



New Facility Development

- Facility for Evaluation of Diesel Exhaust Fluid (DEF) established at ARAI
- ARAI Academy Simulation Laboratory
- ARAI Academy – Noise & Vibration Lab (FID Chakan)

New Capabilities

- Centre of Excellence in “Automotive Emerging Areas”
- Testing for Airbag Sensor Calibration
- Automotive Cable Testing as per National/International Standards

Services

- ARAI Academy – Training Centre
- ARAI Knowledge Centre

Facility for Evaluation of Diesel Exhaust Fluid (DEF) established at ARAI

ARAI’s Environment Research Laboratory (ERL) has established new facility for evaluation of Diesel Exhaust Fluid (DEF) as per ISO 22241/IS 17042. The laboratory houses state-of-the-art infrastructure, equipment and resources to deliver high quality DEF testing services. This expanded suite of testing services will assist automotive sector in meeting various national and international requirements.




	<p>UV-Visible Spectrophotometer</p> <ul style="list-style-type: none"> ▪ Detector type: Photo Multiplier Tube ▪ Wavelength Range: 190 – 900 nm ▪ Spectral Bandwidth: 0.5 to 2.0 nm
	<p>Refractometer</p> <ul style="list-style-type: none"> ▪ Refractive Index (nD) range: 1.33000 – 1.70000
	<p>FTIR</p> <ul style="list-style-type: none"> ▪ Detector: DTGS detector with KBr Beam Splitter ▪ Instrument Range: 350 – 7800 cm⁻¹ ▪ Resolution: 0.5 cm⁻¹

Fig. 1: Laboratory infrastructure established at ERL for new DEF testing facility

DEF is an aqueous Urea solution of 32.5% high purity Urea (Compound of Nitrogen that is converted to Ammonia when heated) and 67.5% deionized water. DEF is used in many modern diesel engine applications, which use Selective Catalytic Reduction (SCR) technology to convert NOx into harmless gases emitted by exhaust system (Fig. 2). Contaminants or impurities in DEF can cause break down of SCR system. Thus, it is important to maintain DEF quality standards.

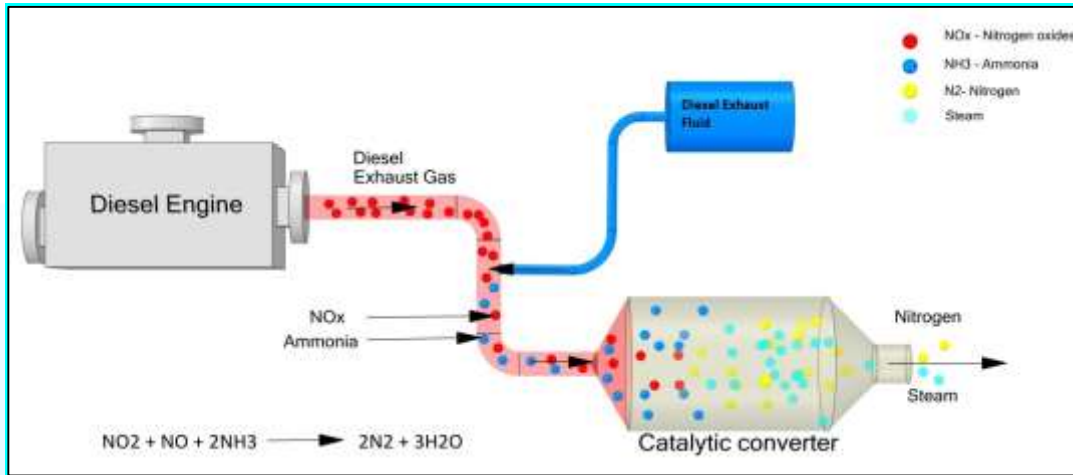


Fig. 2: Schematic representation of working of Selective Catalytic Converter (SCR)

Fig. 3 provides an overview of laboratory facilities and tests conducted on DEF as per ISO 22241 and IS 17042 standards.

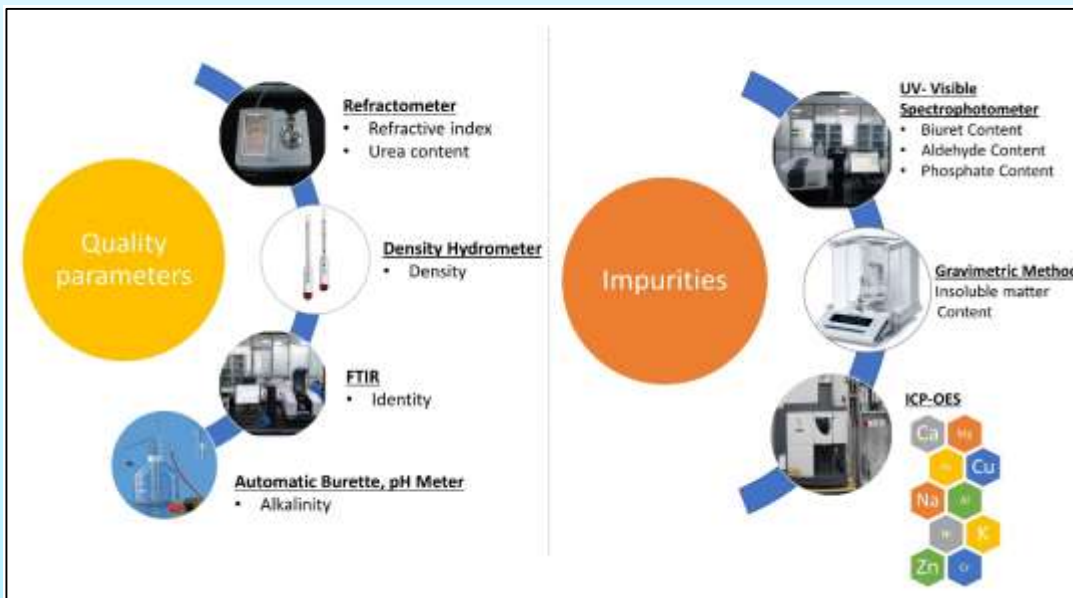


Fig. 3: Overview of laboratory facilities and tests conducted on DEF as per ISO 22241 and IS 17042 standards

Testing of DEF ensures its quality and gives consumers choice of quality brands to choose from. This new facility can offer clients with one stop solution for DEF testing.

□ **ARAI Academy Simulation Laboratory**

Simulation Laboratory of ARAI Academy at Chakan is equipped with softwares, like BOOST, FIRE, CRUISE, EXCITE from AVL, GT_SUITE from Gamma Technologies and WAVE and IGNITE from Ricardo for education and training. This laboratory is meant for teaching students / faculty / training delegates about the software packages and their applications and also for their academic research projects.

□ ARAI Academy – Noise & Vibration Lab (FID Chakan)

ARAI, in collaboration with various universities like VIT (Vellore), VELTECH (Chennai), College of Engineering (Pune) and Christ University (Bengaluru), has embarked upon building human resource by commencing Graduate, Post Graduate and PHD programs related to Automotive Engineering.

ARAI Academy, a skill development initiative of ARAI-Pune, is shifted to its dedicated campus at ARAI-FID, Chakan, Pune. ARAI Academy is building up various labs, specifically for education, training and research purposes. The labs to be established are Engine and Simulation Lab, CAED Lab, Automotive Engineering Systems Lab, Automotive Electronics Lab, EMI and EMC Lab, HIL Lab and Noise & Vibration Lab.

Out of these labs, one of the important labs is Noise and Vibration Lab. Noise & Vibration Lab was inaugurated on 25th June 2019 at the hands of Mr. Paul Mascarenas, President - SAE International, USA, in the presence of Prof. Dr. M. L. Munjal, Indian Institute of Science, Bangalore. Noise & Vibration Lab has latest facilities such as Acoustic Enclosure, Impedance Tube, NVH Instruments & sensors and DC power supply.

Some of the snaps of the event and facilities in Noise & Vibration Lab are:



Inauguration of N&V Lab



Inauguration



Experimental Modal Analysis



Impedance Tube (100 mm and 30 mm)



Demonstration by students to Prof. Dr. M. L. Munjal



Acoustic Enclosure

Details of Noise and vibration facilities:

i) Acoustic Enclosure

Acoustic Enclosure for testing offers precision-grade free-field environment used to measure sound source frequency response, sound pressure level and noise emissions from radiating sound sources. The enclosure provides engineered features that achieve results without compromising acoustical concepts. The acoustic enclosure has high performance wall panel system that provides low-noise environment required to test low-noise products. Size of acoustic enclosure is 5m length X 5m width X 3m height and having Acoustic Door of 1.2m width X 2.1m height. Vision glass in door 400 mm width X 700 mm Height. Minimum Noise level achieved is 30 dB(A).

ii) Impedance Tube

BSWA SW series Impedance Tubes can accurately measure sound absorption coefficients and impedance according to ISO or ASTM standards. They also support sound transmission loss measurements based on Transfer Function Method using four microphones. This can be useful in material testing and acoustic absorption measurements and Acoustic transmission loss measurements.

- VA-Lab IMP supports two methods to measure absorption coefficients of material
- Method using Standing Wave Ratio (ISO10534-1)
- Transfer Function Method (ISO10534-2, ASTM E1050 and ASTM E2611)
- SW series impedance tubes use transfer function method for absorption and transmission loss testing
- Standing Wave Ratio Impedance tube method is a classic method for measuring acoustic characteristics of materials.

iii) Experimental Modal Analysis

With this experimental set up, natural frequencies can be found and characterization of vibration mode shapes of structures and mechanical systems can be done. Knowing the system, natural frequencies and mode shapes is the key to avoid Resonance.

iv) Noise & Vibration Measuring Instruments

Noise & Vibration Lab is equipped with latest measuring instruments such as uniaxial accelerometers, tri-axial accelerometers, sound pressure level meter, pressure field microphone, calibrator for microphone, vibration shaker, modal test impact hammers, tachometer, etc.



ARAI and ANSYS have signed an MOU and set up Centre of Excellence (CoE) in ARAI, Kothrud, Pune. This new Centre of Excellence set up by ARAI and ANSYS will focus on developing solutions around emerging automotive area. The MoU was signed by Mr. Rafid Somani, Area Vice President - India and South Asia Pacific, ANSYS and Mrs. Rashmi Hemant Urdhwareshe Director, ARAI.

The Centre of Excellence will support development of innovations in emerging automotive area such as

1. Electric and Hybrid Vehicles
2. Energy Storage System
3. Advanced Driver Assistance System (ADAS)
4. Autonomous Vehicle

The CoE will work on common interest of both the parties in non-commercial manner. R&D activities those will be carried out from this Centre are expected to benefit the entire automotive industry at large.

This facility will focus on innovation of mobility and safety systems, with relevance for intelligent vehicles and their future initiate localization of development and manufacturing.

□ Testing for Airbag Sensor Calibration

Airbags are the standard feature in most of the new vehicles. Large number of vehicles already have different airbags: front airbags, side airbags, head airbags and knee airbags for driver and front-seat passenger.

Development of vehicle safety performance is now being perceived as one of the most important parameter in the development process of any new car. Main objective of passive vehicle safety performance development is:

- Protect occupants from injuries in case of accident.
- Protection is mainly achieved by design of vehicle structure and restraint systems (airbags and safety belts)
- How “good” restraint system works depends on design of airbags and belts and on the sensing system, which is responsible for deploying restraint systems.

Vehicle safety performance development includes following aspects:

- fulfillment of legal safety requirements for type approval
- good insurance rating
- good consumer rating

Legal (Safety) Requirements in India

Type approval of a new car is based on notified IS/AIS regulations, which cover vehicle safety, environmental protection, energy efficiency and theft-resistance. This includes following regulations regarding vehicle crashworthiness:

IS 14225 : door latches and door retention components

IS 15139 : safety belt anchorages

IS 15140 : safety belts and restraint systems

IS 15546 : seats, seat anchorages, head restraints

IS 14812, AIS093 : front and rear protective devices (bumpers, etc.)

AIS096 : Intrusion of steering column

AIS098 : protection of occupants in the event of a frontal collision

AIS099 : protection of occupants in the event of a lateral collision


AIS100 : Pedestrian Protection

Typically, regulatory requirements vary from country to country and OEMs must keep tab on the same in order to meet minimum mandatory requirements. Different country-wide regulatory requirements are as given below:

(Source: <https://www.safetywissen.com/news/SAFETYNEWS/>)

Gesetze zum Insassenschutz			carhs									
USA	FMVSS 208	FMVSS 208	FMVSS 208	FMVSS 208	FMVSS 208	FMVSS 208	FMVSS 208	FMVSS 208	FMVSS 208	FMVSS 208	FMVSS 208	FMVSS 208
Europa	UN R28	UN R28	UN R28	UN R28	UN R28	UN R28	UN R28	UN R28	UN R28	UN R28	UN R28	UN R28
Japan	APL 11.024/11.024.20	APL 11.024/11.024.20	APL 11.024/11.024.20	APL 11.024/11.024.20	APL 11.024/11.024.20	APL 11.024/11.024.20	APL 11.024/11.024.20	APL 11.024/11.024.20	APL 11.024/11.024.20	APL 11.024/11.024.20	APL 11.024/11.024.20	APL 11.024/11.024.20
China	GB 11551-2004	GB 11551-2004	GB 11551-2004	GB 11551-2004	GB 11551-2004	GB 11551-2004	GB 11551-2004	GB 11551-2004	GB 11551-2004	GB 11551-2004	GB 11551-2004	GB 11551-2004
India												
Südkorea	KMMS 100	KMMS 100	KMMS 100	KMMS 100	KMMS 100	KMMS 100	KMMS 100	KMMS 100	KMMS 100	KMMS 100	KMMS 100	KMMS 100
Australien	ADR 69/00	ADR 69/00	ADR 69/00	ADR 69/00	ADR 69/00	ADR 69/00	ADR 69/00	ADR 69/00	ADR 69/00	ADR 69/00	ADR 69/00	ADR 69/00

Reifere Seite	Pfeil Seite	Folgenschutz	Heckaufprall	Kopfaufprall	Rollover
FMVSS 214	FMVSS 214		FMVSS 202a FMVSS 201	FMVSS 201	Teil 201 FMVSS 208 Eichentwurf FMVSS 215a Eichentwurf FMVSS 216
UN R65	UN R65	R 65/01 A 65/01 UN R65	UN R62	UN R61	
APL 11.024/11.024.20		Article 88 Attachment 99	Article 18 Attachment 34		
GB 20301-2006		GB/T 24550-2009	GB 20303-2006	GB 11552-2009	Eichentwurf GB 26134-2010
AS 1004P		AS 100	AS 101		
KMMS 100			KMMS 100-2		
ADR 69/00	ADR 69/00				

Alle Details in:

 Free Download @ carhs.com/app
 carhs

Source: [2]

Fig. 1 : Examples of Front and Side Impact regulations in use

Airbag Systems in Modern Day Vehicles

Following image shows different types of airbag systems that are integrated these days into the vehicle. Airbags are designed and integrated to protect the occupants from frontal impacts, side impacts and rollover protection and in recent times also to protect from far side impacts. These days, airbags are also offered to protect second row occupants.

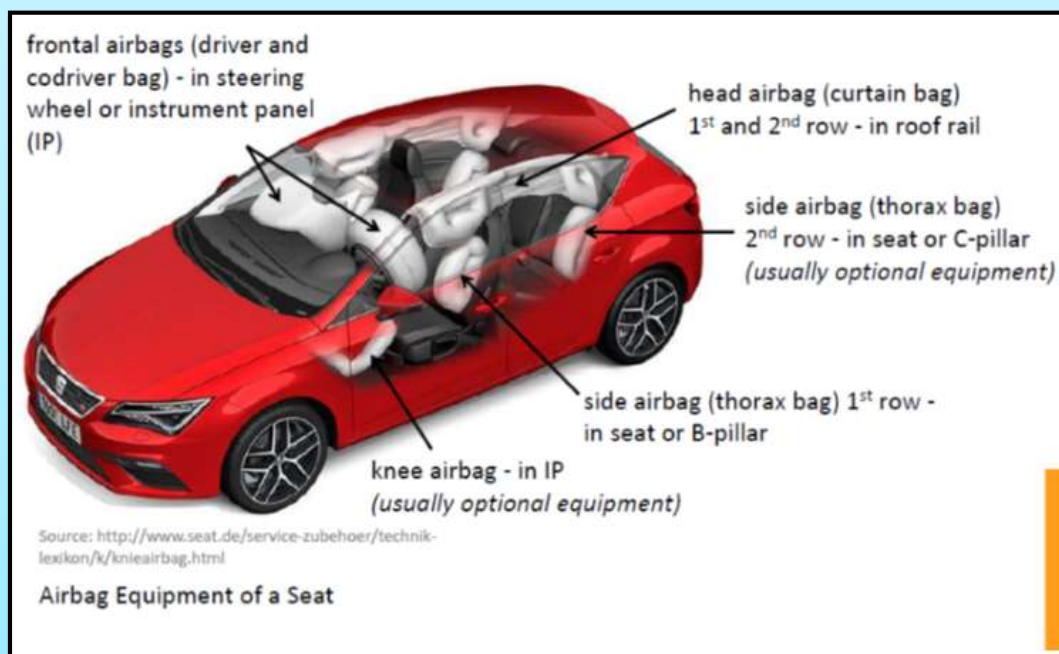
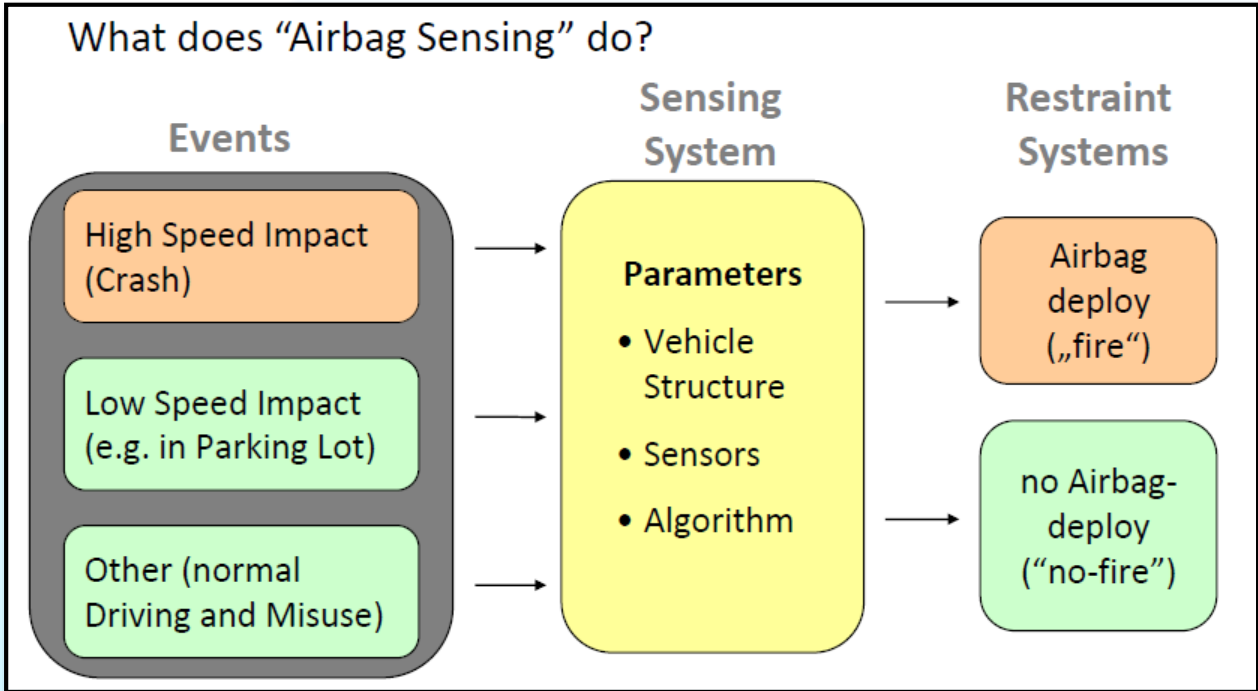


Fig. 2 : Airbag Systems and Components

Airbag Sensing

Airbag system uses number of acceleration sensors located at different positions on vehicle bodywork. Deceleration occurring after the impact is detected by these systems, evaluated and if necessary decision taken to trigger individual airbag. The self-diagnosis system monitors operativeness of the system before and during the journey.

Crash sensing system consists of electronic crash sensors that detect crash and airbag module (control unit) that decides if and when restraint systems have to be deployed to protect the occupant/s from injury.



Fig, 3 : Airbag Sensing Algorithm



Fig. 4 : Crash Sensing System components

Electronic Front Sensor (EFS) and Side Impact Sensor (SIS) are strategically placed on vehicle structure to provide necessary inputs to Airbag Module, which ultimately takes the decision. Following figure typically shows “maximum configuration” concept. OEMs again decide number and position of these sensors according to vehicle design, regulatory requirements and many other factors such as costing.

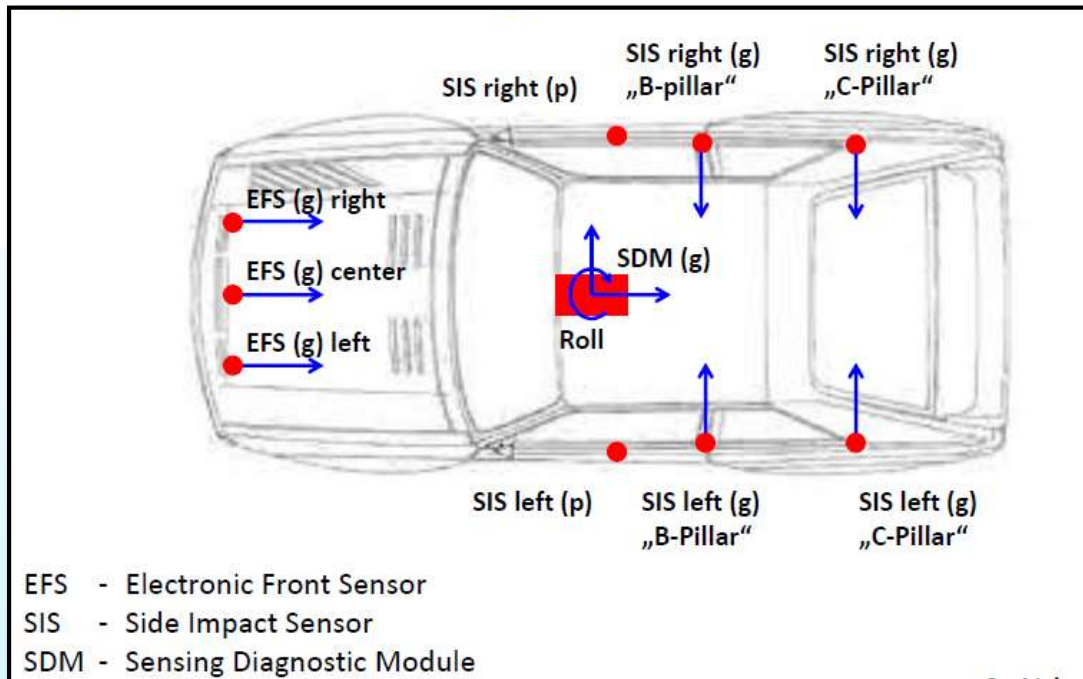


Fig. 5 : Possible Crash Sensor configuration in the vehicle

How is a deploy decision being made?

Below flowchart shows typical decision-making process followed by airbag SDM while taking fire/no-fire decision

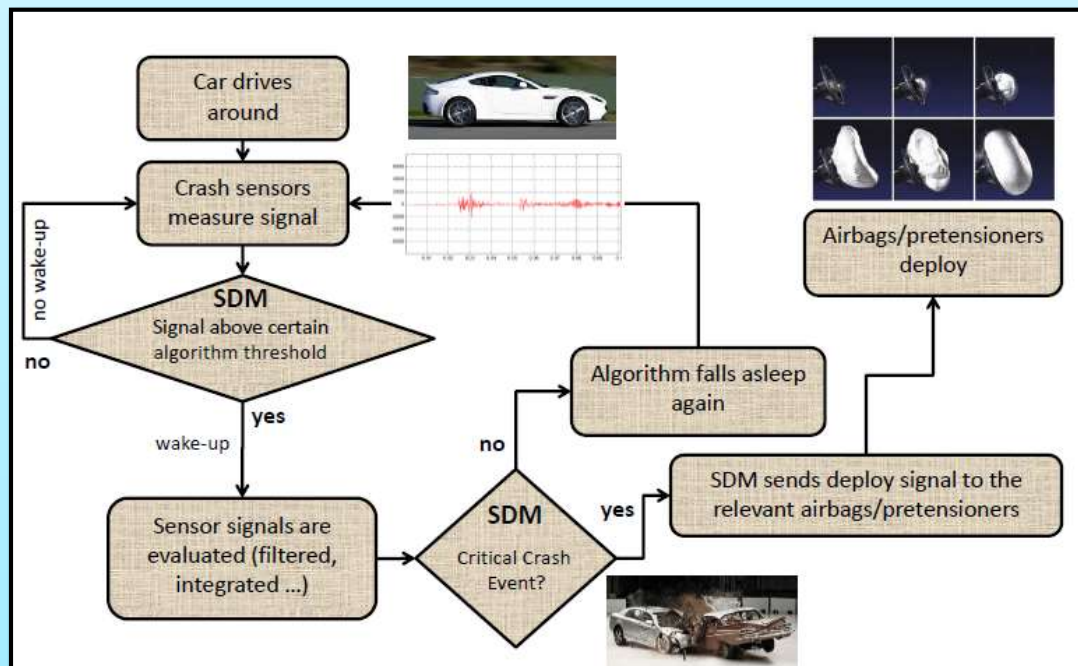


Fig. 6 : Flowchart for Airbag Deployment

For arriving at a decision of critical crash event, laboratory test data is collected by subjecting the car / prototype to various crash test configurations. These crash configurations typically involve

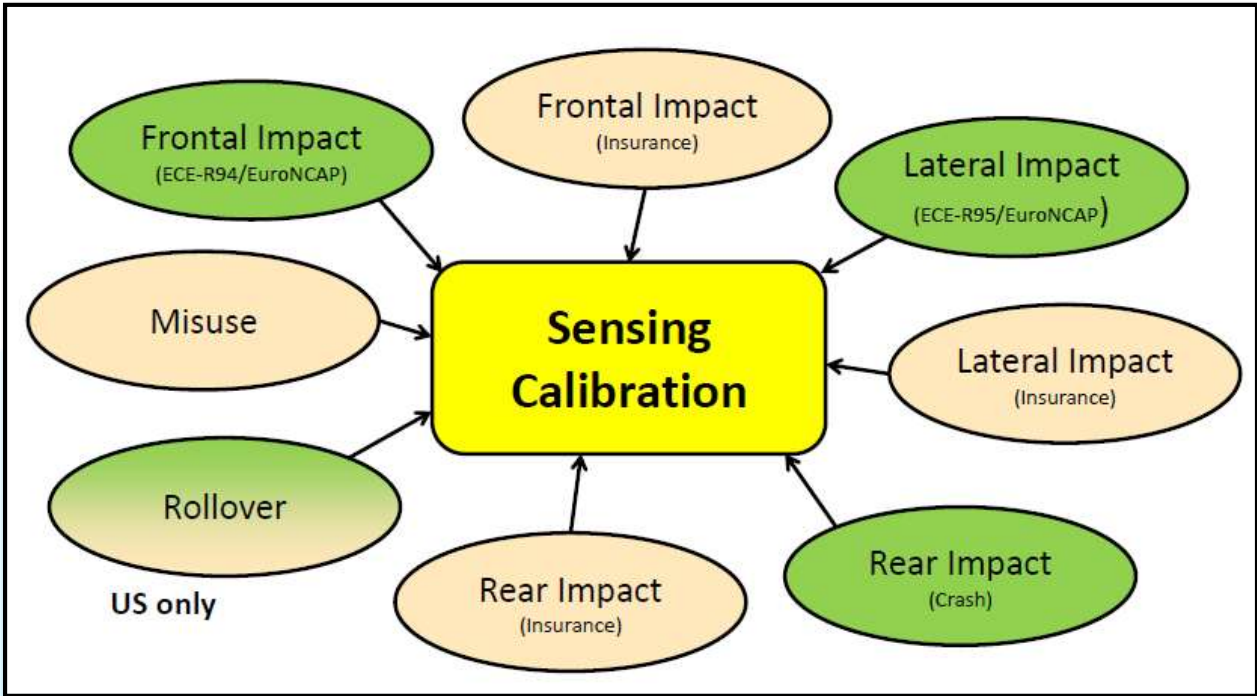


Fig. 7 : Crash Test Configurations employed for Airbag sensor calibration

Again, within each type of crash test, multiple load cases are identified to decide upon time to fire. For example, in case of medium frontal crash and high speed frontal crash, deployment times for airbags could be different depending upon the severity.

11 km/h	Frontal impact R-CAR EU over-/underride		low speed → no deploy
12 km/h	Frontal impact 0° 100%		
16 km/h	Frontal impact Danner 0° 40%		
16 km/h	Frontal impact 0° 100%		mid speed → deploy
26 km/h	Frontal impact 0° 100%		
32 km/h	Frontal impact Underride 0° 100%		
32 km/h	Frontal impact Pole center		high speed → fast deploy
40 km/h	Frontal impact 30° 100%		
40 km/h	Frontal impact ODB 0° 40%		
56 km/h	Frontal impact ODB 0° 40%		
56 km/h	Frontal impact 0° 100%		
65 km/h	Frontal impact ODB 0° 40%		

Fig.8 : Different load cases for identifying airbag deployment strategies in case of frontal impact

Role of ARAI's New Crash Test Facility

Since notification and implementation of crash standards in India, OEMs in India have modified design of passenger vehicles to include mandatory airbags for protection of occupants. Currently, Indian Standards require mandatory fitment of driver airbag. In addition, OEMs are increasingly introducing vehicle models with multiple airbags.

ARAI's new crash test facility has been aligned to cater to the need of Indian Auto Industry and is facilitating virtually all the tests required for development of airbag algorithm. In addition to basic test capabilities such as offset frontal and full frontal tests, ARAI has developed in-house different types of barriers to allow customers to perform different types of crash tests such as frontal RCAR barrier test, Frontal and Side Pole Impact tests, Full underride or offset underride tests, angled barrier tests, etc.

Following images display some of the OEM specific tests conducted on these in-house developed barriers.



Fig. 9 : Various test configurations for development and modifications of frontal and side airbag algorithm

In addition to above configurations, considering the need of global customers, ARAI has already undertaken Development of FMVSS side impact barriers, rear impact barriers and rear RCAR barriers for offering full spectrum of airbag sensor calibration tests.

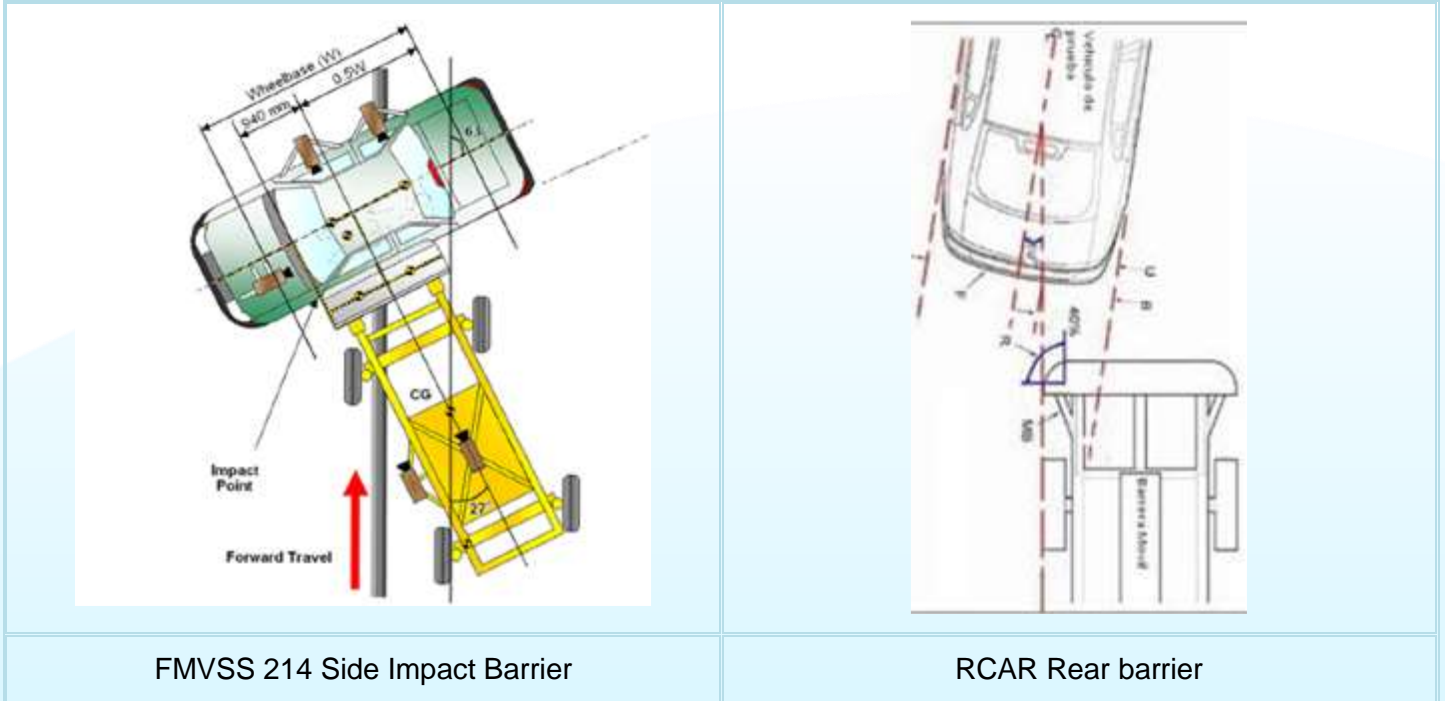


Fig. 10: Development of new barriers for airbag sensor calibration tests

Such new facility strongly demonstrates ARAI's capabilities and willingness to support customers for indigenous development of safer vehicles.

ARAI has stood consistent with the OEMs' exponential demand for availability of test facility providing complete package of different tests supporting validation of systems developed for passive safety, along with vehicle certification. With this continual support from customers and for customers, ARAI's Passive Safety Laboratory successfully completed its 400th crash test last month.



Fig. 11: PSL Team after 400th Crash Test at ARAI-HTC, Chakan

□ Automotive Cable Testing as per National/International Standards

Environment Research Laboratory (ERL) of ARAI has rich experience of testing more than thousand cables, variety of insulation materials for OEMs as well as various component and cable manufacturers. ERL regularly provides services of Automotive Cable Testing to cater to the requirements of OEMs and cable manufacturers.

Electric mobility is expanding at rapid pace worldwide and considering safety aspects, it is essential to thoroughly test every cable before installation or depending on the circumstances before the cable routes are covered. Any situation may become critical due to failure of cable and, therefore, various national and international standards are in force to govern the quality of cables.

Cable testing standards

Cable testing standards for vehicles have evolved significantly over the period. Fig. 1 shows evolution of cable testing standards over the years, while Fig. 2 presents list of Automotive Industry Standards (AIS) for certification of automotive cables. As compared to IC engine vehicles, electronics complexity is higher in Electric Vehicles (EVs). In view of EV for higher voltage cable application, cables need to be validated as per ISO 19642, specifically designed for high voltage wires and cables. The components tested include Wires, WH Assemblies, Splices and Corrugated Conduits.

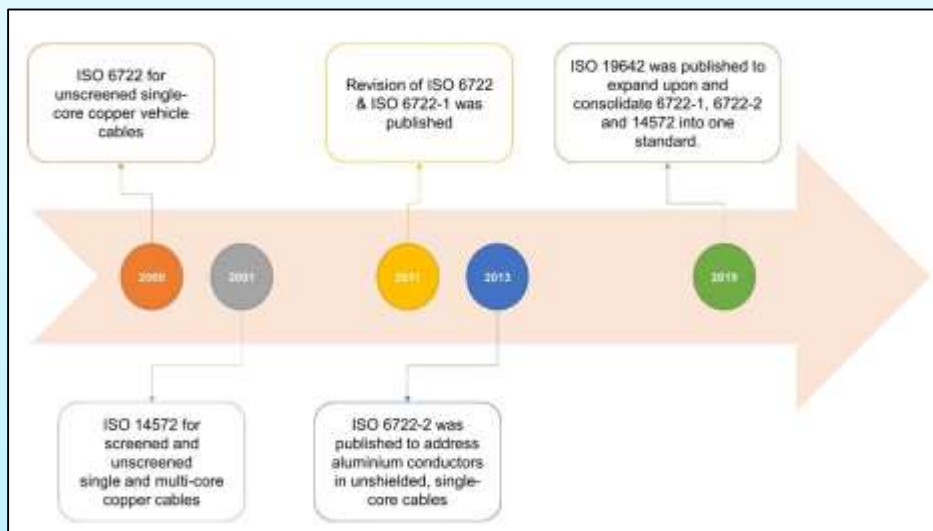


Fig. 1: Evolution of Cable Testing Standards

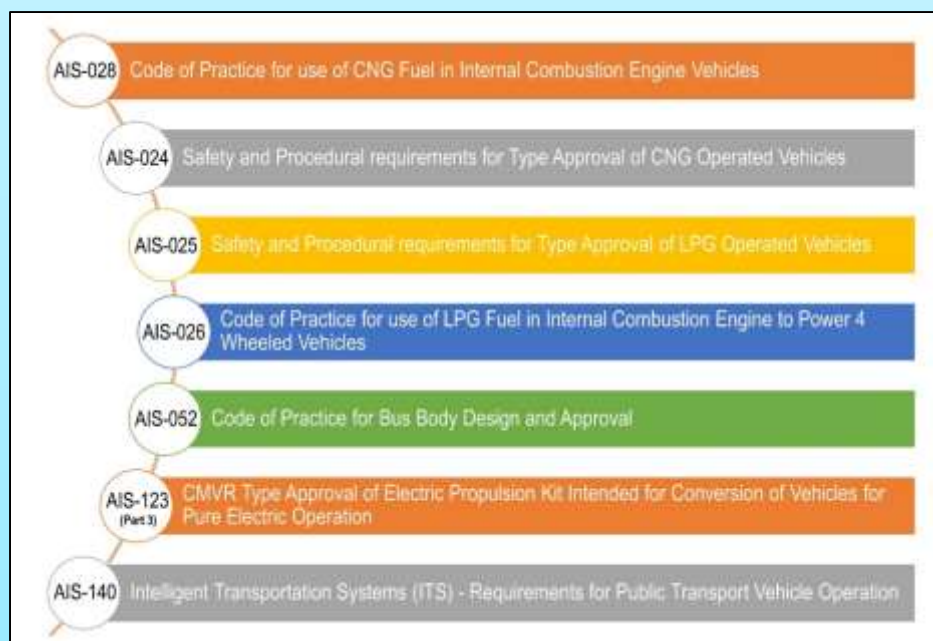


Fig. 2: Certification requirements for Automotive Cables

Safety Critical Tests

Resistance to flame propagation is important in test standards. Compliance with fire safety tests will ensure that cables will limit flame propagation in case of fire, thereby increasing level of safety in day-to-day life. To assess trouble-free cable operation under harsh chemical and environmental conditions, thereby reducing costly manufacturing downtime and minimizing periodic maintenance or cable replacement, electrical wire and cables must also comply with the following requirements:

- Long-term, short term ageing and Thermal overload of insulation
- Shrinkage test
- High voltage withstand
- Cold temperature resistance to ensure proper operation under cold environments
- Fluid Compatibility-Resistance to liquid chemicals
- Temperature and humidity cycling
- Resistance to ozone
- Resistance to hot water

ERL houses state-of-the-art infrastructure, equipment and resources to deliver high quality cable testing services.



Fig. 3: Glimpses of Cable Testing at ARAI

ERL is geared up for testing of cables as per national and international standards.

ARAI, over five decades, has provided design and development expertise to the Indian automotive industry, focusing on testing and evaluation of components and systems to meet national and international standards. ARAI strives to achieve international recognition in these areas. In keeping with the globalization of economy and business, ARAI continues to enlarge its scope of services to meet the requirements of automotive industry world-over.

In addition to utilizing state-of-the-art technology, laboratories and highly-trained personnel, ARAI recognizes the need to develop new generation of engineers to meet the demands of the automotive industry, not just in India but world-over. ARAI Academy, which has completed 15 years on 10 May 2019, is a Skill Development initiative of ARAI. It is classified into three divisions, viz Learning Centre, Training Centre and Knowledge Centre. Learning Centre has embarked upon building up human resources by commencing educational programmes (Graduate, Post Graduate and Ph.D.), with specialization in Automotive Engineering. It has tied up with VIT (Vellore), VELTECH (Chennai), College of Engineering (Pune), Christ University (Bengaluru).

Training Centre has devised various Proficiency Improvement Programmes (PIPs). It gives engineers, faculty and students knowledge and technical expertise in wide range of automotive disciplines. It helps in understanding system view point for automotive design and manufacture, with specific skills in formulating automotive engineering solution in terms of their function and performance, through optional modules. Domain Training Programmes (DTPs), where training is imparted at Customer's site are also becoming more popular. Academy is developing high quality e-learning modules, called "ePIPs", on various Automobile Engineering subjects. These highly interactive e-Modules hosted on ARAI's own Learning Management System (LMS) <https://elearning.araiindia.com/> help users access these courses anytime and anywhere. With this, ARAI Academy has become global with 360 blended training approach.

PROFICIENCY IMPROVEMENT PROGRAMMES (PIPs)

TITLE OF THE COURSE	DATE	DURATION IN DAYS	VENUE	PROPOSED PARTNER/S
Electric Vehicle: Development, Validation & Certification	4 - 6 Dec 19	03	ARAI FID	
IC Engine	9 - 11 Dec 19	03	AEC, Surampalem	Aditya Engg. College (AEC)
Failure Analysis (including Auto & Engine components)	11 - 13 Dec 19	03	ARAI FID	ASM, Pune
Fluid Connections for Automotive (inclusive of Electric Vehicles)	16 - 17 Dec 19	02	ARAI FID	ARaymond
Automotive Sensors & Actuators	19 - 20 Dec 19	02	ARAI FID	
Tool Engineering	09 - 10 Jan 20	02	ARAI FID	ASM, Pune
HIL for Automotive Applications	23 - 24 Jan 20	02	ARAI FID	
CAE for Automotive Application	13 - 14 Feb 20	02	Vel Tech	Vel Tech Chennai & Altair
Rapid Prototyping for Automotive Electronics Application	18 Feb 20	01	ARAI FID	
Continuous Quality Improvement (CQI 9) for Heat Treatment	28 Feb 20	01	ARAI FID	ASM, Pune
Automotive Engineering	16 - 19 Jun 20	04	ARAI FID	
Powertrain Engineering	29 Jun - 2 Jul 20	04	ARAI FID	

PROFICIENCY IMPROVEMENT PROGRAMMES (PIPs) TO BE PLANNED

TITLE OF THE COURSE	DATE	DURATION IN DAYS	VENUE	PROPOSED PARTNER/S
Foundry Technology	To be decided	03	ARAI FID	ASM, Pune
Battery, BMS & Charging Infrastructure	To be decided	02	ARAI FID	
Automotive NVH	To be decided	03	ARAI FID	
E-mobility & FAME II requirements	To be decided	02	ARAI Kothrud	
Engine Testing & Certification	To be decided	03	ARAI FID	
Basic & Advances in Heat Treatment	To be decided	03	ARAI FID	ASM, Pune
Hybrid Electric Vehicle (HEV)	To be decided	03	ARAI FID	
Engine Design & Development	To be decided	04	ARAI FID	
Engine Emission & Control	To be decided	03	ARAI FID	
DPF & SCR for BS VI	To be decided	02	ARAI FID	
Alternate Energy (Including CNG, Methanol)	To be decided	02	ARAI FID	
Embedded Systems	To be decided	02	ARAI FID	
Engine Electronics & Management Systems (bPIP)	To be decided	03	ARAI FID	
Vehicle EMC	To be decided	02	ARAI FID	
On Board Diagnostics (OBD)	To be decided	01	ARAI FID	
Forging Technology	To be decided	03	ARAI FID	
Reliability Engineering (bPIP)	To be decided	02	ARAI FID	
Geometrical Dimensioning & Tolerancing (GD&T)	To be decided	02	ARAI FID	
Automotive Materials & Characterization	To be decided	03	ARAI FID	
ECU & Diagnostics	To be decided	02	ARAI FID	
Failure Mode & Effect Analysis (FMEA)	To be decided	01	ARAI FID	
Automotive Manufacturing	To be decided	02	ARAI FID	
Corrosion Engineering	To be decided	02	ARAI FID	ASM, Pune
Emission Type Approval including PUC (bPIP)	To be decided	02	ARAI FID	
Real Driving Emission	To be decided	01	ARAI FID	
eMobility	To be decided	02	Bengaluru	Christ, Bengaluru
Simulation for Electric & Hybrid Vehicles	To be decided	02	ARAI FID	ANSYS

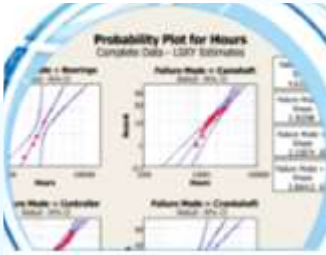
DOMAIN TRAINING PROGRAMMES (DTPs)

Engine Design & Development	BSVI Regulations
Engine Testing & Certification	Design, Validation & Failure Analysis of IC Engine
Automotive / Vehicle Testing & Certification	DFMEA / DVP&R
Automotive Engineering	Heat Treatment
Fundamentals of Automotive Electricals and Electronics	Testing of Seating Systems

Note: ARAI reserves the rights to change the dates, schedule, contents, speakers, venue, etc. for the program without any notice.

Get Trained on the latest Automotive Topics anywhere, anytime...
Become a Certified Expert

Reliability Engineering



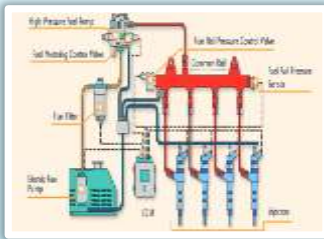
Course Content:

- Introduction to Reliability Engineering (Including Bathtub Curve, Failure Rate Behavior)
- Reliability Statistics and Distributions
- Life Data Analysis (Using Minitab software)
- Warranty Data Analysis
- Reliability Block Diagrams
- Reliability Testing Methods (ALT, HALT, HASS, ESS, etc.)
- Sample Size in Reliability Testing

e-PIPs Benefits:

- All online courses are flexible in nature. i.e. 24 x7 operational
- Easy to monitor learner's activity to know their course current status
- Hands-on practice in virtual environment
- Very engaging due to interactive slides which improves learners knowledge absorption and retention
- Certificate which help learners for their career advancement.

Engine Electronics & Management Systems (EEMS)



Course Content:

- Fundamentals of Automotive Electronics
- ECU, Microcontrollers and Memories
- Sensors and Actuators
- Automotive Control Systems
- Engine Management System
- Calibration and Diagnostics
- Standards

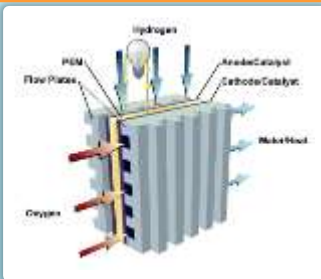
e-PIP highlights:

- Latest and up-to-date content
- Highly interactive, engaging and effective
- Real-life industry examples
- Hands-on practice in virtual environment
- Pre and Post assessments to assess learner's knowledge.
- Certificate on passing the Final Assessment

EEMS e-PIP is jointly prepared by ARAI and Robert Bosch



Fuel Cell Technology



Course Content:

- Basic Introduction of Fuel Cells
- Structure and Working of Fuel Cells
- Classification, Advantages and Applications of Fuel Cells
- Benefits, Performance and Losses in Fuel Cells
- Thermodynamic Analysis
- PEMFC Design Challenges of fuel cell
- Hydrogen Production, Storage & Handling

Contact Information:

Mr. Rajesh Patil
Dy. GM, ARAI Academy,
The Automotive Research Association
of India (ARAI)

B-16/1, MIDC Chakan, Taluka Khed, Dist
Pune 410501 (INDIA)

Contact No.: +91 2135-630790 /92/ 95
OR
+91 2135-396690/92/ 95

Email: patil.pga@araiindia.com
jain.pga@araiindia.com,
training.pga@araiindia.com

Category (Prices excluding tax)	Reliability Engineering	EEMS	Fuel Cell Technology
Student	2500	7500	1000
Faculty	4000	12500	1600
Corporate Individual	7000	20000	3000
Corporate Perpetual (15 Licenses – 1 year)	50000	150000	20000

□ ARAI Knowledge Centre

ARAI Knowledge Centre (@ ARAI, Kothrud, Pune) set up in 1975, is a fully automated special library and is one of the finest libraries in India, having specific collection in Automotive and allied subjects. Another new Knowledge Centre has recently been established at ARAI Academy at ARAI-FID, Chakan, near Pune, to provide information services. These Knowledge Centres serve professionals, faculty, students, NGOs and various Government organizations.

Collection at a Glance

• Books & Standards	: 25,000
• Project Reports	: 1,600
• SAE Technical Papers from 1974 onwards	: 75,000
• SAE Special Publications	: 500
• Journals Subscription	: 36
• E-Books	: 500
• Kindle E-book Readers	: 8

Services

- Membership (Option 1) for reference only
- Membership (Option 2) Book Borrowing Facility
- Deposit Account Scheme (Document Delivery)
- Literature and Patent Search Service
- SAE Digital Library
- Automotive Abstracts (ARAI Publication)
- Mobility Technology Journal (Coming Soon)

➤ **Memberships**

Knowledge Centre offers Annual Membership to educational and research institutes, companies and professionals from automotive field with two options. It also offers daily, weekly and monthly membership for reference purpose.

- OPTION 1: Membership for Reference
- OPTION 2: Membership with Book Borrowing Facility

This membership facility helps students, faculty and professionals to keep updated in automotive domain.

➤ **ARAI Digital Library**

ARAI Digital Library is developed to capture, organize, preserve and disseminate knowledge. It includes Conference Proceedings, Keynote and Technical papers, Seminar papers, Staff publications, ARAI Updates, Automotive Abstracts, etc. It only provides access to all staff and students through campus Intranet. It has more than 16,000 documents in various collections.

➤ **Publications**

ARAI Publication, Automotive Abstracts (ISSN No. 0970-7115), is brought out since 1975. Abstracts of articles published in most of the leading Journals / Periodicals on Automotive Technology and International Symposiums such as APAC, FISITA, IMechE, ISATA, SAEINDIA Mobility Conferences, SIAT, etc. are covered in this. It also covers Auto news, Techno scan, IPR scans, book reviews, forthcoming events, etc. This publication aims to provide updates on the latest technology trends and events in automotive sector.

Further, it is planned to publish new Journal, concentrating on research in the field of Automotive Technology with the title "Mobility Technology - Journal of Automotive Research Association of India (JARAI)". Primary objective of this journal is to encourage research by disseminating study outcomes in Automotive Engineering and its sub-areas. This journal is targeted for scholars, academicians and professionals associated with mobility sector.



Knowledge Centre at ARAI, Kothrud



Automotive Abstracts Magazine



Knowledge Centre at ARAI-FID, Chakan

Mrs. Rashmi Urdhwareshe, Director, ARAI
director@araiindia.com



The Automotive Research Association of India
Survey No. 102, Vetal Hill, Off Paud Road, Kothrud, Pune 411 038 (India)
Tel.: +91-20-3023 1101, 3023 1111 Fax: +91-20-3023 1104