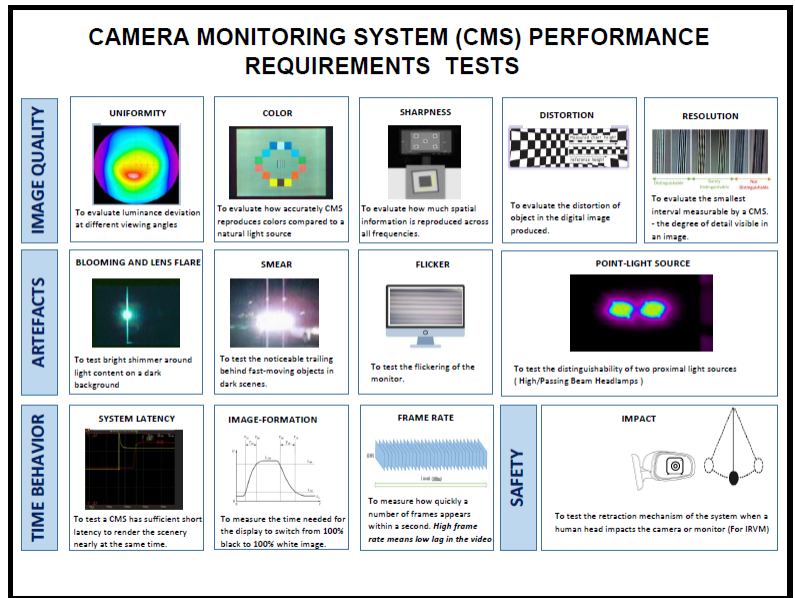


Fig 2: Performance Test Requirements for CMS

Core Capabilities:

- **Image Quality Evaluation**
 - Resolution, luminance, contrast ratio and sharpness assessments
 - Glare and blooming effects under high dynamic range conditions
 - Visibility testing under various ambient light levels (including night and tunnel simulations)
- **Field of View (FoV) & Coverage Testing**
 - Camera placement and viewing angle measurements to meet indirect vision coverage zones
 - Verification of compliance with minimum horizontal and vertical FoV requirements
- **Latency & Real-Time System Performance**
 - Measurement of end-to-end system delay (camera sensor to display output)
 - Ensures latency remains within AIS 001, ISO 16505 and ECE R46 limits to maintain driver safety and real-time awareness
- **Display Readability & HMI Ergonomics**
 - Testing under daylight and nighttime conditions for readability and visibility
 - Human factor studies for optimal positioning, driver distraction minimization, and image interpretability
 - Assessment of display flicker, ghosting, and visual comfort during long-term use
- **Environmental & Durability Testing**
 - Temperature cycling from -40°C to +85°C
 - Ingress protection (IP67/IP69K) for camera housing
 - Resistance to vibration, mechanical shock, and UV exposure in line with ISO 16750 and ISO 20653

- **Fail-Safe & Diagnostic Functionality**
 - Testing of fallback mechanisms in case of camera/display failure
 - System self-monitoring and diagnostic capability validation
- **Electrical & EMC Compatibility**
 - EMI/EMC testing to ensure interference-free operation in vehicle environments
 - Voltage variation, short circuit and power cycle durability testing

In alignment with **AIS 001, ISO 16505 and ECE R46**, CMS Test Facility ensures that automotive camera systems are not only compliant with international safety regulations but are also optimized for real-world performance and driver acceptance. This facility provides platform for the OEMs, Tier 1 suppliers and Indian CMS manufacturers for the development of their product by accelerated certification and market readiness with confidence including export market.



Inauguration of CMS Lab

Test Infrastructure:

- Programmable lighting tunnels (day/night, backlighting, and glare scenarios)
- Environmental chambers and vibration test rigs
- ISO-compliant image quality test charts and calibration tools Real-time latency

❑ First Ever Global Autonomous BAJA hosted by ARAI along with Innovation showcase event INTELLIMOBILITY

In its 17th edition, national-level engineering-student competition - BAJA SAEINDIA, transformed the competition landscape by introducing new avenues to address current challenges in the mobility industry at the academic level, leveraging applied engineering practices. The theme, "Multiverse of Mobility", highlighted the significant milestone this year, by introducing two new categories along the ever-popular mBAJA (IC Engine) and eBAJA (Electric) categories. aBAJA (Autonomous) and hBAJA (Hydrogen) categories symbolize a leap into the future of mobility, aligning with the Host Institute "ARAI's" dedication to provide engineering students with a global platform for learning, experimentation and growth. Embracing the developing technology and alternative fuels will nurture and equip the participants to tackle the challenges the mobility industry encounters.

Autonomous BAJA SAEINDIA (aBAJA SAEINDIA) 2024, held at ARAI, Pune, brought together five teams from leading engineering colleges across India for three days of rigorous competition. These teams demonstrated their ability to innovate and push the boundaries of autonomous technology, showcasing their talent in both dynamic and static events. Before the official start of the competition, pre-event readiness checks were conducted to ensure the preparedness of all the teams to face the challenges ahead. These included comprehensive technical inspections of electrical, mechanical and autonomous systems as well as trial runs on the dynamic event tracks, such the Object Detection, Classification, and Tracking (ODCT) and Remote Driving System (RDS). This phase provided teams the opportunity to fine-tune their vehicles and make necessary adjustments, ensuring their readiness to meet the high standards set by the competition.



Day 1 of aBAJA SAEINDIA 2024 roared to life on 4th October 2024 with an electrifying atmosphere as five autonomously operational vehicles were prepped and ready to navigate the tracks of ARAI, Kothrud in Pune. The excitement was palpable as 150 participants from 5 teams eagerly awaited the opportunity to showcase performance of their vehicles. The day featured a blend of technical insights and formal ceremonies, beginning with the Static Events, including Business Presentation and Design Evaluation. The Business Presentation provided students with an opportunity to experience entrepreneurship, exposing them to boardroom discussions and cultivating a business mindset. In the Design Evaluation, teams demonstrated their design thinking, engineering expertise and ability to develop both software and hardware architecture for their autonomous systems, showcasing the culmination of their hard work and dedication.



Day 2 showcased an impressive blend of innovation and engineering expertise as teams took part in dynamic events designed to push their autonomous vehicles to the limits of precision, reliability and technical sophistication. The day began with a safety briefing followed by rigorous evaluations, including the Safety Driver Takeover Brake Test, once again reaffirming that safety remains paramount in BAJA SAEINDIA. Teams then participated in dynamic events such as Object Detection, Classification and Tracking (ODCT) test, which assessed the perception capabilities of their vehicles using RADAR and camera inputs to detect regular traffic objects, along with the Throttle and Brakes Actuation tests, which evaluated efficiency of their longitudinal controller actuated through Throttle-By-Wire and Brake-By-Wire systems. In parallel with the dynamic events, the first round of the INTELLIMOBILITY Ideathon took place, where teams presented innovative solutions to real-world mobility challenges. These concepts were evaluated for their creativity, feasibility and potential impact, setting the stage for the final round on Day 3. This ideathon, along with the day's events, provided students with invaluable hands-on experience, bridging academic knowledge with practical application in advanced technologies.



Day 3 marked the culmination of Autonomous BAJA SAEINDIA 2024 with the much-anticipated Re-remote Driving System (RDS) event, which truly tested the precision, control and technical prowess of the participating teams. Replacing the traditional endurance race, the RDS event posed complex challenges as teams navigated their autonomous vehicles around the track, controlled remotely, for the specified duration. This event showcased not only the engineering excellence behind the vehicles but also emphasized the advancements made by each team in Drive-By-Wire technology, stepping towards autonomous technology.



The day concluded with the grand valedictory ceremony, celebrating the hard work, dedication and innovation exhibited by all the participants throughout the competition. The ceremony was graced by an esteemed line-up of dignitaries, their insightful addresses underscored the potential of the participants and highlighted the role of initiatives like aBAJA in driving future innovations in engineering and mobility.



❑ Seminar on Hydrogen – Emerging Technology Scenario for ICE Applications

ARAI conducted seminar on Hydrogen – Emerging Technology Scenario for ICE Applications on 26th November 2024 in Pune.

The global automotive sector's increasing demand for alternative fuels, rising fuel costs and emission reduction targets have driven development of H2ICE technology. Hydrogen is seen as a key decarbonizing solution for vehicles. To support this, ARAI's Alternate Fuel Centre organized seminar to provide platform for experts to share their insights and work in the field.

The seminar received valuable sponsorship support from several organizations, like M/s. Tata Motors, M/s. A B Process Technologies, M/s. BPCL, M/s. Phinia, M/s. Sciometric Technologies, M/s. Bosch, M/s. Schaeffler, M/s. IOCL, M/s. AVL, M/s. Advantek, M/s. Comsol, M/s. MNGL, M/s. Bender, M/s. Kistler, M/s. Horiba, M/s. MGL, M/s. Madhuchit, and M/s. Praj Industries. Additionally, ARAI - TechNovuus served as the outreach partner for the event. The seminar was attended by pan-Indian OEMs, OMCs and academic stalwarts, attracting overall footfall of over 250 delegates.

Dr Reji Mathai, Director ARAI covered following important points in his Welcome Address:

- Transportation sector, responsible for about 30% of environmental pollution, urgently needs to shift to clean energy solutions derived from renewable sources.
- India is promoting clean energy through programs supporting biofuels, natural gas and hydrogen.
- Hydrogen is the cleanest fuel discovered as it does not contain any carbon and hence is environmentally friendly.

- Government of India launched National Green Hydrogen Mission in January 2022. The mission seeks to make India a green Hydrogen Energy Hub. The mission outcomes projected by 2030 are:
 - Development of green hydrogen production capacity of at least 5 MMT (Million Metric Ton) per annum with an associated renewable energy capacity addition of 125 GW.
 - Total investment will be to the tune of ₹ 8 lakh crore.
 - Creation of over 19 lakh jobs.
 - Cumulative reduction in fossil fuel imports of over ₹ 1 lakh crore.
 - Abatement of nearly 50 MMT of annual greenhouse gas emissions.
- As a part of National Hydrogen Mission, funds have been allocated for -
 - Development of fueling Infrastructure in dedicated corridors.
 - Pilot trials of vehicles in the corridors and,
 - R&D Projects for development of Hydrogen vehicles.

Dr. S S Thipse, Sr. Deputy Director and Convenor of Hydrogen seminar made detailed presentation on regulatory framework for use of H₂ICE vehicles.

- He briefed about the standards and regulations of H₂ICE.
- While explaining the need for alternative fuels, he talked about the vision for Aatmanirbhar Bharat, Greenhouse gas mitigation and how use of alternate fuels can boost the Indian economy.
- He touched upon various types of H₂, including Green, Grey, Blue and Turquoise.
- He elaborated H₂ program roadmap for India.
- He also briefed on various aspects of National Green H₂ Mission. He also elaborated on the role of ARAI in H₂ program and how ARAI represents in various forums/committees and represent India.
- He also indicated that ARAI is coming up with H₂ testing facility at ARAI-HTC Chakan.

Dr. Thipse emphasized that the ARAI-organized event provides a vital platform for discussing H₂ICE technology and its potential to reduce urban pollution. The seminar explored the green hydrogen ecosystem, including storage, mobility and infrastructure, with insights from leading countries. It also highlighted the importance of skill development and employment opportunities to support India's green hydrogen transition.

During the technical sessions Shri Saravanaraja T, Senior GM at Tata Motors, emphasized India's energy independence goals by 2047 and Net Zero emissions by 2070, with Tata aiming for Net Zero by 2040 for passenger vehicles and 2045 for commercial vehicles, exploring H₂ICE to enhance performance and reduce costs. Shri Rajesh M Badhe of Indian Oil R&D shared insights on the hydrogen value chain, while Dr. Jean-Luc Beduneau of Phinia Delphi highlighted that their H₂ICE system is nearing serial production, demonstrating performance comparable to diesel with ongoing real-world validation. Dr. Shabana Shaikh from Advantek addressed fuel system components and integrated design considerations for H₂ICE applications. Shri K U Ravindra of Bosch highlighted hydrogen engines as sustainable and cost-effective powertrains, emphasizing the importance of infrastructure development and advanced fuel system technologies for emission compliance.

Shri Atul Tare from Praj Industries provided an overview of bio-hydrogen production for bio-mobility and Shri Sameer Badve of A B Process Technologies stressed the importance of safety protocols, emergency responses and training for hydrogen infrastructure. Dr. Deepak Kasturi of Schaeffler discussed technological innovations like Variable Valve Train and H₂ injectors that enhance engine efficiency and reduce emissions.

Finally, Shri Naresh Phansalkar of Tenneco introduced ATS-One-Box, an integrated solution combining hydrogen oxidation catalysts and urea dosing to streamline hydrogen engine systems, all underscoring a collective push towards cleaner, efficient, and safe hydrogen-powered mobility solutions.

Highlights of the Seminar

Automotive sector is witnessing burgeoning interest in H₂ICE technology driven by escalating conventional fuel costs and stringent regulatory mandates for emissions reduction.

- Insights into the technological landscape of H₂ICE applications in automotive engineering.
- Perspectives on the hydrogen value chain, emphasizing supply chain dynamics and integration.
- Exploration of advancements and challenges in H₂ICE technology, focusing on R&D initiatives.
- Examination of hydrogen infrastructure, handling protocols and safety standards.
- Discussion on fuel system components and calibration methodologies for hydrogen engine optimization.
- Overview of hydrogen storage solutions, including tank types, pressure management and safety compliance.
- Design considerations for after-treatment systems in H₂ICE to meet emission standards.
- Comprehensive analysis of bio-hydrogen production processes and their implications for bio-mobility.

Glimpses of Hydrogen Seminar



Dr. Reji Mathai, Director- ARAI, Felicitating the Chief Guest, Shri C V Raman of M/s. Maruti Suzuki India Ltd.



Group Photograph with the Chief Guest and eminent Speakers

❑ Implementation of Official Language Policy in ARAI

Official Language (OL) Policy of Government of India

As per Article 343 of Constitution of India, Hindi in Devanagari script is the official language of the Union, supported by the Official Languages Act, 1963. English is also permitted for official purposes and both are used in complementary manner.

In ARAI, implementation of Official Language Policy is guided by the directives of Department of Official Language (Ministry of Home Affairs) and Ministry of Heavy Industries.

Implementation of OL in ARAI:

In compliance of the Orders/ Rules, Official Language Policy is implemented in ARAI through:

- **Official Language Implementation Committee (OLIC):** As per the directives of Department of Official Language, an Official Language Implementation Committee (OLIC) has been constituted under the chairmanship of Director-ARAI. This committee regularly reviews the progress made in use of Hindi in ARAI on quarterly basis. It gives appropriate suggestions and recommends measures to be taken for effective implementation of official language policy. Its report is submitted to Department of Official Language (Ministry of Home Affairs) and Ministry of Heavy Industries.



- **Bilingual Documentation:** Technical manuals, tender documents, safety instructions and internal communications are increasingly issued in both Hindi and English.
- **Hindi Workshops:** Regular Hindi language workshops are organized to train engineers, supervisors and administrative staff in Hindi.



Industry-Specific Applications

- Instructions, SOPs and safety signage are displayed in trilingual (Marathi, Hindi, English) to ensure clarity for the workforce.
- Technical Communication: While English is often used for highly technical communication, Hindi is promoted for routine administrative work and internal documentation.
- Customer Interaction (for Govt. vehicle units): Bilingual communication helps serve diverse customers across India, especially in rural or semi-urban areas.

Compliance, Monitoring & Encouragement

- Parliamentary Committee on Official Language conducts inspections to assess implementation of Rajbhasha usage in official work.
- Incentives are provided to employees who perform official work in Hindi.

❑ ARAI Journal of Mobility Technology (Volume 5, Issue 2, April-June 2025)



ARAI Journal of Mobility Technology, a technical journal, focuses on automotive and related topics. It is available online and in print version. The journal was started to help professionals, researchers and students share their original research in the field of mobility technology. One of its goals is to provide platform for publishing articles on variety of automotive and allied subjects. Papers published in this journal are well-promoted and respected in the automotive and research communities.

The journal welcomes contributions from researchers all over the world and is aimed at scholars, academics and professionals in the automotive industry.

Second edition of the journal for year 2025 (**Volume 5, Issue 2, April-June 2025**) has been released online. If you need any full-text papers, feel free to contact ARAI. For more details, please visit the website: <https://araijournal.com/index.php/arai>

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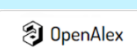
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