ARAI

Progress through Research

53rd Annual Report 2022-2023

Leading the Path towards safer and sustainable mobility solutions

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

ARAI Vision and Mission

Our Vision

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

Our Mission

- Create and facilitate SAFE, SUSTAINABLE and SMART Mobility Solutions.

100 kW DC Fast Charger Technology Launch

Contents

Highlights of the Year

- **Technology transfer of Chassis Dynamometer Control System**
- **Launch of 100 kW Fast Charger Technology**
- **Vehicle Control System Technology developed**
- **Recognized with 'Dr. R J Rathi Award' for Green Initiatives, by MCCIA**
- **Grant of patent to ARAI and Dow Chemical International Pvt. Ltd. for 'Underrun Protection Devices and Method thereof'**
- **Two Patents filed**
  - Development of artificial rider for 2-wheeler evaluation
  - System and method for controlling vibrations
- **NABL Accreditation for Charger Testing & EMC of CEVs**
- **Accreditation of NTSEL, Japan for Motorcycle Exhaust Gas Emission**
- **Emission Inventory Development Report for Pune District launched under Clean Air Project in India**
- **New Service for certification of tyres & wheel rims as per specific requirements of countries like Brazil (Inmetro), Philippines and Indonesia**
- **Hackathon conducted under TechNovuus – ARAI's Technology Innovation Platform, with problem statements on Smart, Safe and Sustainable Mobility solutions for Aatmanirbhar Bharat**

Empowering Growth of Mobility Eco-system Under the Support of Ministry of Heavy Industries

The global and Indian automotive industry is undergoing significant changes across the value chain. The industry is ripe with disruptions across new technologies, business models, and rapidly evolving policies. The industry is undergoing transformation with the advent of new technologies, as they are creating unprecedented opportunities and redefining competition.

To support the capital goods sector, including mobility eco-system, Ministry of Heavy Industries (MHI), Government of India has launched various initiatives, and one of them is 'Scheme for Enhancement of Competitiveness in the Capital Goods Sector'. This scheme is to make the sector globally competitive, facilitate a self-sustaining eco-system for research and innovation, to enhance skills, support infrastructure creation for testing the quality of processes/ products developed, create common engineering infrastructure for designing and manufacturing, promote smart manufacturing and nurture indigenization of technologies.

ARAI is being supported by MHI under this scheme for projects on augmentation of its Testing & Certification facilities, establishment of Centre of Excellence for Intelligent Vehicle Technology (IVT), setting up of Common Engineering Facility Centre (CEFC) for Digital Twinning and collaborative development of indigenous technologies through Technology Innovation Platform – TechNovuus.

Augmentation of Testing & Certification Facilities

ARAI is augmenting its testing & certification facilities in the area of safety, viz. Battery Safety, Verification & Validation (V&V) of Advanced Driver Assistance Systems (ADAS) and Cylinder Testing.

- **Advanced Battery Safety Lab**

The facilities being established for battery safety will cater to all the prevailing and futuristic national/ international standards/ regulations for all battery domains. They are going to be technology agnostic and will support various sectors, apart from automotive applications, like consumer electronics, medical devices, industrial equipment and stationary storage. These facilities will support Indian industry to develop, validate and certify their battery technologies locally.

- **Modular Infrastructure for Verification & Validation (V&V) of ADAS**

Advanced Driver Assistance Systems (ADAS) are active safety systems designed for motorized vehicles. However, before these complex systems are released into the market, they need to be tested extensively. The testing infrastructure being established for V&V of ADAS will support the Start-ups, MSMEs, Research Institutes working in the domain of advanced/ intelligent vehicles and those engaged in developing control systems for different OEMs and Tier 1 manufacturers. These facilities can be directly utilized by the different stakeholders for validating their ADAS control systems in vehicle and traffic environment. Along with these facilities, ARAI is also establishing 'Simulated City' level test track, which will be useful for field level validation of ADAS/ Autonomous Vehicles.

- **Cylinder Testing**

The facilities being established for cylinder testing will cater to meeting industry's requirements of approval of gaseous cylinders covering Type-I to Type-IV (type approval, batch approval, periodic testing and development testing). It will also foster technology upgradation in terms of light weight cylinders

required for CNG, HCNG and Hydrogen applications. Also, these facilities will be useful for approval of gaseous cylinders for various applications as per Gas Cylinder Rules, 2016.

- **Centre of Excellence for Intelligent Vehicle Technology (IVT)**

Technologies, like Big Data analytics, IoT, V2X, etc. are influencing the way automobiles are developed and built today. Convergence of these ever evolving technologies will help in manufacturing of safer and smarter vehicles, and also help in providing sustainable mobility. To harness the benefits of these advanced technologies, Centre of Excellence (CoE) for Intelligent Vehicle Technology (IVT) is being developed at ARAI.

The technology solutions envisaged for development at this CoE include models for Indian traffic objects and infrastructure detection; cost effective vision/ radar based solution for Front Collision Warning System (FCWS) and alert to mitigation adaptation use case for AEBS (Automatic Emergency Brake System).

- **Common Engineering Facility Centre (CEFC) for Digital Twinning**

Emerging automotive systems are witnessing incorporation of disruptive technologies for facilitating safe and sustainable mobility. These technologies include Automotive e/E systems for various control systems; AI & ML based applications for vehicle controls and application of ICME approach for designing products, materials and processing methods. Considering that small enterprises have limited technology orientation and also face a challenge in accessing facilities for development of solutions, ARAI is establishing Digital Twin Centre for Emerging Automotive Systems, comprising of the following:

a. Centre for system development using Artificial Intelligence and Machine Learning Techniques

b. HIL Farm facility comprising of various “Hardware in Loop” System

c. Centre for Integrated Computational Materials Engineering Simulation Platform

This CEFC will hand hold small entities for their product development, validation and training requirements.

TechNovuus

TechNovuus, a Technology Innovation Platform of ARAI, is a collaborative eco-system for enabling indigenous technology, innovation and solution development through an open innovation and technology development platform. It facilitates development of solutions for challenges related to mobility to start with and gradually cater to other sectors like Defence, Aerospace, Telecommunication, Railways etc. providing an impetus to Government of India’s Make in India and Atmanirbhar Bharat programmes.

This platform, built under the support of Ministry of Heavy Industries (MHI), brings together solution providers and seekers to unlock the potential of new technologies that are driving and shaping the future technology revolution. It helps in addressing challenges in mobility area through India specific solutions using frugal and value engineering methodologies. It also helps in enabling India to emerge as a Technology and Innovation hub across the world. This platform has different sub-portals, viz. Collaborative Technology Solutions, Technology Discussion Forum, Technology Transfer Portal, Technology Consortium Portal (Build Your Team) and Resource Sharing Platform. It has currently over

12000 registrations with more than 200 organizations >100 industrial experts, >500 Academia participants and professionals as well as students on this platform. Through its engagement programs, it has successfully conducted over 50 webinars by prominent industry experts in different automotive technology domains.

A significant initiative undertaken under TechNovuus during the year 2022-23 was the 'Hackathon' event for students on the theme – Smart, Safe and Sustainable Mobility. This was conducted as a part of celebration of 'Azaadi ka Amrit Mahotsav'. This event was launched at the august hands of Hon'ble Minister of State for Heavy Industries, Shri Krishna Pal Gurjar, on 13th January 2022. The objective of this hackathon was to empower the students and present them with an opportunity to make mobility safer, smarter and more sustainable. This hackathon event, which had ten problem statements on the theme, witnessed registration of 177 teams from 75 colleges spread across the states, viz. Tamil Nadu, Maharashtra, Andhra Pradesh, Telangana, Gujarat, etc. There were 235 submissions from 177 teams. Out of these teams, 24 finalists were selected and the grand finale was held at ARAI, Pune from 15th to 17th July 2022. Based on the evaluation, 7 winning teams were awarded prizes and 1 team was awarded a consolation prize.

President - ARAI interacting with Hackathon Finalists

Director - ARAI interacting with Hackathon Finalists

Prize Distribution Ceremony of Hackathon

Finalists of Hackathon

Governing Council

PRESIDENT	**Mr. Rajendra M. Petkar,** President & Chief Technology Officer, Tata Motors Ltd.
VICE PRESIDENT	**Dr. N. Saravanan,** President & Chief Technology Officer, Ashok Leyland Ltd. (w.e.f. 9th February 2023)
	Mr. Ravi Gogia, President, Fiat India Automobiles Pvt. Ltd. (for earlier period)
DIRECTOR	**Dr. Reji Mathai**

ARAI is under the administrative control of Ministry of Heavy Industries, Govt. of India.

MEMBERS

1. Ashok Leyland Ltd.
2. Bosch Ltd.
3. Cummins India Ltd.
4. Cummins Technologies India Pvt. Ltd.
5. Eicher Motors Ltd. (Royal Enfield)
6. Fiat India Automobiles Pvt. Ltd.
7. Force Motors Ltd.
8. Honda Cars India Ltd.
9. Hyundai Motor India Ltd.
10. JCBL Ltd.
11. Kirloskar Oil Engines Ltd.
12. Mahindra & Mahindra Ltd.
13. Maruti Suzuki India Ltd.
14. Mercedes-Benz India Pvt. Ltd.
15. Simpson & Co. Ltd.
16. Skoda Auto Volkswagen India Pvt. Ltd.
17. Tata Cummins Pvt. Ltd.
18. Tata Motors Ltd.
19. Toyota Kirloskar Motor Pvt. Ltd.
20. Tractors and Farm Equipment Ltd.
21. TVS Motor Co. Ltd.
22. VE Commercial Vehicles Ltd.
23. Volvo Group India Pvt. Ltd.
24. Wheels India Ltd.

GOVT. OF INDIA REPRESENTATIVES

Ms. Arti Bhatnagar
Additional Secretary & Financial Adviser
Govt. of India
Ministry of Heavy Industries
Udyog Bhavan, New Delhi 110 011

Dr. Hanif Qureshi
Joint Secretary
Govt. of India
Ministry of Heavy Industries
Udyog Bhavan, New Delhi 110 011

Mr. Rajnesh Singh
Director (Auto),
Govt. of India
Ministry of Heavy Industries
Udyog Bhavan, New Delhi 110 011

INVITEES

- Society of Indian Automobile Manufacturers
- Automotive Component Manufacturers Association of India
- Tractor and Mechanization Association

SECRETARY TO THE GOVERNING COUNCIL

Mrs. Prajakta M. Dhere

OFFICE

Survey No. 102, Vetal Hill
Off Paud Road, Kothrud
Pune 411 038, INDIA
Phone : +91-20-6762 1122, 6762 1111
Fax : +91-20-6762 1104
Email: director@araiindia.com

BANKERS

Bank of Baroda
HDFC Bank Ltd.

STATUS OF INSTITUTE

- Registered under The Societies Registration Act, XXI of 1860 Regn. No. 133/66 GBBSD dated 10.12.1966
  - New Regn.No. Maha/2066/2016/Pune dated 13.12.2016
- Registered under The Maharashtra Public Trust Act, 1950, Reg. No. F-48091/Pune dated 13.12.2016

STATUTORY AUDITORS

M/s. Kirtane & Pandit
Chartered Accountants,
5th Floor, Wing A, Gopal House,
S. No. 127/ 1B/1, Plot AI,
Kothrud, Pune 411 029

Members

1. Aargee Equipments Pvt. Ltd.
2. Adient India Pvt. Ltd.
   (Formerly Johnson Controls Automotive Ltd .)
3. A.J. Auto Pvt. Ltd.
4. ARaymond India Pvt. Ltd.
   (Formerly ARaymond Fastners India Pvt. Ltd.) ##
5. Ashok Leyland Ltd.
6. Ather Energy Pvt. Ltd.
7. Atul Auto Ltd.
8. Bajaj Auto Ltd.
9. Behr-Hella Thermocontrol (India) Pvt. Ltd.
10. BEML Ltd.
11. Bharat Forge Ltd.
12. BMW India Pvt. Ltd.
13. Bosch Ltd.
14. Brakes India Pvt. Ltd.
15. Chemito Infotech Pvt. Ltd.
16. Cooper Corporation Pvt. Ltd.
17. Cummins India Ltd.
18. Cummins Technologies India Pvt. Ltd.
19. Daimler India Commercial Vehicles Pvt. Ltd.
20. Eicher Motors Ltd.
21. Enginetech Systems Pvt. Ltd.
22. FCA India Automobiles Pvt. Ltd.
23. Fiat India Automobiles Pvt. Ltd.
24. Force Motors Ltd.
25. Ford India Pvt. Ltd. ~
26. Greaves Cotton Ltd.
27. Greaves Electric Mobility Pvt. Ltd.
    (Formerly Ampere Vehicles Pvt. Ltd.)
28. Gromax Agri Equipment Ltd.
    (Formerly Mahindra Gujarat Tractor Ltd.)
29. Hero Electric Vehicles Pvt. Ltd.
30. Honda Cars India Ltd.
31. Hyundai Motor India Ltd.
32. India Japan Lighting Pvt. Ltd.
33. India Kawasaki Motors Pvt. Ltd.
34. Isuzu Motors India Pvt. Ltd. *
35. JCBL Ltd.
36. Kabra Extrusion Technik Ltd. *
37. Kanda Auto Pvt. Ltd. ~~
38. Kia India Pvt. Ltd. (Formerly Kia Motors India Pvt. Ltd.)
39. Kirloskar Oil Engines Ltd.
40. Kohler Power India Pvt. Ltd. (Formerly Lombardini India Pvt. Ltd.)
41. Lear Automotive India Pvt. Ltd.
42. Madras Engineering Industries Pvt. Ltd.
43. Mahindra & Mahindra Ltd.
44. Mahindra Electric Mobility Ltd. ~
    (Merged in Mahindra & Mahindra Ltd.)
45. Maruti Suzuki India Ltd.
46. Masstrans Technologies Pvt. Ltd.
47. Mercedes-Benz India Pvt. Ltd.
48. MG Motor India Pvt. Ltd. *
49. MLR Auto Ltd.
50. MSKH Seating Systems India (P) Ltd.
51. Omega Seiki Pvt. Ltd. *
52. PCA Automobiles India Pvt. Ltd.
53. Piaggio Vehicles Pvt. Ltd.
54. P M Diesels Pvt. Ltd.
55. Randhawa Automobile Engineering Pvt. Ltd.
56. Renault Nissan Automotive India Pvt. Ltd.
57. Rocket Engineering Corporation Pvt. Ltd.
58. Rotary Electronics Pvt. Ltd.
59. Simpson & Co. Ltd.
60. Skoda Auto Volkswagen India Pvt. Ltd.
61. S. M. Auto Engineering Pvt. Ltd.
62. SML Isuzu Ltd.
63. Switch Mobility Automotive Ltd. *
64. Tata Cummins Pvt. Ltd.
65. Tata Motors Ltd.
66. Terex India Pvt. Ltd.
67. T.M. Automotive Seating Systems Pvt. Ltd.
68. Toyota Kirloskar Motor Pvt. Ltd.
69. Tractors and Farm Equipment Ltd.
70. Trimble Mobility Solutions India Pvt. Ltd.
71. TVS Motor Co. Ltd.
72. Vanaz Engineers Ltd.
73. VE Commercial Vehicles Ltd.
74. Visteon Technical and Services Centre Pvt. Ltd.
75. Volvo Group India Pvt. Ltd.
76. Wheels India Ltd.
77. ZF Commercial Vehicle Control Systems India Ltd.
    (Formerly WABCO India Ltd.) ##

* New Membership
Change in name

~ Withdrawal
~~ Cancellation

FINANCE & INTERNAL AUDIT COMMITTEE (FIAC)

CHAIRMAN

Dr. N. Saravanan
Vice President- ARAI
President & Chief Technology Officer, Ashok Leyland Ltd.
(w.e.f. 9th February 2023)

CHAIRMAN

Mr. Ravi Gogia
Vice President- ARAI
President, Fiat India Automobiles Private Ltd.
(for earlier period)

MEMBERS

Mr. Balaram Pradhan
General Manager (Finance)
Mercedes-Benz India Pvt. Ltd.

Mr. Gopal Bhutada
Sr. General Manager (Supply Chain)
Tata Motors Ltd.

Mr. Anurag Bhagania
CFO
Kirloskar Oil Engines Ltd.

Mr. Abhinav Sogani
Head of Tax & Customs - India Centre of Excellence, Tax & Customs, Finance,
Skoda Auto Volkswagen India Private Ltd.

Mr. Chetan Kamdar
Finance Director
Cummins India Ltd.

Mr. Mahendra K. Harit
CFO
Switch Mobility Automotive Ltd.

Mr. Dinesh Gandhi
Vice President (Finance)
Maruti Suzuki India Ltd.

Mr. Rasesh Joshi
CFO - Last Mile Mobility
Mahindra and Mahindra Ltd.

Members from ARAI

Dr. Reji Mathai
Director-ARAI

Mr. Atul Bhide
Deputy Director
(HoD- Finance & Accounts), Member Secretary

PROJECT EVALUATION & MONITORING COMMITTEE (PEMC)

CHAIRMAN

Mr. Aniruddha Kulkarni
Vice President & Head CVBU Engineering, Tata Motors Ltd.

MEMBERS

Mr. R. K. Jaiswal
Development Officer (Engineering),
Government of India,
Ministry of Heavy Industries

Mr. Rajinder S. Sachdeva
Chief Operating Officer,
V E Commercial Vehicles Ltd.

Mr. Alok Jaitley
Sr. Vice President (Engg)
Maruti Suzuki India Ltd.

Ms. Anuradda Ganesh
Director - Research, Innovation and Compliance, India ABO
Cummins Technologies India Pvt. Ltd.

Mr. S. Janardhanan
Vice President (Co-ordination),
Simpson & Co. Ltd.

Mr. Pankaj Sonalkar
Chief - Electric Vehicle, Technology Centre, Mahindra & Mahindra Ltd.

Mr. S. Sriraman
Sr. Vice President ((R&D)
Tractors and Farm Equipment Ltd.

Members from ARAI

Dr. Reji Mathai
Director-ARAI

Mr. N. B. Dhande
Sr. Dy. Director, ARAI

Mr. Suyog Gadgil
Manager, Member Secretary

President's Statement

Mr. Rajendra Petkar
President, ARAI

Dr. N. Saravanan
Vice President, ARAI

Dear Members,

Year 2022-23 was one of the most important years in ARAI's history with strong operational and financial performance. Our performance was excellent as we delivered outstanding results from all perspectives to register growth of over 13% in our operational revenue. We continued to demonstrate resilience, ability and commitment to support our customers and stakeholders in ever changing economic conditions.

Our teams, coupled with strong culture and values, once again proved their ability to tackle any challenge, no matter the complexity, as they have been doing throughout ARAI's journey. I am proud of the steadfast dedication and ever-inspiring creativity of our teams, who have been working together to support our customers, driving innovation and seek new opportunities. We have continued to enhance our processes, efficiency and improve operationally. This focus has resulted in in-house development of technology solutions, like 100 kW Fast Charger, Chassis Dynamometer Control System and Vehicle Control System. Likewise, our capabilities have also been recognized with NABL accreditation for Charger Testing and EMC of CEVs and NTSEL, Japan for Motorcycle Exhaust Gas Emission. Similarly, our environment-friendly measures were recognized by Mahratta Chamber of Commerce Industries and Agriculture (MCCIA) with 'Dr. R J Rathi Award for Green Initiatives'.

"Our teams, coupled with strong culture and values, once again proved their ability to tackle any challenge, no matter the complexity, as they have been doing throughout ARAI's journey"

We are aiding our stakeholders make critical decisions by providing solutions that combine deep domain knowledge with specialized services. During the year, we released a report on 'Emission Inventory for Pune District' under Clean Air Project in India (CAP India) - supported by The Swiss Agency for Development and Cooperation (SDC) and implemented along with TERI and other consortium partners. This emission inventory will be useful for assessment of source contributions from different polluting sectors in Pune region. Similarly, our projects in the area of alternate fuels, like performance evaluation of M15 fuel on gasoline vehicles, impact of E20 fuel on E10 compatible vehicles and assessment of diesel ethanol blends on diesel gensets have given valuable insights to our stakeholders and customers.

Living up to the expectations of our clients, requires us to continually transform and reinvent ourselves, our capabilities and also our capacities. Over the past year, we have made significant investments in enhancing and revamping our capacities to serve our clients. During the year, we invested in WorldSID Dummy, Walk-in-Chamber, Weatherometer and also upgraded Chassis Dynamometer, considering the future needs of the industry.

Continuous and astute investment in technology, R&D and manpower has enabled us to build a strong and scalable portfolio. In the next few years, we will be adding new facilities in the areas of battery, ADAS, cylinder, photometry, NVH, vehicle security barriers, highway security barriers, etc. MHI support has been a key factor in setting up some of these facilities and also in developing future technologies.

Alongside, we explored ways to enhance the capabilities of our employees through quality training in various automotive engineering domains. We are working with a forward looking culture by forecasting emerging trends related to people skills, along with various training sessions. We completed over 25,000 man-hours of training in 2022-23 to facilitate upskilling of our employees through skill based training and robust learning eco-system. These efforts have yielded rich dividends in the form of new business avenues, like testing, validation and certification of battery packs as per the

"We completed over 25,000 man-hours of training in 2022-23 to facilitate upskilling of our employees through skill based training and robust learning eco-system."

latest standards; 2-wheeler emission testing as per Japan TRIAS 31-J044GTR002-01 emission regulation; 3-D scanning of high voltage batteries and certification of tyres & wheel rims as per specific requirements of countries like Brazil (Inmetro), Philippines and Indonesia.

Further, through ARAI Academy, we continued to collaborate with the industry and universities to ensure dissemination of knowledge and expertise. During the year, we organized 32 Proficiency Improvement Programs in various automotive engineering domains. In addition to this, we also provided upskilling opportunities to industry personnel through our e-Learning courses. Through our collaborations with national and international universities, we continue to offer undergraduate, postgraduate and doctoral programs with specialization in automotive engineering.

We play a significant role by providing inputs in various national as well as international committees/ forums like Automotive Industry Standards Committee (AISC), CMVR – Technical Standing Committee (CMVR-TSC), Standing Committee on Implementation of Emission Legislations (SCoE), CPCB Standing Committee, Bureau of Indian Standards (BIS) and WP.29 & its sub-groups. During the year, we participated in various meetings of these committees and contributed significantly for formulation and harmonization of standards.

Our growth agenda is driven through disciplined cost management and improving efficiency at all levels of our operations. Alongside our revenue growth, this approach enables us to deploy our resources prudently for innovation, brand building and meeting the expectations of our customers. Accordingly, we are focusing on how we can quickly change and repurpose our processes and our systems to become more agile. The ongoing deployment of Human Resource Management System (HRMS) and in-house development of test rigs for front axle beam and pendulum type bumper impact testing are some of the measures initiated in this regard.

"Alongside our revenue growth, this approach enables us to deploy our resources prudently for innovation, brand building and meeting the expectations of our customers."

We strongly believe that leadership and culture, together with employee engagement, drives innovation and performance. We leverage different skills and approaches of our employees, so as to empower them to contribute their best in order to deliver solutions that our clients demand. With this backdrop, I am confident we are on the right course strategically and in a strong position competitively, as we enter 2023-24 with strong momentum.

Our strong momentum underpins our confidence in delivering value in future. We have ingenuity, talent and resilience to continue and transform our services into one that performs with increasing discipline, efficiency and excellence. At the same time, we continue to build a stronger portfolio and pipeline to put us in a strong position and deliver growth in future. Our talented teams are excited, engaged, and fully committed to deliver value for all stakeholders. Considering these virtues, I am confident we will unlock our potential and help make ARAI a globally renowned Institute.

"Our talented teams are excited, engaged, and fully committed to deliver value for all stakeholders."

I would like to place on record my sincere appreciation to the Vice President - ARAI and Members of the Governing Council; Ministry of Heavy Industries (MHI); the Chairman and Members of Finance and Internal Audit Committee; the Chairman and Members of Project Evaluation and Monitoring Committee; ARAI Members; and Director - ARAI for their valuable contribution and continued support.

I would like to express my gratitude to our customers, partners and associates for their continuing faith in ARAI. I would also like to thank the entire team at ARAI for their untiring efforts and unflinching commitment through the last year and I look forward to 2023-24 - what promises to be an exciting year for ARAI.

Rajendra Petkar

Dr. Reji Mathai
Director - ARAI
director@araiindia.com

Director's Report

The Governing Council of ARAI has great pleasure in presenting the Annual Report and Audited Statement of Accounts for the year ending 31st March 2023.

I am pleased to see that we continued our momentum in 2022-23, delivering over 13% growth in the revenue from our operations. 2022-23 was a landmark year for ARAI, as we surpassed numerous milestones in each of our business verticals. It is our forward planning, coupled with competency development, which has enabled us to surmount the varied challenges. Taking up futuristic research, building the capability and capacity has taken ARAI to newer heights.

It is our forward planning, coupled with competency development, which has enabled us to surmount the varied challenges.

We are leveraging our capabilities to prioritize research in emerging automotive areas. At the heart of this, our focus is on electric mobility, battery, materials, simulation, ADAS, etc. Our steadfast commitment has enabled us in designing & developing the technology for 100 kW Fast Charger, Vehicle Control System and GISSMO Material Model Card during the year. Similarly, our consistent efforts in establishing ourselves in newer areas have resulted in ARAI being accredited by NABL for charger testing & EMC (for CEVs), and by NTSEL Japan for motorcycle exhaust gas emission testing.

When I reflect on all we have accomplished over the last couple of years, I am truly inspired by power of the people at ARAI to deliver and live up to customers' expectations.

When I reflect on all we have accomplished over the last couple of years, I am truly inspired by power of the people at ARAI to deliver and live up to customers' expectations. Providing our people with the skills and resources to succeed is of utmost importance, as we navigate today's dynamic operating environment and set ourselves up to achieve our goals in the future. In-line with this thought process, we continued investing in upgrading our facilities, upskilling of our employees, and establishing collaborations with industry and academia. Our environment-friendly practices for preserving and conserving the environment have been recognized by MCCIA by way of 'Dr. R. J. Rathi Award for Green Initiatives'.

The support from Ministry of Heavy Industries is a key enabler.

We are beginning 2023-24 with optimism, confidence and purpose. The support from Ministry of Heavy Industries is a key enabler. I am confident, our new projects – funded by Ministry of Heavy Industries on augmenting of testing and certification facilities (Advanced Battery testing facility, Cylinder test facility & ADAS V&V facility); Digital Twin Centre for supporting MSMEs and Start-ups and Centre of Excellence for Intelligent Vehicle Technology will add value to our portfolio and help in delivering growth in 2023-24 and beyond.

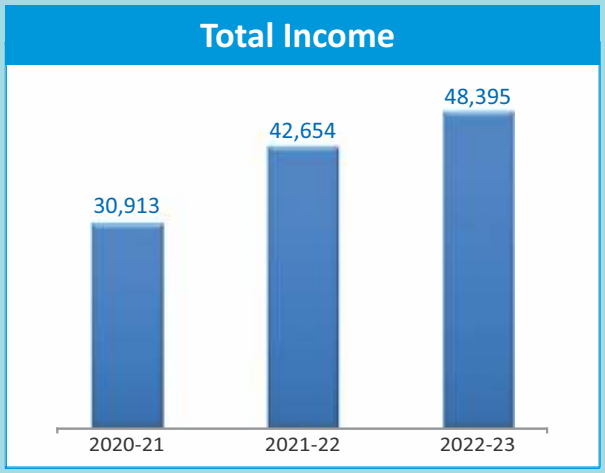
The ARAI brand name stands for reliability, commitment, and integrity.

The ARAI brand name stands for reliability, commitment and integrity. It has been created through sheer dedication of the workforce. Waiver of Customs Duty by Govt. of India on products/ components for testing/ certification will open greater opportunities to make India a hub for testing & certification. I am confident of establishing the brand image of ARAI globally.

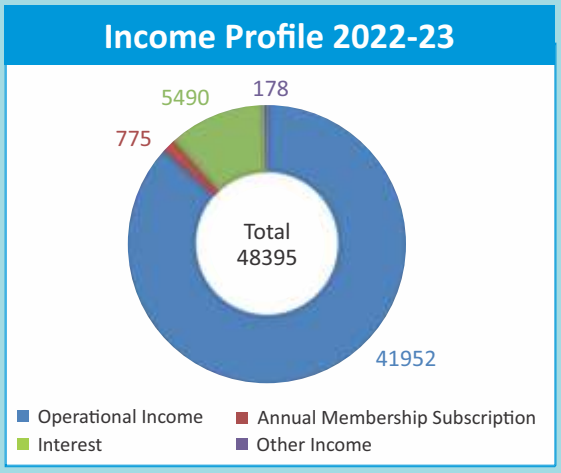
On behalf of Team ARAI, I would like to thank the President, Vice President, Members of the Governing Council, Members of Finance & Internal Audit Committee, Members of Project Evaluation & Monitoring Committee, ARAI Members and Senior Officials of MHI for their continued support.

Dr. Reji Mathai

(Rs. in lakh)



(Rs. in lakh)



Operational Highlights

Finance & Accounts

Income & Expenditure Account, Balance Sheet and Auditor's Report are presented herewith.

- **Financial Performance**

  During the Financial Year 2022-23, Operational Income is Rs.41,951.57 lakh as compared to Rs. 37,037.59 lakh in 2021-2022. Total Income is Rs. 48,395.10 lakh as compared to Rs. 42,654.14 lakh of last year.

- **Investment of funds**

  The cash & bank assets available with ARAI have been invested in Scheduled Banks / Financial Institutions in term Deposits and in Government Securities as per the Governing Council's guidelines.

- **Government Supported Projects:**

  Projects approved by Ministry of Heavy Industries (MHI) are under 'Enhancement of Competitiveness in the Indian Capital Goods Sector' and 'FAME-India' schemes. In case of projects approved by Department of Science & Technology (DST), they are under 'Innovation, Technology Development and Deployment' scheme; and project approved by Ministry of Mines is under their scheme on 'Science and Technology Programme'.

- **Appointment of Statutory Auditors**

  M/s. Kirtane & Pandit, Chartered Accountants, Pune were appointed as Statutory Auditors for the Financial Year 2022-23, in the Annual General meeting held on 14th September 2022.

- **Membership Subscription**

  The total number of members of ARAI as on 31/3/2023 is 76 and the Annual Membership Subscription for the year under report is Rs. 775.10 lakh.

- **Recognition by DSIR**

  ARAI is recognized as a Scientific and Industrial Research Organization (SIRO) by the Department of Scientific & Industrial Research, Ministry of Science & Technology, Govt. of India for the period from April 2020 to March 2023 and from April 2023 to March 2026.

- **Income Tax**

  Central Board of Direct Taxes has approved ARAI for exemption purposes under Sec. 35 (1) (ii) of Income Tax Act, 1961, vide Notification No. 9/2007 (F.No. 203/18/2005-ITA –II) dated 28-3-2007 effective 01-04-2004.

- **Research and Development**

During the year, following projects supported by Ministry of Heavy Industries (MHI), Government of India under Development Council for Automobile & Allied Industries (DCAAI) funding were completed successfully.

- Development of efficient battery thermal management system for two and three wheeler EV application through design of innovative packaging material.

  This project was for developing thermally conductive packaging material solution based on two approaches – Silicone and Phase Change Material (PCM) and demonstrating thermal management with the optimal solution.

- Development of guidelines for accelerated validation of safety critical axle components due to increase in axle load specifications / norms, change in driving pattern and infrastructure:

  This study project was on analyzing the effect of increased axle loads on the safety critical components, viz. axle, wheel rim & bearing, suspension links and leaf springs and to develop test guidelines for accelerated durability validation of these safety-critical components.

Some of the projects of National importance, like evaluation of E20 in E10 compliant vehicles, Studies of M15 blends, etc. were carried out diligently.

Further, following projects are being implemented currently under MHI's Scheme for 'Enhancement of Competitiveness in the Indian Capital Goods Sector' (CG Scheme).

- Development of web-based Technology Innovation Platform, viz. TechNovuus
- Augmentation of existing facilities at ARAI, viz. Battery Safety Lab, Modular Infrastructure for Verification & Validation (V&V) of Advanced Driver Assistance Systems (ADAS) and Cylinder Testing
- Establishment of Digital Twin Centre for Emerging Automotive Systems
- Establishment of Centre of Excellence (CoE) for Intelligent Vehicle Technology (IVT)

In addition to the above, ARAI is also working on R&D projects funded by other ministries.

- Prototype Aluminium Seat Frame development for passenger buses with Jawaharlal Nehru Aluminium Research Design & Development Centre (JNARDDC) – Supported by Ministry of Mines, Government of India
- SiC based Battery Emulator development with CDAC – Supported by Ministry of Electronics & Information Technology, Government of India
- Project Management & Assistance for development of R&D Roadmap document for e-mobility in India – Supported by Office of the Principal Scientific Adviser, Government of India

ARAI is also undertaking projects under internal funding to enhance competencies and to meet industry's future requirements.

- **Model Inspection & Certification (I&C) Test Centres**

ARAI has been identified by Ministry of Road Transport & Highways (MoRTH) for facilitating establishment of model test centres for Inspection and Certification (I&C) of in-use vehicles. Under this program, ARAI has facilitated establishment of I&C Centres at Nashik in Maharashtra; Nelamangala (Bengaluru) in Karnataka; Railmagra in Rajasthan; Surat in Gujarat and Cuttack in Odisha. In addition to these centres, ARAI is currently facilitating establishment of centres in another five states, viz. Telangana, Puducherry, Kerala, Andhra Pradesh and Uttarakhand.

Further, ARAI is also providing consultancy services for setting up I&C Centres at 44 different locations for Transport Department of Maharashtra. Similarly, consultancy is being provided to Motor Vehicles Department of Kerala at 15 different locations. Also, ARAI has provided consultancy to Karnataka State Road Transport Corporation (KSRTC) for setting up of I&C Centres at two places in Karnataka, viz. Mysore and Dharwad, and is now engaged with BMTC for a centre in Bengaluru. In addition to this, as per the approved procedure of Rajasthan State Government, ARAI has carried out audits of 17 vehicle fitness test centres belonging to private parties.

- **Business Development Initiatives**
  - Brand Building :
    - Industry interactions: Hosted senior level delegations of various organizations and also, visited many customers for business promotion
    - Showcasing and demonstration of capabilities at expos, viz. Auto Expo 2023 & Motor Show 2023, Micelio Global Clean Mobility Summit 2022, International Automotive Manufacturing Summit 2022, Truck Tyre & Trailer Expo 2022, DEF-EX 2022, India EV Expo 2022, SAE INDIA Automotive Mobility Conference, Alternate Fuel Conclave 2022, EV Summit, etc.
    - Leveraging Social Media Platforms: Reached out to the industry through periodic updates on capabilities, events, new developments, etc. on social media platforms, viz. LinkedIn, Instagram, Facebook, YouTube and Twitter
    - Periodic posts and updates on ARAI website regarding events and engagements
    - Launch of ARAI Hindi Website during Hindi Pakhwada
    - Participation in 'Industry and R&D Institutes Collaboration Meet' at MCCIA, Pune
    - Launch of the report on "Development of Emission Inventory for Pune District" under Clean Air Project in India (CAP India)
    - Interactions of Customer Relations Cell with ARAI customers for enhancing ease of doing business
  - Technical Collaborations/ Strategic Tie-ups:
    - Statement of Intent (SOI) with IIT Guwahati – For establishment of Digital Twin Centre for Emerging Automotive System at IIT Guwahati
    - MoUs with Industry Partners for establishment of Centre of Excellence for Intelligent Vehicle Technology (IVT)
    - MoU with ARAI-AMTIF (a Section 8 Company of ARAI) – To provide an array of services along with technical and business resources to start-ups
    - MoU with Indian Institute of Tropical Meteorology (IITM) – To exchange scientific knowledge and undertake joint research work in the areas of emissions and air quality modelling
    - MoU with Additional Skill Acquisition Programme (ASAP) Kerala – To offer Skill Development Programs and establishment of CoE for EV
    - MoU with Tata Technologies – To provide certification programs for upskilling and reskilling of students and working professionals in the automotive industry
    - MoU with Providence College of Engineering & School of Business – To offer Skill Development Programs
    - MoU with Symbiosis International University – To offer a full-time M. Tech. Program in Automotive Technology

- MoU with Chitkara University – To offer BE Program in Automobile Engineering with specialization in EVs and HEVs
- Various other MoUs with Industry in the areas, like development, testing, knowledge enhancement, sustainable and efficient public transport, etc.

- Workshops/ Training Programs/ Expert Talks:

  Workshops and training programs were conducted for industry, Motor Transport Department Officers and student community. Some of the areas, in which these workshops and training programs were organized, are given below.

- BS-VI Emission Certification for 2W, 3W, 4W & HDV and Real Drive Emissions for Motor Transport Department Officers
- Electromagnetic Compatibility (EMC) for 2W
- ISC (In-service Compliance) and IUPR (In-Use Performance Ratio), AES/ BES documentation requirements compliance
- Best Practices of Product Design, Mold Design and Process with respect to Plastic Material Rheology in Injection Molding Process
- Technical requirements of Bus Body as per AIS 052/ AIS 063/ AIS 119 for Regional Transport Officials (RTO)
- Homologation of Electrical Bus as per CMVR requirements for Regional Transport Officials (RTO)
- 'Emission Inventory and Source Apportionment Study in Non-Attainment Cities of Odisha' for State Pollution Control Board, Odisha
- Workshop on 'Advanced Material Model Cards for Damage Prediction'

- **Systems Compliance and Quality Management**
  - Successful completion of Surveillance Audits of ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 and ISO 27001-2013
  - Successful completion of Desktop Surveillance by NABL for Calibration and Testing Scopes
  - Accreditation of 184 number of new testing services as per ISO/IEC 17025:2017
  - Successful completion of BIS Recognition as per LRS2020 for Mechanical Testing Scope. Addition of new IS standards, viz. IS2835 and IS14900 successfully demonstrated through Desktop assessment
  - Approval of NTSEL for Exhaust Emissions of Motor Cycles (WMTC) as per TRIAS 31-J044GTR002-01

- **Continual Improvement Initiatives**

  ARAI strongly believes in continual improvement culture. During the year, following activities were done to build and strengthen operational excellence in our services.

  - Upgradation of Dyno Lab
  - Test Rig development for testing of Front Axle Beam
  - Test Trolley development for Advanced European – Mobile Deformable Barrier AE-MDB Test
  - In-house development of Pendulum type Bumper Impact Test Rig
  - Installation of Standby Electric Drive for minimum downtime of crash test facility
  - Development of Ambient Volatile Organic Compounds (VOCs) sampling equipment
  - Development of e-Modules for training on 'Basics of Fire and Firefighting'

- Modification of fire mitigation system for carrying out testing with 50^{0}C ambient temperature
- Installation of Rooftop Solar Power plant at ARAI – HTC and Solar Power Plant at ARAI Kothrud
- Organized seminars for awareness on Cyber Security

- **Environment, Occupational Health & Safety**

ARAI believes in working in harmony with environment. In-line with this, ARAI focuses on environmental protection, occupational health and safety and also endeavours for continual improvement in environmental, health and safety performance of employees and stakeholders. Following events were organized at ARAI in this direction.

- Webinar on 'Circular Economy: Key to Fight Climate Change' on 5th June 2022, i.e. World Environment Day.
- Observance of Swachhata Pakhwada – 2022 during 16th – 30th August 2022: Various activities on Eco-friendly disposal of Vehicles, Solid Waste Management, Single Use Plastic, Tree Plantation, etc. were organized.
- Celebration of National Safety Week from 4th to 11th March 2023 with the theme as "Our Aim – Zero Harm".

ARAI's efforts for environmental protection have been recognized with Dr. R. J. Rathi Award for Green Initiatives in Service category for the year 2022 by MCCIA.

- **Corporate Social Responsibility (CSR)**

It is important to engage with the social and environmental challenges that humanity is facing. It is our conviction that the engagement with social issues must be deep, meaningful and formed on the bedrock of long-term commitment. CSR activities at ARAI are carried out through our Social Responsibility Support Group (SRSG), formed specifically for this purpose. We support various entities in carrying out activities in the areas of community development, education and health care. This year we supported a Science Lab on Wheels, which helps underprivileged students with some infrastructure; provided eye check-up equipment to the foundation operating health camps in slums; roller water drums for villagers to fetch water effortlessly from long distances and water cooler for the school located in remote area in Pune district.

Observance of National Safety Week


Director–ARAI receiving Dr. R. J. Rathi Award for Green Initiatives

Research & Development

Testing and Certification

Role in Standardization

New Facilities

Human Resource Development

Research Publications/ Presentations

Business Development

Events

ARAI Academy

ARAI undertakes research and development programs to build competencies, capabilities and competitiveness, which in turn has reflected in its consistent growth. Leveraging its inherent strengths in different automotive engineering domains, ARAI has successfully executed various government supported/ industry funded/ internally funded research projects. Some of the research projects implemented during 2022-23 are listed below.

DESIGN & DEVELOPMENT

- **100 kW DC Fast Charger Technology**

Building on the design and development expertise generated in 50 kW AC and DC combined chargers and Light Electric Vehicle AC Charge Point technologies, ARAI has successfully demonstrated technology development of high power 100 kW DC fast charger for EV charging under guidance of Ministry of Heavy Industries (MHI).

This technology has been developed indigenously, except for the charging gun. The Charger Control Unit has been designed and developed in-house, whereas the Power Module has been developed along with a Power Electronics manufacturer. It has been developed considering a modular approach, which facilitates modification of output power capacity with addition or removal of power modules. It supports CCS 2, DC001, AC Type 2 and CHAdeMO communication protocols. This technology was launched at the hands of Dr. Mahendra Nath Pandey, Hon'ble Minister, Ministry of Heavy Industries. It is expected to promote domestic manufacturing of fast chargers.

100 kW DC Fast Charger Technology

- **Efficient Battery Thermal Management System for 2 & 3-wheeler EV application**

Thermally conductive packaging material solution for Lithium-ion batteries used in 2 and 3-wheeler EVs operating in Indian conditions has been developed along with IIT Ropar and Industry Partners under a project supported by MHI. This project was taken up considering the need for devising a cooling strategy which works efficiently in Indian conditions.

In this project, benchmarking of battery pack for the identified vehicle has been carried out for finalization of target properties for efficient battery thermal management. Solutions using different materials, viz. Silicone and Phase Change Material (PCM) and approaches were developed, followed by thermal & structural simulation, and validation. Subsequent to this, optimal solution was arrived at and the prototype manufacturing of the same, along with testing in laboratory and validation for its actual on-road performance was carried out.

Swappable Battery Pack with Packaging Material Solution

- **Thermal Management System for Fast Charging of Removable Battery Pack**

An internally funded project is being undertaken for designing a thermal management system for fast charging of removable battery pack for 2W and 3W applications specific to Indian application. The target herein is to develop the prototype of designed thermal management system and demonstrate the developed technology. The project involves establishing target setting, concept development of the thermal management system & its evaluation, prototype development, testing & validation of the developed prototype and technology demonstration.

- **Development of DC Cast Al Alloy for Yoke Material**

The need for light weighting of automobiles and its components is increasing considering electric mobility and consumer demands. Hence, Aluminium alloys are widely used in automotive applications due to excellent strength-to-weight ratio, which significantly reduce the fuel consumption and also enables to meet emission norms. The applications of automobiles worldwide include space-frames, closures, bumpers, wheels, heat exchanger. The demand for e-mobility is increasing continuously and need for special alloys for various applications is on the rise. This project aims at developing a new cast aluminium alloy for yoke application used in automobile and also testing and validation of prototype with mechanical properties of the proposed alloy.

Yoke used in Transmission Applications

- **Development of 4 Cylinder Diesel Engine to meet Euro-IV Emission Norms**

Further to introduction of BS-VI norms, engine manufacturers have successfully moved from BS-IV to BS-VI having carried out major changes in fuel injection, ECU software and after-treatment system. However, based on a requirement of a customer, a BS-VI compliant engine has been downsized to BS-IV compliant one. In this project, the challenging task was removing of SCR – which would cause rise in NOx and also, change the calibration pattern and control software. The various activities carried out in this project included base engine analysis after removal of SCR, performance calibration, emission calibration on steady state & transient cycle, calibration with EAT for tail pipe emissions and OBD calibration. Subsequent to this, over 20% emission margins vis-à-vis legislative norms, best in class BSFC, low smoke levels and all these without any change in vehicular & DPF calibration were achieved. Overall two prototypes were demonstrated at ARAI and three prototypes were checked for consistency successfully at the customer's end. The end result of this project was successful homologation of the developed engine as per European norms.

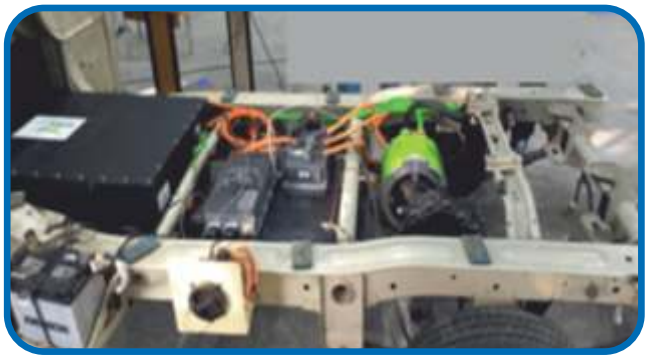
- **600 HP, DI, Diesel Engine for Defence Application**

This ongoing project is on design and development of V-8, 600 HP DI Diesel Engine for defence application. Design vetting and updation of the preliminary design (received from the customer) of V-8 engine was carried out. Further to the review, a modified design with new components and sub-assemblies was arrived at, after a thorough analysis. Based on ARAI's manufacturing drawings and acceptance criteria, the components were manufactured and proto engine was assembled. The engine performance of the proto has been achieved on the test bed and 100 hours of engine testing has been completed. Engine durability trials are currently underway.

V-8, DI, Diesel 600 HP Engine for Defence Application

- **E-axle for 1.5T Small Commercial Vehicle**

E-axle for an IC engine based vehicle has been designed and developed at ARAI. In this development process, the base IC engine vehicle was instrumented with data acquisition system to acquire the road load data and to carry out laboratory and test track level tests. Also, the base engine vehicle performance was simulated and this was subsequently calibrated with the mathematical model (developed with the help of experimental data). Further, a simulation model of e-axle based powertrain was developed and sizing of add-on electrical components like motor, battery, etc. was carried out. Currently, the performance trails of the developed E-axle fitted on the vehicle are underway.



Developed E-axle fitted on 1.5T SCV

- **Other ongoing Design and Development Projects**
  - Hydrogen PEM Fuel Cell Powered Electric 3W
  - 4 Cylinder Engine for CNG application
  - Hydrogen PEM Fuel Cell based Electric Tractor
  - 30W and 65W Electric Water Pump for automotive application
  - E-axle for Light Commercial Vehicles (as a Retro-fitment option)
  - Power Distribution Unit (PDU) for Light Commercial Vehicle & Passenger Car application
  - 4WD Front Axle for 25 HP Compact Tractor

- **Magnesium Material Characterization**

The competency developed in characterization of magnesium alloys for metallurgical and physical properties is being deployed for development of closed die forging process for magnesium alloys. This project is being implemented jointly with an industry partner. Under this project, ARAI is working on development and validation of a component with AZ80 alloy through closed die forging process. This development process will include thermo-mechanical simulation, forging deformation simulation and actual trials to manufacture prototype components.

- **Material Model Cards**

ARAI has built competence in developing advanced material models such as GISSMO, Johnson-Cook, MAT 24 with C & P parameters, Mooney Rivlin, Neo Hookian etc. These material model cards are used for prediction of material behaviour and damage prediction in complex loading conditions. It is mathematical representation of functional relationship between the material behaviour and physical influence (such as loading conditions, state of stress, strain rate etc.). These cards play an important role in design of components, optimization and various test simulations. This method helps in accelerating product development cycle by simulating multiple iterations with various materials, till such time the desired results are achieved. ARAI is also launching project on generating databank of Material Model Cards for

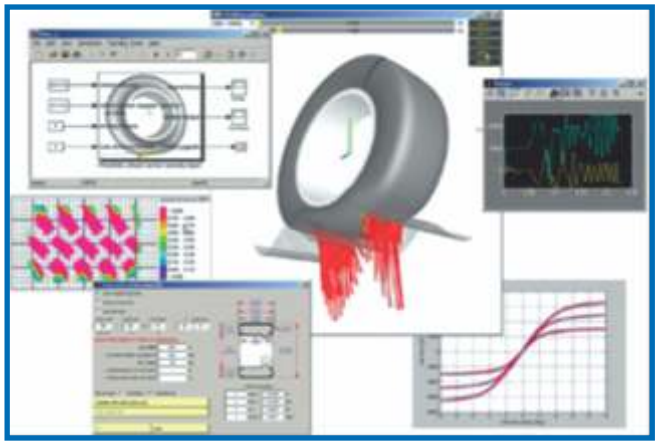
damage prediction of advanced steels and aluminium grades. This databank will help designers for quick material selection and design optimization.

- **Test Methodology for Objective Evaluation of Squeak and Rattle Noises**

Noise from powertrain and moving components have reduced significantly in Electric Vehicles due to advancement in technologies. However, due to this the in-cab noises have become obvious to the passengers, leading to discomfort for the drivers and vehicle occupants. So, in order to eliminate the undesirable component noises during the development phase itself, ARAI had taken up this internal project. Under this project, a component was identified to evaluate squeak and rattle noise issue with the help of physical tests for random and sine excitation profiles. The aim was to subjectively assess the noise using jury rating method and objectively evaluate the same by measuring the noise. Suitable jury evaluation method was selected and recorded sounds were replayed for jury rating. Objective data sound quality metrics, viz., loudness, sharpness, roughness, fluctuation strength and overall Sound Pressure Level (SPL) were measured. Based on this, correlation co-efficient was established to identify the most relevant sound quality metrics that were contributing to particular identified noise issue. Regression analysis was then performed to establish the correlation between subjective and objective data, and a mathematical model was prepared using artificial intelligence and machine learning algorithm. The developed model was able to predict the subjective rating with good accuracy.

- **Tire Characterization Capability**

ARAI has the domain knowledge in holistic road vehicle interaction analysis, along with CAE-MBD tools and road profiles. ARAI has now established the expertise in generating tire digital twin (F-Tire parametrization) from field and lab test data for any Passenger Car & SUV tire by developing test protocols and data processing methodology. Along with this, robust test routine (based on laboratory and vehicle level tests) has also been developed, which helps in achieving accurate tire modelling. Deploying this capability on the established DOE and test procedures, ARAI can help in designing tire, ensuring accurate and efficient collection of tire data. This F-tire fitting tool will use precise data pre-processing techniques for verification and conversion of data. And the data post processing techniques for fine tuning the tire model, will facilitate in accurate representation of the actual tire with the finest fit possible.



F-tire Model Fitting Process

- **Guidelines for Accelerated Validation of Safety Critical Axle Components**

This project, supported by MHI, was for developing draft test standards for identified safety critical

components. It was carried out for analyzing the effect of increased axle loads on the safety critical components viz. axle, wheel rim & bearing, suspension links and leaf springs. The approach for developing the test guidelines involved studying of vehicle systems, identifying safety critical components, finalization of test matrix, road load data collection & analysis, lab testing, development of India specific load spectra and its normalization, studying the effect of increase in axle loads on load bearing components and preparation of test guidelines. Under this project, generic load spectra for HCV ranging from 18.5 T to 55 T was developed along with an algorithm to predict the load spectra for any given axle static load. The developed draft test standards pertain to axles, for trucks & buses, wheel rims & wheel hub bearings for heavy commercial vehicles and suspension links for trucks & buses. With these guidelines, FOS validation of axles, wheel rims, leaf springs, bearings, etc. can be carried out. The developed method also supports deriving accelerated test cycles for any future changes in static axle load norms.

- **Methodology and Scanning System for 3D Digitization of Public Roads and Road Corridors**

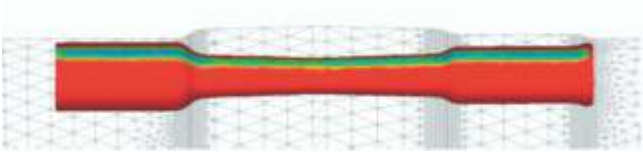
Methodology development for 3D road profile and corridor scanning, and developing a typical database of virtual 3D roads & corridor of identified categories with special events like speed breaker, pot holes, railway crossing, etc. has been undertaken as a project. As a part of this, ARAI has established state-of-the-art 3D LiDAR Scanning & Data processing facility for digitization of public roads/ test tracks/ proving grounds, civil infrastructure, mechanical assemblies/ structures and road infrastructure/ corridors, etc. Also, ARAI has developed algorithms, data processing methodology and software tools for post processing of the raw scan LiDAR data. The developed methodology helps in post processing of data in such a way that it will be suitable for 3D CRG roads and 3D scenarios for ADAS simulation. By making use of the developed methodology, a typical database of Virtual 3D roads and Virtual Proving Ground (VPG) with corridor of identified categories with special events like speed breaker, pot holes, railway crossing etc. has been developed. With these developed capabilities, ARAI can serve the industry's following requirements.

- Provide services for digitization of test track, special events like speed breaker, railway crossing, pothole, etc. and public road with required accuracy.
- Provide readily available database (post processed data) as per customer's format and which will be suitable for vehicle dynamics, durability and ADAS simulations in software like MSC ADAMS, Simpack, IPG car maker, VTD etc.
- Facility established will be useful for non-automotive applications like road geometry analysis, road asset management, road safety audit, etc.

SIMULATION BASED DESIGN SOLUTIONS

- **Development of Special Forming Process**

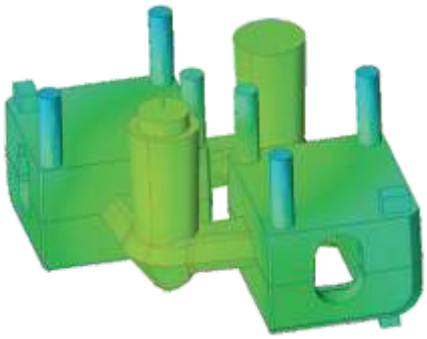
A special Forming Process, i.e. Cross Wedge Rolling (CWR) for improving productivity of crankshaft/ camshaft has been developed for a customer. This new technology developed for Indian Forging industry has yielded higher productivity (by 20 times) along with significant material savings. This new Cross Wedge Rolling forming process has helped in reducing energy consumption by 20%.



Cross Wedge Rolling Process

- **Development of Gravity Casting Process**

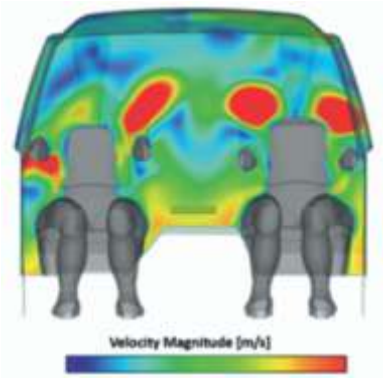
Gravity Casting Process using casting simulation technique has been developed. Due to this process, the challenge of rejections faced by the casting component manufacturer while casting components (corner casting) has reduced. Also, there has been a saving of 2.7 kg per mould in the input material. The casting yield has improved by 3% leading to significant cost saving per batch of samples produced along with lower energy consumption.



Gravity Casting Process

- **Cabin Cooling Optimization using CFD**

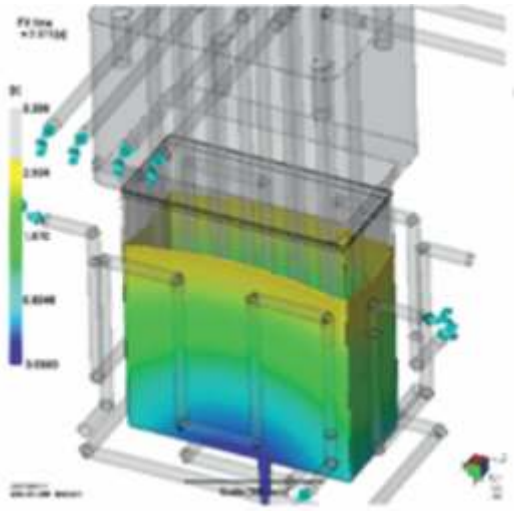
Computational Fluid Dynamics (CFD) simulation technique was deployed for optimizing cabin cooling performance. The desired cooling performance was achieved by designing HVAC system by accurate prediction of important parameters like air flow directivity on driver and co-driver, air velocity mapping on face of driver and co-driver, air flow distribution in cabin and air flow directivity at different flap position. Based on predicted results necessary duct & louver design, HVAC system design configuration, etc. were suggested to customer. The HVAC designed met necessary air flow target in various target areas of the body zones like face, torso, lap/ feet and off-body.



Cabin Air Flow Distribution

- **Plastic Battery Container Thickness Reduction**

Battery container's thickness optimization for undersea defense application has been carried out. In this project, plastic moulding simulation technique was used extensively for designing battery container with optimum thickness along with addressing manufacturing feasibility. The end result of the project was optimization of the component thickness from existing 3.0 mm to 2.2 mm, material weight saving of about 70 gm/part, cost savings of approximately Rs.7.0 per part and elimination of core (insert)-shift phenomena in the new developed part.



Plastic Moulding Simulation

- **Aluminium Seat for Passenger Bus Application**

ARAI along with Jawaharlal Nehru Aluminium Research Design & Development Centre (JNARDDC), Nagpur is working on design and virtual validation of Aluminium Seat for Passenger

Bus application. This consortium project is supported by Ministry of Mines, with JNARDDC as the lead agency. This project involves design of extrusions, seat frame, prototype building of seat and validation testing. Also, development of Aluminium extrusions and selection of material is also part of the project scope.

- **Duty Cycle based Fuel Efficiency Assessment**

This internal project was taken up to develop simulation based methodology to predict fuel consumption for agricultural tractor. It involved selection of tractor, mapping of engine performance, speed-load dependent transmission efficiency measurements along with varying transmission oil temperatures, PTO & drawbar pull measurements, and duty cycle data acquisition for ploughing operation in the farm field. Based on the input data generated, simulation model was built and validated. During validation of the results, it was observed that the fuel consumption predicted by simulation and field measured data were within the acceptable limits. Subsequently, parameter sensitivity analysis was carried to understand the impact of various parameters on the fuel consumption.

EMERGING OPPORTUNITES

- **Indigenous Technology Solutions in ADAS Area**

Technologies like Artificial Intelligence (AI)/ Machine Learning (ML) software models, Big Data analytics, IoT, V2X, etc. are influencing the way automobiles are developed and built today. Convergence of these ever evolving technologies will help in manufacturing of vehicles which are safer, smarter and provide sustainable mobility. To harness the benefits of these advanced technologies, Centre of Excellence (CoE) for Intelligent Vehicle Technology (IVT) is being developed at ARAI with focus areas being Advanced Driver Assistance Systems (ADAS), Intelligent Transport Systems, Autonomous Vehicles, Connected Mobility and Shared Mobility.

This CoE is being established under MHI's 'Enhancement of Competitiveness in the Indian Capital Goods Sector Phase –II' Scheme. The technology solutions envisaged for development at this CoE include AI/ML trained models for Indian traffic objects and infrastructure detection; cost effective vision/ radar based solution for Front Collision Warning System (FCWS); and alert to mitigation adaptation use case for AEBS (Automatic Emergency Brake System).

This CoE will be helpful for developing India specific technology solutions in Intelligent Vehicle Technology domain, framework for safety system development for Indian use cases, data digitalization, verification & validation under standard and abuse conditions, and IP generation. The developed solutions for identified safety systems, can be customized by OEMs/ Tier-1 suppliers to suit their requirements.

- **Drive-By-Wire Platform for ADAS and Autonomous Vehicle**

Drive-by-wire platform enables developing and testing of complex driving automation software in close-to-real-world scenarios. ARAI has built competency in this area and has successfully developed and delivered three drive-by-wire platforms with three different electric vehicles as base vehicles. This development process included installation of a low-level controller along with additional electronic circuits, relays and fuses in a closed controller box mounted in the vehicle's boot. The required vehicle signals were tapped and routed through a wiring harness to the controller box. A DC-DC converter of appropriate specifications was also installed in the vehicle in order to power the entire system. Further, a front panel consisting of switches to turn the system power ON & OFF and to change the vehicle mode from manual to auto and vice versa, was fitted onto the front dashboard. It also consists of indicator LEDs to highlight the vehicle status to the driver. From the safety perspective, emergency switch

and a brake foot switch on the brake pedal were installed. On pressing of these switches, the vehicle immediately switches from auto to manual mode, thereby giving the driver full control of the vehicle. Also, auxiliary systems such as headlamps, indicators, horn and wipers were also automated. The user application software developed in C++ allows the vehicle to be driven without a driver by communicating the actuation signals to the low-level controller over Ethernet via the TCP/IP protocol.

Controller Mounted in Vehicle Boot

IN-HOUSE DEVELOPMENTS

- Methodology for 3D road profile and corridor scanning
- Methodology to predict fuel consumption
- Whine noise reduction methodology
- Test methodology for objective evaluation of squeak and rattle noises
- DVP testing procedure for performance and durability of E-axles and EV-transaxle assemblies
- Testing procedures for evaluation of CV shafts, DUJ shafts and flexible couplings
- Two wheeler fixtures developed for frontal and side pole impact tests
- Mobile barrier trolley for Euro NCAP AEMDB side crash test

High Speed Test of EV Transaxle

Mobile Barrier Trolley as per Euro-NCAP Protocol

Certification and testing is ARAI's strength and this has been acknowledged by various authorities through their accreditations and recognitions as given below.

- ***Recognition by National Traffic Safety and Environment Laboratory (NTSEL), Japan*** to carry out the Tests as per TRIAS 31
- ***Recognition by RDW, Netherlands*** as 'Technical Service Provider' to carry out CoP verification audits
- ***Accreditation by Land Transport Authority (LTA) and National Environmental Agency (NEA), Singapore*** as 'Recognized Overseas Test Lab'
- ***Recognition by Department of Infrastructure, Australia*** to provide Test Reports in compliance to ADRs (Australian Design Rules)
- ***Accreditation by National Accreditation Board for Testing and Calibration Laboratories (NABL)*** for various testing and calibration as per ISO/IEC 17025
- ***Accreditation by National Accreditation Board for Testing and Calibration Laboratories (NABL)*** for Virtual Testing – Only Test Agency in India and one of the very few in the World to obtain accreditation for virtual test scope
- ***Recognition by Bureau of Indian Standards (BIS)*** for 13 safety components as per concerned IS Standard

During the year, ARAI has executed assignments relating to certification, testing, validation, evaluation, data analysis etc. Details of some of the projects are given below.

CERTIFICATION & TESTING PROJECTS

- **Type Approval & Certification**
  - Over 500 Basic Certificates issued for BS-VI OBD II Norms across all categories
  - Over 200 Family Certificates issued for Advance Battery Safety Norms [AIS-156 Part 2 & AIS-038 (Rev. 2) Part 2] for all battery operated vehicles
  - Certification as per WVSCoP
  - Refrigeration Vans, Food Trucks, Cash Vans, Motor Caravans, Trailers and Truck Body Code Standards
  - Mass Emission Testing as per Japan WLTP as per TRIAS 31–J042(4)–02
  - 2-wheeler Emission testing as per Japan TRIAS 31-J044GTR002-01 Emission Regulation
- **Noise Compliance for Generator Sets**
  - Diesel Genset models as per CPCB guidelines
  - Extension of Type Approval Certificates to Generator Original Equipment Manufacturers (GOEMs) as per Central Pollution Control Board (CPCB) guidelines
  - Conformity of Production (COP) tests for OEM & GOEM plants
  - Conformity of Production (COP) tests for Petrol Genset sets
  - Conformity of Production (COP) tests for Gas Generator sets

EVALUATION AND VALIDATION PROJECTS

- **Evaluation of M15 Fuel on Gasoline 2W & 4W**

The objective of the project was to evaluate and assess new and in-use 2W and 4W vehicles and engines with M15 Fuel. This project was carried out by ARAI in association with Indian Oil Corporation Ltd. (IOCL) & Society of Indian Automobile Manufacturers (SIAM). In this project, mass emission tests on 2-wheelers (BS-III, BS-IV & BS-VI), and 4-wheelers (BS-IV & BS-VI) with E10, M15 and E10+M15 (50%-50% vol.) were conducted. Similarly, evaporative emission tests on BS-VI 2-wheelers and 4-wheelers were conducted. Also, other tests like engine durability,

on-road durability and drivability were carried out. For further decisions, a comprehensive report has been submitted to Government of India.

- **Impact of E20 Fuel on E10 Compatible Vehicles**

The objective of the project was to evaluate and assess new and in-use 2W & 4W vehicles and engines with E20 Fuel. This project was carried out by ARAI in association with IOCL & SIAM. Based on directives of MoPNG, Government of India, E20 project was sponsored by Government Oil Marketing Companies (OMCs). This project involved various tests like mass emission test, evaporative emission tests and study of material compatibility for non-metals and also, fuel economy. In case of plastics, tests were conducted on three plastics PA6 GF30, PP TD20 and PA46 and the results for these indicated similar changes in properties in E20 as compared to E10. Further to the tests, it was observed that all test vehicles passed mass emission tests with E20 fuel when compared to their original emission compliance. Regarding fuel economy for E20 as compared to E10 fuel, decrease of 5 to 6 % for 2-wheelers and 2 to 3% for 4-wheelers was observed. The comprehensive report of the activities has been submitted to Government of India and Government OMCs.

- **Noise Barrier in-situ Evaluation**

Noise barriers are used to address the noise pollution concern faced by people living in the vicinity of urban roads and highway corridors. ARAI has developed a methodology to evaluate acoustic performance of noise barriers in lab, as well as in-situ condition as per EN 1793/ EN 1794 for acoustic and non-acoustic properties. Deploying this methodology, ARAI has evaluated the barrier panels in lab and also, at actual sites like express way, highways, roads – in-situ test conditions for many customer projects. Some of these projects were for different barrier suppliers for MSRDC's Samruddhi Expressway. Through these projects, ARAI's capability was demonstrated to MSRDC officials during in-situ evaluation.

Typical Set up for in-situ Evaluation of Noise Barrier

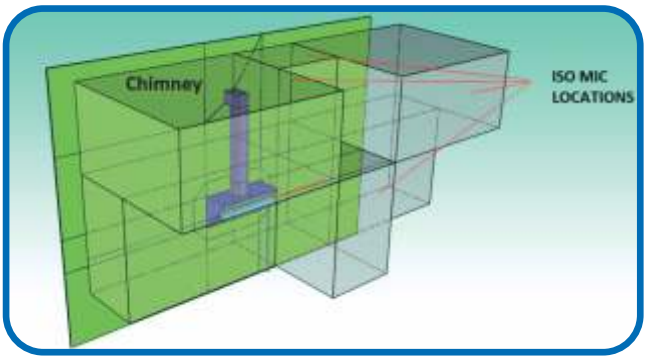
- **Vibration Reduction in Dynamic Conditions**

This project was on addressing battery mounting frame failure issue of an Electric Scooter. Vibration test was conducted on the vehicle at different vehicle operating as well as various road conditions like smooth, rough, pave, etc. On analysis, it was observed that the chassis level vibrations were getting transferred to battery mounting frame, as there was no provision for vibration isolation. Considering this aspect, design changes were suggested for battery mounting frame, in order to isolate the vibrations in a better way, along with appropriate rubber isolators. These design changes and rubber isolators helped the customer in reducing vibration levels at battery mounting frame and battery.

- **Virtual Simulation – SEA Technique**

Virtual Simulation Statistical Energy Analysis technique is used at ARAI for noise reduction and for target noise level achievement. During the year, this technique was deployed for household chimney noise reduction. Herein, noise source mapping was carried out on existing chimney to understand source potentials and frequency signature. SEA acoustic simulation model was then built and contribution analysis was carried out, to identify major noise paths. This was followed by optimization for noise reduction of 10 dB through virtual iterations for parameters like suction louvers, blower flow path and acoustic insulation and at the same time, flow performance of the chimney was maintained. Based on this, solutions on blower concept, suction path, acoustic insulation and louver design were suggested. The proto chimney (with the new design) was tested inside the anechoic chamber and noise reduction of 10 dB was demonstrated. The simulation predictions arrived at were observed to be within 1 dB of test results, indicating robustness of design solution.

This SEA technique was also used for in-cab noise of LCV successfully. It involved studying of in-cab noise levels at product development stage, wherein physical proto was not available. Subsequent to carrying out of contribution analysis to understand dominant air borne paths and panel contributions, acoustic trim optimization was done to achieve targeted noise levels.



Noise Reduction using SEA Technique

- **Clean Air Project in India (CAP India)**

This ongoing project is on implementing 'Clean Air Project in India' (CAP India Project), and is supported by The Swiss Agency for Development and Cooperation (SDC). It is being implemented by a consortium of institutions led by TERI to assist stakeholders such as MPCB and PMC in effective implementation of action plan for air quality management. ARAI is working on the Pune region component of this project. During the year, development of Pune district emission inventory for baseline year 2021 was completed and the report was submitted to MPCB. This emission inventory is used as an input to chemical transport model i.e. WRF-Chem for assessment of source contributions from different polluting sectors in the Pune region. The WRF-Chem model has been configured on high-performance computing resources at ARAI and winter season simulations are in progress.

As a part of this project, ARAI has prepared a gridded emission inventory for Pune district as an initiative towards air quality management. The report titled 'Development of Emission Inventory for Pune District under the Clean Air Project in India (CAP India)' was launched at a press conference held on 19th September 2022. This inventory identifies key sources of air pollution and their contributions.

Launch of Pune District Emission Inventory Report

An event named 'Samanvaya: Living in Harmony with Nature' was organized as part of the CAP India Project by ARAI along with The Energy and Resources Institute (TERI) and Pune Municipal Corporation (PMC). It was conducted at two prominent shopping malls in Pune. The objective of this event was to sensitize the citizens of Pune on Air Pollution, Climate Change and Environment.

MEASUREMENT AND ANALYSIS PROJECTS

- **Pass-by Noise Source Identification and Reduction**

The objective of this project was to evaluate the proto vehicle as per UN regulation R41, including Additional Sound Emission Provision (ASEP) requirement. On testing, it was observed that the noise was almost 4 dB higher than the regulation requirement. During evaluation, exhaust system was identified as the major dominant source for pass-by noise. Tuning of the exhaust system was carried out, which enabled in reducing the pass-by noise and also, at the same time, it was ensured that there was no effect on the vehicle performance, viz. back pressure. With these changes, the vehicle successfully met UN regulation as per R41, including ASEP requirements. This has enabled the customer to launch the vehicle in overseas market.

Pass-by Noise Testing as per UN Regulation R41

Similar to the above project, baseline pass-by noise evaluation test was conducted on HCV as per upcoming new pass-by noise evaluation standard IS 3028-2. Also, noise source identification test was carried out on the vehicle during pass-by noise test to identify the major sources for increase in exterior noise. Subsequent to the analysis of test results, exhaust system and engine were identified as dominant sources for increase in pass-by noise. In order to address the issue, damping treatment on engine front cover, oil sump and tappet cover were carried out and further to which, an improvement of around 2dB was achieved. Also, increasing the Transmission Loss (TL) and Insertion loss (IL) of the exhaust system were recommended in case of exhaust noise.

- **Emission Inventories Development**

This is an ongoing project, wherein, ARAI is part of consortium of National Supercomputing Mission (NSM) for Urban Modelling project. This project, which commenced in 2020-21, is for development of high-resolution emission inventories and conducting dispersion modelling analysis for four Indian cities, viz. Bengaluru, Pune, Bhubaneswar and Ahmedabad. During the year 2022-23, primary survey for emission inventory data collection in Bengaluru city along with data analysis, including classified vehicle counts, parking lot surveys, residential fuel usage, hotel and restaurants fuel usage, DG sets, and road dust re-suspension were carried out. Further, high resolution i.e. 1 x 1 km2 emission inventory for Bengaluru city for baseline year 2022 has been developed. Also, chemical analysis of Particulate Matter ($PM_{2.5}$) using speciation samplers at five locations in Bengaluru city and development of SOPs for dispersion modelling using AERMOD model were carried out.

- **Emission Inventory and Source Apportionment Studies**

ARAI is working on emission inventory generation of pollutants and carrying out particulate matter (PM_{10} & $PM_{2.5}$) source apportionment for Angul-Talcher, Rourkela, Kalinga Nagar – Jajpur Road in Odisha. Also, another similar project is being undertaken for Bhubaneswar-Cuttack and Balasore regions. These projects are being undertaken for State Pollution Control Board, Odisha (OSPCB). The samples for pollutants including $PM_{2.5,}$ PM_{10}, gases and VOC have been collected in these projects. Apart from monitoring, primary surveys were conducted in these regions for vehicles, residential, hotels, DG set sectors. Based on the findings, interim reports have been submitted to OSPCB for both these projects. Also, emission inventory and source apportionment study of Gurugram, Sonipat and Panipat for Haryana State Pollution Control Board (HSPCB) is being undertaken.

Sampling Campaign for Source Apportionment Studies

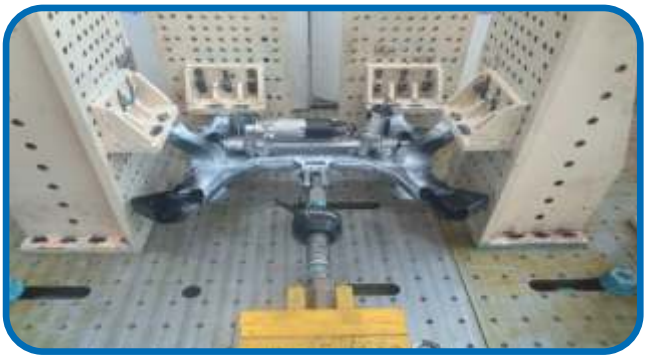
- **Chemical Transport Modelling (CTM) for Surface Ozone Production**

This project was carried out in collaboration with Indian Institute of Tropical Meteorology (IITM), Pune. This study was for understanding the surface ozone production over Delhi-NCR region using regional chemistry transport model. The project focused on historic air quality trends in recent years, sectoral emissions of different air pollutants and summer time surface ozone simulations for the year 2022.

Other Validation & Testing Assignments

- Validation and performance measurement of electric scooters
- Static and endurance testing of different types of engine mounting brackets
- Static stiffness and strength testing of front and rear sub-frames
- Rotary torsional fatigue testing of flex plate assemblies
- Strain and acceleration measurement for structures of artillery system and armoured cabin
- Multi-axial durability test of cooling module assembly
- Bending strain measurement on rocker arm bolts
- Shock mitigation test on high speed boat seat
- Metro and Loco bogie frame validation
- Design validation of SONAR system
- Vertical vibration test for export quality portable fuel tank
- Durability test for audible warning devices
- Effect of hole expansion ratio on energy absorption behaviour of advanced high-strength steel grades
- Load capacity evaluation for e-trolley (airport application)
- Efficiency mapping of worm gearboxes at various load and speed conditions
- Machine-in-loop (MIL) and Hardware-in-loop (HIL) testing
- Experimental modal analysis and dynamic stiffness evaluation for BIW structure
- Tyre noise evaluation
- Gear Whine noise reduction on tractor
- Noise testing on electric material handling vehicles

- Lab and on-site evaluation of cuboid unit/ furniture ensembles
- Sound power evaluation of white goods in hemi anechoic chamber
- Testing and validation of e-powertrain components
- Emission testing for alternate fuel vehicles (M15 & E20 and their blends)
- Real Drive Emission test on gasoline passenger cars on chassis dynamometer
- Fuel economy evaluation based on WMTC driving cycle
- Summer trials on HCV vehicles in test cell for ECU calibration
- Assessment of existing diesel genset and off-road engines for diesel-ethanol blends
- Material compatibility of polymers with E20 (as per SAE J1748)



Static Stiffness and Strength Testing of Front and Rear Sub-frames

Multi-axial Durability Testing of Cooling Module Assembly

Durability Test for Audible Warning Devices

Machine-in-Loop setup for Vehicle Components Testing

Efficiency Mapping of Worm Gearbox

Tyre Noise Evaluation

ROLE AND CONTRIBUTION IN VARIOUS NATIONAL AND INTERNATIONAL COMMITTEES/ FORUMS

Automotive Industry Standards Committee (AISC)

- Secretariat Services to AISC
- Participated in 2 meetings of AISC and several meetings of Technical Panels working under AISC

CMVR - Technical Standing Committee

- Technical Secretariat Services to CMVR-TSC
- Participated in 1 meeting of CMVR-TSC

Standing Committee on Implementation of Emission Legislations (SCoE)

- Technical Secretariat Services to SCoE

CPCB Standing Committee

- Technical support to CPCB Standing Committee
- Contribution in formulation of standards on noise as a Member of National Committee

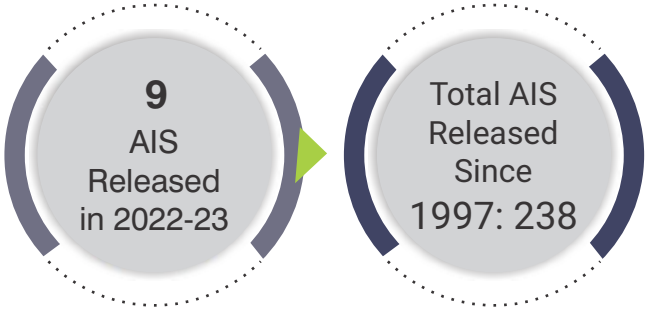
Bureau of Indian Standards (BIS)

- Technical guidance / expertise to BIS
- Chairmanship of 6 TED (Transport Engineering Department) Sectional Committees of BIS

WP. 29

- Technical Secretariat Services for National Committee on WP.29 matters and Core Group on WP.29 related activities
- ARAI was part of 15 delegations that participated in Technical Sessions of WP.29 and GR meetings during the year
- Coordinated WP.29 India sub-group activities on GRPE, GRE, GRBP, GRSP, GRSG, GRVA

FORMULATION OF SAFETY STANDARDS



NEW AIS, REVISED AIS AND AMENDMENTS TO EXISTING AIS

New AIS

(i) AIS-149: Conformity of Production (CoP) Procedure for verifying compliance to Constant Speed Fuel Consumption Norms for vehicles with GVW/GCW exceeding 3.5 tons

(ii) AIS-161: Procedure for Accreditation of Testing Agencies for Notification under Rule 126 of CMVR

(iii) AIS-166: Automotive Vehicles – Protective Devices for Two Wheeled Motor Vehicles – Requirements

(iv) AIS-169: Provisions for Adapted Vehicles of categories: (a) M1 to be used by or for person with disability; (b) N1 to be used by person with disability; and (c) M2 not exceeding 3.5 ton to be used for person with reduced mobility

(v) AIS-173: Requirements for Approval of Quiet Road Transport Vehicles (QRTV) with regard to their reduced audibility

(vi) AIS-174: Specific Requirements for Electric Power Train Construction Equipment Vehicle(s)

(vii) AIS-177: Type Approval Requirement for vehicle of category L2-5 of Electric Power Train

(viii) AIS-194: Specific Exemptions for Armoured Vehicles from the notified provisions under the Central Motors Vehicles Rules, 1989

Revised AIS

(i) AIS-035 (Rev. 1): Automotive Vehicles - The Arrangement of Foot Controls of Vehicles

Amendments to Existing AIS

(i) Amd. 2 to AIS-004 (Part 3) Automotive Vehicles Requirements for Electromagnetic Compatibility

(ii) Amd. 1 to AIS-004 (Part 3) (Rev.1) Requirements for Electromagnetic Compatibility

(iii) Amd. 11 and Corrigendum 1 to AIS-007 (Rev.5) Technical Specifications to be submitted by the Vehicle Manufacturer

(iv) Amd. 3 and 4 to AIS-009 (Revision 1) Installation Requirements of Lighting and Light-signaling Devices for L Category Vehicles, their Trailers and Semi-Trailers

(v) Amd. 2 to AIS-017 (Part 6) Whole Vehicle Safety Conformity of Production (WVSCoP)

(vi) Amd. 2 and 3 to AIS-024 (Rev.1) Type Approval of CNG Operated Vehicles

(vii) Amd. 8 to AIS-025 (Ver.3) Type Approval of LPG Operated vehicles

(viii) Amd. 2 and 3 to AIS-038 (Rev. 2) Requirements for Electric Power Train of Vehicles and REESS

(ix) Amd. 13 to AIS-052 (Rev.1) Code of Practice for Bus Body Design and Approval

(x) Amd. 1 to AIS-059: Recording Equipment in Road Vehicles (Tachograph)

(xi) Amd. 6 to AIS-065 Vehicle Identification Numbering System (VIN)

(xii) Corrigendum 1 to AIS-071 (Part 2): Control Location and Operation Requirements

(xiii) Amd. 4 to AIS-099: Protection of the occupants in the event of a Lateral Collision

(xiv) Amd. 7 to AIS-113 Automotive Trailer Code

(xv) Amd. 1 to AIS-135 Fire Detection, Alarm and Suppression Systems for Buses

(xvi) Amd. 1 to AIS-137 (Part 1) TA and COP of L2 category vehicles for Bharat Stage VI emission norms

(xvii) Amd 2 and 3 to AIS-137 (Part 1): TA and COP of L2 category vehicles for Bharat Stage VI emission norms

(xviii) Amd 1, 2 and 3 to AIS-137 (Part 2): TA and COP of L5 category vehicles for Bharat Stage VI emission norms

(xix) Amd. 5, 6 and 7 to AIS-137 (Part 3) TA and COP of M and N category vehicles having GVW not exceeding 3500 kg for Bharat Stage VI Emission Norms

(xx) Amd. 1 to AIS-137 (Part 6) Administrative Procedure for TA and COP for M and N Category Vehicles

(xxi) Amd. 1 to AIS-137 (Part 7) TA and COP of Agricultural Tractors, CEV & Combine Harvester for Emission as per A: Bharat Stage (CEV/TREM)-IV PART-7-B: Bharat Stage (CEV/TREM)-V

(xxii) Amd. 1 to AIS-137 (Part 9) TA and COP of Quadricycle (L7 category) vehicles for Bharat Stage VI Emission Norms as per CMV Rules 115, 116 and 126

(xxiii) Amd. 1 to AIS-139: Specific Requirements for Double Deck Buses

(xxiv) Amd. 1 to AIS-142 Tyres Rolling Sound Emissions and/or to Adhesion on Wet Surfaces and/or to Rolling Resistance

(xxv) Amd. 2 to AIS-146: Requirements applying to stands fitted in two wheeled motor vehicles

(xxvi) Amd. 1 and Corrigendum 1 to AIS-150 Approval of Vehicles of Categories M2, M3, N and T with regard to braking

(xxvii) Amd 2 and 3 to AIS-156: Requirements for L Category Electric Power Train Vehicles

(xxviii) Amd. 2 and 3 to AIS-160 Safety Requirements for Construction Equipment Vehicles

AIS Standards Finalized (To be released in the Year 2023-24)

(I) AIS-001(Part 1) (Rev. 2) Devices for Indirect Vision – Specifications

(ii) AIS-002(Part 1) (Rev. 2) Devices for Indirect Vision – Installation

(iii) AIS-083 (Rev. 1) Headlamp Cleaners of Power-Driven Vehicles

(iv) AIS-100 (Rev. 1) Pedestrian Protection Systems

(v) AIS-101 (Rev. 1) Protection of Fuel Systems in Rear Impact

(vi) AIS-162 Advanced Emergency Braking Systems (AEBS) for M2, M3, N2 and N3

(vii) AIS-178 Adapted Vehicles two wheelers, three wheelers and tricycles

(viii) AIS-180 Vehicles for transportation of Dangerous Goods

(ix) AIS-181 Approval of Tank Vehicles with regard to Rollover Stability

(x) AIS-182 ISOFIX Anchorage systems

(xi) AIS-183 Type Approval Requirement for Three wheeled moped of L1-1 category

(xii) AIS-184 Driver Drowsiness and Attention Warning System

(xiii) AIS-186 Blind Spot Information System (BSIS)

(xiv) AIS-187 Moving off Information System (MOIS)

(xv) AIS-189: Cyber Security and Management System (CSMS)

(xvi) AIS-190: Software Updates and Management System (SUMS)

(xvii) AIS-193: Automated Vehicles Steering Systems and Methods of Evaluation

(xviii) AIS-196 Replacement Wheels for Passenger Cars and their trailers

COOPERATION WITH BUREAU OF INDIAN STANDARDS (BIS)

Indian Standards on automotive safety components and systems are formulated in various TED (Transport Engineering Department) Sectional Committees of BIS. Transformation/ adaptation of AIS into IS is one of the major activity in TED. Additionally, ARAI provides technical guidance/ expertise to BIS and also, has the responsibility of Chairmanship of following TED Sectional Committees.

- TED 4: Automotive Braking Systems, Vehicle Testing, Steering and performance Evaluation Sectional Committee
- TED 6: Automotive Body Chassis Accessories and Garage Equipment
- TED 22: Transport Tractors, Trailers and Industrial Trucks
- TED 26: Automotive Vehicles Running on Non-Conventional Energy Sources
- TED 29: Passive Safety Crash Protection Systems
- TED 34: Springs and Suspension Systems Sectional Committee Sectional Committee

CMVR AND ITS IMPLEMENTATION

CMVR Technical Standing Committee

CMVR-TSC has identified following subjects of national importance for formulation of Policy/ Norms/ Standards and their implementation:

- Advanced Driver Assistance Systems
- Event Data Recorder
- Lane Keep Assist Systems
- Revision of standards on light and light signaling devices

INTERNATIONAL COOPERATION AND HARMONIZATION OF NATIONAL STANDARDS

ARAI provides Technical Secretariat for National Committee on WP.29 matters and Core Group on WP.29 related activities. India became signatory to 1998 Agreement under UN ECE as part of our commitment to harmonization of automotive regulations. Under this agreement Global Technical Regulations (UN GTRs) are being formulated. During this year, India has voted in favour of following documents.

- Proposal for Amendment 5 UN GTR No. 2 (Worldwide Motorcycle Emission Test Cycle (WMTC))
- New UN GTR No. 23 on durability of after treatment devices for two and three-wheeled motor vehicles

Additionally, India's Durability Driving Enforcement Procedure for two-wheeled vehicles was included in the Compendium of Candidates for UN GTRs.

Participation in Technical Sessions of WP.29 – Highlights

During the year, India participated in several technical sessions of WP.29, its subsidiary working parties and Informal Group meetings. Indian delegations participated in the GR and

WP.29 sessions through virtual platform and physical meetings. Secretariat at ARAI provided technical and other support to these national delegations for attending sessions at United Nations, Geneva, Switzerland. Director –ARAI participated in the 85th convention of Inland Transport Committee held in Geneva, as part of Indian delegation along with Honorable Minister of State for Road Transport and Highways (MoRTH) and other senior officials from MoRTH.

TYPE APPROVAL CERTIFICATION

ARAI has carried out Type Approval and Certification for several safety components and emission norms as per safety standards and emission norms for different categories of vehicles. Also, it has initiated work for safety norms to be implemented in 2023-24. Major highlights are given below.

Key Safety Standards and Emission Norms Implemented in 2022-23:

Safety Standards:

- Implementation of Revised Brake Standard IS 11852 (2013) including endurance braking system for all models
- Implementation of Revised Brake Standard AIS 151 or IS 15986 (2015) for all models
- Implementation of Electronic Stability Control System (ESC) (if fitted) for all models
- Implementation of Brake Assist System (BAS) (if fitted) for all models
- Implementation of Whole Vehicle Safety CoP
- Implementation of AIS-163 (Special Purpose Vehicles Cash Van and Mobile Canteen)
- Implementation of AIS-164 (Insulated Vehicles)
- Implementation of AIS-167 (Two-Wheeled First Responder – Fire)
- Implementation of Fire alarm and protection system in occupant compartment for M3 Category Type III Buses and School Buses and Electronic Stability Control System (ESC)
- Use of harness for children below age of four years
- Implementation of AIS-163 Cash Vans
- Implementation of revised IS 15636 for Commercial vehicles (N, M2, M3, T3 and T4) and AIS-142 on Rolling resistance, Wet Grip and Rolling Sound Emissions
- Implementation of AIS-140 for dangerous goods carrying N2 and N3 category vehicles (New Models: 1st September 2022 and Existing Models: 1st January 2023)
- Implementation of AIS-038 (Rev. 2) and AIS-156 for Electric Vehicles
- Provisions on Registration and Functions of Vehicle Scrapping Facility
- Implementation of AIS-194 on Armored Vehicles under Rule 125-L
- Vehicles registered in BH-Series
- Exemption of imported safety glass from BIS Quality Control Order

Emission Standards:

- Implementation of TREM IV norms
- BS-VI retro fitment provisions
- Implementation of Ethanol Blended Petrol with percentage of ethanol up to twenty per cent

Notifications on Safety Standards and Emission Norms for Implementation in 2023-24:

Safety Standards:

- Implementation of IS 2553 (Part 2): 2019 Safety Glass
- Improved Braking Performance including Electronic Vehicle Stability Control System (EVSC) for Buses covered in AIS-153

- Implementation of QCO for Wheel Rim used in L, M, N, T3 and T4 category vehicles
- Constant Speed Fuel Consumption (CSFC) for vehicles above 3.5 ton as per IS 11921
- GSR 888 (E) dated 19th December 2022 regarding insertion of component CoP of Traction Batteries under CMV Rule 124 compliant to AIS-048/ AIS-038
- Non-renewal of Certificate of Registration of Government Vehicles older than 15 years

Emission Standards:

- Constant Speed Fuel consumption (CSFC) for vehicles above 3.5 ton as per IS 11921 and COP as per AIS 149
- Indian Real Driving and Conformity factor
- OBD II/ OBD II-A (as applicable) emission norms
- Revised emission limits for Gensets upto 800 kW and portable Gensets upto 19 kW

Notifications for Implementation of Safety Standards and Emission Norms infuture after 31st March 2024:

Safety Standards:

- Construction Equipment Vehicle (CEV) Phase II

Emission Standards:

- OBD Stage II-B Thresholds for BS-VI vehicles for 2/3 W motor vehicles
- Implementation of TREM/ CEV V norms for Agricultural Tractors and CEV

Note: Please refer concerned AIS and relevant notification for applicability of the standard to the vehicle category.

Standby Electric Drive

Weather-ometer

Walk-in chamber for Environmental Testing

High Voltage Battery Charger

Forced Ventilation Oven

Rotating Bending Fatigue Testing Machine

- Mobile Barrier Trolley (designed and developed in-house in accordance to AE-MDB Test Protocol of Euro-NCAP)
- Facility for Electrical Transients for 12/24/48V Systems as per ISO and JASO Standard
- Facility for Magnetic Field Immunity as per MIL and ISO Standard
- Facility for Magnetic Field Exposure Level Tester as per ICNIRP 2010
- DC Power Source for testing EV drivetrain up to 250 kW
- Particle Number Measurement system
- Vortex Mixer
- Gas Analyzer to measure relative volumes of carbon monoxide, carbon dioxide, hydrocarbons, oxygen and nitric oxide in the exhaust gases of motor vehicles
- CNG Pressure Reduction System
- Power Analyzer
- Fuel Pressure Regulator
- Blow-by-meter
- 400 kW Engine Coolant Conditioning unit
- Cyclic Salt Spray Chamber
- Creep Testing Machine
- Software for material model card generation
- Rotating Bending Fatigue Testing Machine
- Forced Ventilation Oven
- Portable Gas Analyzer
- Sampling Pump
- Stack Emissions Monitoring System for dioxins and furans

Human Capital is a key to our success and so, we are committed to making ARAI a place where our people have the opportunity to contribute, grow, feel valued and have a profound sense of belonging. We believe that culture and work environment, together with employee engagement, drives innovation and performance. Accordingly, we focus on cultivating a work culture that nurtures and develops talent. This enables us to harness the power of our employees' passion and commitment, and differentiate ourselves through our people-centric approach.

Employee Well-Being

Employee well-being is fundamental for building and driving performance. So, the health, safety and well-being of our employees is of utmost importance at ARAI. Supporting the well-being of our employees benefits them not only as individuals, but also benefits us and the communities in which we live and work. We are committed and determined to prevent accidents by continually eliminating risks and by enabling our employees to adopt safe behaviour. Some of our initiatives for our employees undertaken for employee well-being during the year included annual medical check-ups, insurance coverage (term life, group medical & group personal accident), COVID-19 vaccination & booster dose drive for employees and their families, yoga sessions and provision of transport facility for Chakan locations at subsidized rate.

Learning and Development

We focus on nurturing talent and fostering a culture of continuous learning and development. During the year, we continued to invest in upskilling of our employees through our training and knowledge sharing programs to ensure that our employees have the skill sets in-line with industry's

Swachhata Pakhwada

Republic Day Celebration

Blood Donation Camp

International Women's Day

future needs. We accelerated use of virtual and digital platforms to build scale and intensity in training our employees for continuous learning and engagement, and delivered over 25,000 man-hours of training to our employees. Through our Learning Management System (LMS) platform on Human Resource Management System (HRMS), we have introduced some training e-modules and also, subscription based online training programs, which can be attended by our employees as per their convenient timing. This initiative of digitizing of HR processes through HRMS, has made good progress, with modules like HR Foundation, Work Force Management, Payroll, Performance Management and Learning Management System (LMS) being tested for accuracy. The other modules like Tour/ Travel Management and Recruitment are being planned in the later stage.

Employee Engagement

We are committed to making ARAI a place where people can thrive, by creating a work environment with highly engaged employees. Our engagement with employees continued to strengthen, as we celebrated various events like Annual Day, Independence Day, Republic Day, International Women's Day, Rashtriya Ekata Divas, National Safety Week, Hindi Pakhwada, Swachhata Pakhwada, Blood Donation Camp, etc. during the year. These initiatives have supported our people to stay motivated to deliver their best at all times and also, develop a strong sense of belonging.

- 'Optimization of Casting Process to Increase Component Yield Using Inspire Cast' by A. R. Kumbhar in September 2022 at Altair Conference
- 'Results Prediction of Heat-treatment Process by Simulation & its Reality' by S. A. Kulkarni in September 2022 at Forging & Foundry Technology Center
- 'Investigation of Vehicle Cable Harness in an Electric Vehicle for EMC performance using FEKO' by S. S. Dandge in September 2022 at Altair Conference
- 'The Characterization of Automotive Radar System' by S. S. Dandge in September 2022 at Altair Conference
- 'AI-ML- ARAI Perspective' by R. S. Mahajan in September 2022 at Altair Conference
- 'Electric Vehicle Prospects & Challenges with Focus on Materials' presented by Dr. P. K. Ajeet Babu in September 2022 at the virtual Workshop titled "Next Generation Steels for Future Mobility" organised by R&D Division, Tata Steel Ltd.
- 'Tyre Noise Simulation' by M. A. Patwardhan in October 2022 at SAE Conference
- 'Effect of solutionising on change in phase morphology, mechanical behaviour & corrosion behaviour for AZ series as cast automotive magnesium alloy components' by A. S. Waghmare, P. B. Deshmukh, S. Setia, P. S. Phale and M. S. Jambhale, in October. 2022 at SAEINDIA International Mobility Conference (SIIMC 2022)
- 'Study of Strain Ratio Effects on Low Cycle Fatigue Behaviour of Dual Phase (DP) Steel' by S. R. Deshmukh, A. A. Manwatkar in October 2022 at SAEINDIA International Mobility Conference (SIIMC 2022)
- 'Simulation of shell barrel interaction using LS Dyna' by N. A. Kulkarni in November 2022 at Oasys LS-DYNA Indian users meet 2022
- 'Bringing Real World to Simulation for Virtual Testing of Automated Driving (AD)' by N. A. Pachhapurkar and J. G. Kale in November 2022 at MathWorks Conference 2022
- 'Development of e-bus with light weight' by M. A. Patwardhan in December 2022 at LWT Conference
- 'Role of temperature and strain rate on evolution of microstructure, flow stress and constitutive equation in hot deformation of AZ80A Mg alloy' published by Dr. P. K. Ajeet Babu in International Journal of Material Forming
- 'Performance, Durability and NVH Evaluation of Drivetrain Components at ARAI' published by Dr. N. H. Walke, S. K. Jain, S. Y. Badgujar, A. A. Sabane, V. K. Siddhartha and P. B. Shroff in SAEINDIA Silver Jubilee Technical Bulletin
- 'Comprehensive Design of Small Electric Vehicle for Powertrain Optimization for Optimum Range with Weight and Size Reduction' published by Y. K. Bhateshvar, Mohammad Rafiq B Agrewale, Dr. K. C. Vora and S. Vignesh in April 2022 in Planning of Hybrid Renewable Energy Systems, Electric Vehicles and Microgrid Energy Systems in Electrical Engineering, Springer, Singapore
- 'Gear fault detection using noise analysis and machine learning algorithm with YAMNet pretrained network' published by K. P. Wani and Sanjana Patil in September 2022, in Materials Today
- 'Modal analysis of plate to analyze the effect of mass stiffeners using the Chladni plate approach' published by K. P. Wani and Shubham Gaygol in September 2022, in Materials Today

- 'Development of unified diagnostic services on CAN using MATLAB and Arduino' publsihed by Y. K. Bhateshvar and Sumeet Desai in September 2022, in Materials Today
- 'Design of semi-actively controlled battery-super capacitor hybrid energy storage system' published by Y. K. Bhateshvar and Rajat Powade in September 2022 in Materials Today
- 'Development of sensor data fusion for obstacle detection for electric mini tractor' publsihed by Mohammad Rafiq B Agrewale, Y. K. Bhateshvar and Mandar Shinde in September 2022, in Materials Today
- 'Optimal brake force distribution in motorcycle for straight-line braking' published by Mohammad Rafiq B. Agrewale and A. Phalke in September 2022, in Materials Today
- 'Development of low-cost Data Logger system for capturing Transmission Parameters of Two-Wheeler using Arduino' published by N. A. Sakle and Akshay Yadav in Elsevier Materials Today
- 'Design and Testing of miniature BIW model using multi-material light weighting technology for M1 category vehicle' published by N. A. Sakle and Pratik Baisane in Elsevier Materials Today
- 'Characterization of AZ31B, AZ61A and AZ80A magnesium alloys with an emphasis on temperature compensation for their application to a hot forging' published by Dr. P. K. Ajeet Babu in Journal of Manufacturing Processes Volume 84, December 2022
- 'Design Optimization in Aluminium Forging Process for Automotive Application' published by A. R. Kumbhar and P. A. Nirmal in Aluminium in India (Jan 2023 issue)

New Services & Capabilities

- Testing, validation and certification of Traction Batteries as per latest standards viz. AIS-038 Rev 2 and AIS-156
- Testing, validation and certification of Battery Packs as per latest standards viz. AIS-038 Rev 2 and AIS-156
- Testing and validation of e-powertrain components
- eCall (Emergency Call) Service
- AIS-140 Certification of backend server system for Vehicle Tracking and Emergency Buttons
- Whole Vehicle Safety Confirmatory of the Product (WVSCOP) certification as per AIS-017 Part 6
- New COP service for HDFE
- BS-VI Stage 2 certification
- EV powertrain validation using HeRTS HIL System
- Battery Crush testing – Cell and Battery Level
- EV battery charging, discharging, startability and range determination in summer/ winter conditions
- Latin-NCAP CRS Installation Assessment
- 3-D Scanning of High Voltage Batteries
- Tyre Rolling Resistance test as per AIS-142 (for national and international tyre manufacturers)
- Certification for tyres & wheel rims as per requirements of Brazil (Inmetro), Philippines and Indonesia
- Evaluation of AIR Brake hose – plastic type as per FMVSS106, SAE J2494-3, MPAPS F7006, SAE J 844, SAE J 1131
- Mass Emission testing as per Japan WLTP as per TRIAS 31–J042(4)–02
- 2-wheeler emission testing as per Japan TRIAS 31-J044GTR002-01 Emission Regulation
- Emission testing support for new alternate fuel vehicles, viz. M15 & E20 and their blends
- Laboratory evaluation of operator seat vibration for Earth Moving machinery
- Cold startability for heavy duty defence vehicles
- GISSMO material model card of DP 600 (available as ready-to-take away product)
- Brake test for Construction Equipment Vehicle as per IS 16479:2020
- Steering effort evaluation as per IS 16480:2018
- Cash Van and Mobile Canteen Requirements as per AIS-163
- Arrangement of Foot Control for M1 and L7M category vehicles as per UN R35 Rev 01
- External Projections as per UN R61
- External Projections as per UN R26 Rev 01c
- Tell Tale Requirements for M and N Category vehicles as per UN R121 Rev 02
- 3-wheeler Noise test as per UN R9 Rev 03
- 2-wheeler and 3-wheeler Brake test as per UN R78 Rev 02
- Method of recording Dust Ingress as per IS: 11739-1986
- Method of conducting Water Proofing test as per IS: 11865-2006
- ESC M1 category vehicle as per UN R140
- BAS as per UN R139
- Surface temperature measurement as per requirements of PESO
- Spark arrestor as per requirements of PESO
- Roof Carrier testing for crashworthiness on Sled System
- Door Latches and Hinges dynamic test on Sled System
- Measurement of Head Restraint Backset using HRMD device
- Testing of Helicopter Seat and components of Commercial Airliner
- Certification of customer dummies
- Seat – SAB (Side Air Bag), Seat – FSAB (Far Side Air Bag) and vehicle level Airbag deployment testing

- Static measurement of seats
- Generation of F-Tire model characteristics file based on measured field and lab test data
- Vehicle Seat Belt Anchorage (SBA) test on 3-wheeler as per Directive 3/2014/EEC
- Design and development of E-axle based Electric Vehicles (1.5T to 5T category)
- Development of Hydrogen Fuel Cell based Powertrains for 3-wheeler EV & Tractor application
- Casting process design and optimization using simulation to remove casting defects
- Design and development of Aluminium frame of Passenger Seat for city bus
- Strength evaluation of 2-wheeler Footrest as per AIS-148 through simulation
- Red line mark-up updation
- 3D CFD climate control simulation of small commercial vehicles
- Hydrogen storage system structure evaluation of bus as per AIS-157 (2020) using simulation
- Design and simulation evaluation of Highway Safety Barrier as per EN 1317
- Summer trial vehicle performance evaluation
- Evaluation of cleaning effect of Emission Control Devices used in BS-VI compliant vehicles in polluted urban environment
- Screening method for determination of emissions of volatile organic compounds from vehicle interior parts and materials
- Monitoring of undiluted exhaust emissions from diesel equipment in underground coal mines
- New calibration procedure developed for dummy Load cell calibration
- Dummy Potentiometer calibration
- RF Generator/ Signal Generator calibration

Battery Level Crush Testing

Static Measurement of Seats

Head Restraint Backset Measurement

Seat Belt Anchorage Test on 3-wheeler

Brand Building

- Showcased and demonstrated capabilities at expos, viz. Auto Expo 2023 (Motor Show and Component Show), Micelio Global Clean Mobility Summit 2022, International Automotive Manufacturing Summit 2022, Truck Tyre & Trailer Expo 2022, DEF-EX 2022, India EV Expo 2022, SAE INDIA Automotive Mobility Conference, Bauma Conexpo India, Alternate Fuel Conclave 2022, EV Summit, etc.
- Reached out to the industry through periodic updates on capabilities, events, new developments, etc. on social media platforms, viz. LinkedIn, Instagram, Facebook, YouTube and Twitter
- Periodic posts and updates on ARAI website regarding events and engagements
- Launch of ARAI Hindi Website during Hindi Pakhwada
- Launch of the report on "Development of Emission Inventory for Pune District" under Clean Air Project in India (CAP India)
- Participated in 'Industry and R&D Institutes Collabored Meet' at MCCIA, Pune
- Interactions by Customer Relations Cell with customers visiting ARAI for enhancing ease of doing business

ARAI at Auto Expo 2023 (Motor Show and Component Show)

Stall at Bauma Conexpo India

Stall at Alternate Fuel Conclave 2022

Interactions with Industry :

During the year, ARAI hosted senior level delegations of various organizations and also visited many customers for business promotion. The core idea of these interactions was to explore potential business avenues and collaborative opportunities. During these interactions, ARAI's capabilities and facilities were presented and demonstrated to the customers. They included ARAI's service offerings in the areas of certification, validation support, engine testing, component testing, transmission, EV, NVH, ethanol, fuel/ Lubricant analysis, skill development initiatives, etc. The industry interactions have helped in

understanding certification and development programs of the customers, and created new leads for future business opportunities.

Technical Collaborations/ Strategic Tie-ups

- Collaboration with Micelio – For setting up of Common Engineering Facility Center (CEFC) for Digital Twin Centre in Emerging Automotive Systems
- Statement of Intent (SoI) with IIT Guwahati – For establishment of Digital Twin Centre for Emerging Automotive System at IIT Guwahati
- MoUs with Industry Partners for establishment of Centre of Excellence for Intelligent Vehicle Technology (IVT)
- MoU with ARAI-AMTIF (a Section 8 Company of ARAI) – To provide an array of services along with technical and business resources to start-ups
- MoU with Indian Institute of Tropical Meteorology (IITM) – To exchange scientific knowledge and undertake joint research work in the areas of emissions and air quality modelling
- Various other MoUs with Industry for development, testing, knowledge enhancement, sustainable and efficient public transport, e-mobility, etc.

Collaboration with Micelio

Statement of Intent with IIT Guwahati

Workshops/ Training Programs/ Expert Talks Organized

- Workshop on 'Advanced Material Model Cards for Damage Prediction'
- Workshop on 'Metallurgical Failure Analysis for Process & Product Optimization'
- Workshop on 'Best Practices of Product Design, Mold Design and Process with respect to Plastic Material Rheology in Injection Molding Process'
- Workshop on 'Advanced Material Model Cards for Damage Prediction'
- Workshop on 'Battery, Safety, reliability, durability and advances in battery technology'
- Seminar on Photometry
- Seminar on Tyre & Wheel Rim
- CMVR procedure for approval of Construction Equipment vehicles, Retro-fitment/ adaptation kit for vehicles, E-Rickshaw, E-Kart, Battery Operated Vehicles & Retrofitted vehicles used by differently abled personnel for Road Transport Authorities & Municipal transportation department

- Homologation requirements for Construction Equipment Vehicles, Agricultural Tractors, Truck & Trailer Codes, Caravan & Cash Van/ Mobile Canteens, E-Rickshaw, E-Kart, Battery Operated Vehicles & Retrofitted vehicles used by differently abled personnel for Road Transport Authorities & Municipal transportation department
- BS-VI emission certification for 2W, 3W, 4W & HDV and Real Drive Emissions for Motor Transport Department Officers
- Technical Requirements of Bus Body as per AIS 052/ AIS 063/ AIS 119 for Regional Transport Officials (RTO)
- Technical Requirements of Electric Buses as per CMVR for Regional Transport Officials (RTO)
- Homologation of Electrical bus as per CMVR requirements for Regional Transport Officials (RTO)
- Homologation of retrofitted Hybrid Electric Bus as per AIS:123 for Regional Transport Officials (RTO)
- Electromagnetic Compatibility (EMC) for 2W
- ISC (In-service Compliance) and IUPR (In-Use Performance Ratio), AES/ BES documentation requirements compliance
- Training on regulatory requirement for EV and HEV
- Emission Inventory and Source Apportionment Study in Non-Attainment Cities of Odisha for State Pollution Control Board, Odisha
- Source Apportionment Study and Emission Inventory of Bhopal City" for the officials of Madhya Pradesh State Pollution Control Board
- OBD II-A requirements for 2-wheeler and 3-wheeler manufacturers
- Clean fuel engine technologies for automotive
- Fire hazards identification and prevention in public transport
- Road accident awareness and prevention for gaseous fuel vehicles
- Natural gas vehicles and its safety
- Upcoming alternate fuels including LNG and its technologies for engines
- Upcoming BS-VI norms for gaseous fuel vehicles and OBD requirements
- New advancements in alternate fuels for transport sector
- Plastic injection moulding rheology simulation
- 'MANAK MANTHAN' program organized jointly with Bureau of Indian Standards (BIS)

Training on Source Apportionment Study


Manak Manthan Program

Launch of 100 kW DC Fast Charger Technology

ARAI has successfully developed and demonstrated the technology for high power 100 kW DC fast charger for EV charging under guidance of Ministry of Heavy Industries (MHI). This indigenous technology was launched by Dr. Mahendra Nath Pandey, Hon'ble Minister, Ministry of Heavy Industries (MHI) on 19th January 2023 and in the presence of Dr. Hanif Qureshi, Joint Secretary – MHI, Dr. Reji Mathai, Director – ARAI and other Senior Executives from ARAI. It supports CCS 2, DC001, AC Type 2 and CHAdeMO communication protocols.

Also, during this visit of the Hon'ble Minister, various other events, viz. Release of SIAT 2024 First Announcement, Exchange of MoU between ARAI and ARAI-AMTIF, Exchange of MoU between ARAI-AMTIF and Industry Partners under Industry Accelerator Project supported by MHI, e-Foundation laying of ARAI-Mobility Research Centre (ARAI-MRC) and showcasing of 1000th Crash Test & 600th EMC Test were organized.

Dr. Mahendra Nath Pandey, Hon'ble Minister, MHI at the launch of 100 kW Fast Charger Technology

Release of SIAT 2024 First Announcement

Showcasing of 1000th Crash Test

Showcasing of 600th EMC Test

Future Trends in Automotive Lighting

An online lighting conference on 'Future Trends in Automotive Lighting' was organized by ARAI in association with SAEINDIA – Western Section on 10th June 2022 on virtual platform. It was inaugurated by Dr. Reji Mathai, Director – ARAI. The other senior executives from ARAI present on this occasion included Mr. A. A. Badusha, Mr. S. S. Nibandhe and Dr. B. V. Shamsundara. It served as a platform for sharing new trends in automotive

lighting and light signaling devices. This conference had a participation of about 500 delegates drawn from various vehicle manufacturers (2W, 3W, 4W, Tractors, CEV, EV, etc.), lighting manufacturers, non-automotive lighting manufacturers, test agencies and academia. It featured presentations, viz. Uniform Progress in GRE, New Trends in Vehicle Rear Lights, Lighting Technology for Tomorrow's Headlights, Intelligent lighting solutions for future vehicles (autonomous), Technology roadmap for light sources and Homologation of Automotive Lighting.

Action Plan for Automotive E-waste Management and Recycling

A workshop on developing 'Action Plan for Automotive E-waste Management and Recycling for Pune' was organized by ARAI in association with Pune Knowledge Cluster (PKC) on 2nd July 2023. The round table at this workshop had three panels on focus areas, viz. (a) Gap and way forward to the Regulatory Scenarios in E-waste recycling (b) Technologies available for E-waste recycling and (c) Industry outlook towards E-waste recycling and management. It witnessed insightful discussions, with eminent panelists and participants sharing their experience and expertise. The attendees at this workshop included prominent personalities from Pune Municipal Corporation, stakeholders from recycling sector, industry experts, academia, apart from Director – ARAI, executives from ARAI and representatives from PKC. The deliberations at this workshop covered various topics like life of vehicle; establishing standard operating procedure; reduce, recycle & reuse; vehicle scrapping policy; life cycle analysis; etc. It concluded with finalizing of recommendations and plan of action for automotive E-waste management and recycling.

Adaptive Technologies in Tyre and Wheel

A webinar on 'Adaptive Technologies in Tyre and Wheel' was organized by ARAI through TechNovuus (Technology Innovation Platform of ARAI) and ARAI Academy on 24th August 2022. The purpose of this conference was sharing of knowledge pertaining to new trends in automotive tyres and wheel domain. It had a participation of over 500 delegates drawn from automotive manufacturers (2W, 3W, 4W, Tractors, CEV, EV, etc.), tyre and rim manufacturers, academia, test agencies, BIS, BEE, etc. It was inaugurated by Dr. Reji Mathai, Director – ARAI in the presence of other senior executives from ARAI, viz. Mr. A. A. Badusha, Mr. S. S. Nibandhe and Dr. B. V. Shamsundara. The various topics covered at this conference were Advanced Trends in Tyre Evaluation including Tyre Rolling Resistance, BIS's Role in Certification and Standardization of Tyre Wheels, Advanced Tyre Technologies, Tyre and Rim Certification Capabilities, BEE Tyre Labelling Scheme – An Overview and Advanced Technologies for Future Wheels.

Innovative Technologies and Regulations Governing Safety Glasses

Conference on 'Innovative Technologies and Regulations Governing Safety Glasses' was organized by ARAI along with SAEINDIA – Western

Section on 30th November 2022 for sharing knowledge on new trends, regulations and upcoming QCOs in safety glasses. It was inaugurated by Dr. Reji Mathai, Director – ARAI. The other senior executives from ARAI present on this occasion included Mr. N. B. Dhande, Mr. A. A. Badusha, Mr. S. S. Nibandhe and Dr. B. V. Shamsundara. The presentations at this conference were on Driving the Change through Advanced Automotive Glazing Technology, Implementation of QCO Order for Safety Glass for ISI Marking in India, Testing Requirements for Safety Glass, Trends in Safety Glass Technologies for Automotive Applications and Overview of Global Regulations for Safety Glass. This conference witnessed a participation of about 225 delegates from the industry and academia.

25 Years of Automotive Industry Standards Committee (AISC)

AISC, formulated by Ministry of Road Transport and Highways, completed 25 years of its existence in 2022. Under the Chairmanship of Director – ARAI, it has played a key role in development of Automotive Industry Standards. To mark the 25 years of contribution by AISC in standard formulation activities and to recognize the contribution of member organizations and various experts, ARAI had organized this event on 29th November 2022. During this event past Chairpersons, Key Contributors and Panel Conveners were felicitated. This memorable event was attended by the members from different test agencies, viz. Indian Institute of Petroleum, Central Institute of Road Transport, International Centre for Automotive Technology, Global Automotive Research Centre, National Automotive Test Tracks (NATRAX); and various member organizations, viz. Bureau of Indian Standards, Society of Indian Automotive Manufacturers, Automotive Component Manufacturers Association, The Tractor and Mechanization Association (TMA), Indian Construction Equipment Manufacturers' Association (ICEMA), Automotive Tyre Manufacturers Association and Indian Tyre Technical Advisory Committee. Present Chairman, Dr. Reji, Mathai, Past Chairpersons – Mr. B Bhanot, Mrs. Rashmi Urdhwareshe; Mr. K. V. R. K. Prasad, Director – CIRT; Mr. P. K. Banerjee, SIAM; Mrs. Seema Babal, ACMA; Mr. S. S. Gussain, ATMA & ITTAC; key contributors like Mr. S. Ravishankar, Mr. D. P. Saste and Mr. A. A. Badusha presented their views on the past work and the future ahead. Also, contribution and support of officials from Ministry of Road Transport and Highways was highly appreciated and acknowledged during this event.

Upcoming Event: SIAT 2024

The eighteenth edition of 'Symposium on International Automotive Technology', i.e. SIAT 2024 is being organized by ARAI in association with SAEINDIA and SAE International (USA) during 23rd to 25th January 2024 Pune International Exhibition and Convention Center, Moshi. The theme of SIAT 2024 is "Transformation towards Progressive Mobility". This upcoming symposium

will witness presentation of over 200 technical papers, including keynotes on futuristic topics by renowned experts from across the globe. These papers will be published in the form of Symposium Proceedings. Additionally, Technical Reference Bulletin, containing technical articles, case studies, products/ services information, etc. will also be published. Some of the topics to be covered at this symposium include Active and Passive Safety, Advanced Powertrain Technology, Autonomous Vehicles, Harmonization of Regulations, Simulation & Modeling, Advanced Driver Assistance Systems, Alternate Fuels, E-mobility, Materials & Manufacturing, Fuel Cell, Hydrogen IC Engine, Tyre Technology, etc. The concurrent exposition, SIAT EXPO 2024, offers an appropriate platform for spectrum of companies from across the globe to showcase and demonstrate their products, technologies, innovations and service capabilities.

Supporting SAEINDIA Activities

ARAI is associated with SAEINDIA's wide spectrum of activities, which are carried out for the benefit of professionals, practicing engineers, engineering students and school children. During the year, ARAI supported following programs organized by SAEINDIA Western Section.

- BAJA SAEINDIA 2022
- Two-day online conference on 'Sustainability & Circular Economy of Materials through understanding of ELV, RoHS (SoC), IMDS, REACH, and CDX'
- SAEINDIA Silver Jubilee celebration
- TIFAN – 2022 valedictory event
- International conference on 'Modern Vehicular Safety Technologies – Active and Passive'
- Professional development program on 'Battery Safety, Durability and Advances in Battery Technology'

ARAI undertakes skilling, reskilling and upskilling activities for disseminating knowledge through ARAI Academy's Learning Centre (LC), Training Centre (TC) & Library. This includes training and educational programs to enhance human resource skills for meeting the growing needs of mobility sector. For this purpose, ARAI Academy collaborates with various universities and industry. During the year 2022-23, these collaborations were further strengthened through following collaborations.

- MoU with Chitkara University – To offer BE Program in Automobile Engineering with specialization in EVs and HEVs
- MoU with Additional Skill Acquisition Programme (ASAP) Kerala – To offer skill development programs and establishment of CoE for EV
- MoU with Providence College of Engineering & School of Business – To offer skill development programs
- MoU with Tata Technologies – To provide certification programs for upskilling and reskilling of students and working professionals in the automotive industry
- MoU with Symbiosis International University – To offer a full-time M. Tech. Program in Automotive Technology

MoU with Chitkara University

MoU with ASAP, Kerala

MoU with Providence College of Engineering & School of Business

MoU with Tata Technologies

MoU with Symbiosis International University

The focus areas in 2022-23 for skill development of engineering students and industry professionals were conducting of student internships programs, development of e-modules and organizing of free webinars.

LEARNING CENTRE

Learning Centre conducts undergraduate, postgraduate, postgraduate diploma and doctorate programs with specialization in Automotive Engineering and E-mobility through collaborations with various universities. A summary of the joint programs conducted with various universities is given below.

Collaborations for UG Programs:

- Christ University, Bengaluru – B. Tech. in Automobile Engineering
- Chitkara University, Punjab – BE in Automobile Engineering with specialization in EVs and HEVs
- SRM Institute of Science and Technology, Chennai – B. Tech. in Automotive Engineering with specialization in EHV

Collaborations for PG Programs:

- COEP Technological University, Pune – M. Tech. in Automotive Technology
- Rajarambapu Institute of Technology, Sangli – M. Tech. in Automotive Technology
- Chitkara University, Chandigarh – M. Tech. in Automotive Engineering
- SRM Institute of Science and Technology, Chennai – M. Tech. in Automotive Technology with specialization in Electric & Autonomous Vehicles
- Kalasalingam Academy of Research and Education (KARE), Tamil Nadu – M. Tech. in Automotive Engineering (Electric & Hybrid Vehicle and Powertrain Engineering)

Collaborations for Post Graduate Diploma Programs:

- COEP Technological University, Pune (Electric Mobility)
- Rajarambapu Institute of Technology, Sangli (Electric and Autonomous Vehicles)

Collaborations for Doctoral Programs:

- Dr. Vishwanath Karad MIT World Peace University, Pune – PhD (Automotive Engineering)

TRAINING CENTRE

Training Centre organizes Proficiency Improvement Programs (PIPs); Domain Training Programs (DTPs); and E-learning Online Courses for students as well as working professionals. During the year 2022-23, 32 programs (PIPs and DTPs) were organized, wherein lectures were given by ARAI personnel, academicians and eminent industry experts, including speakers from abroad. These PIPs & DTPs had a participation of about 1500 delegates. Some of the domain areas in which these programs were conducted are given below.

PIPs and DTPs:

- Systems Engineering Fundamentals
- Automotive Embedded System
- Modern Vehicular Safety Technologies – Active & Passive
- Automotive Research Development
- Engine Testing & Certification
- Engine Technology
- Engine Performance & Troubleshooting (Level II)
- Real Driving Emission
- Transmission Design
- Automotive NVH
- Forging Technology
- Noise & Vibration Applications in Automotive Engineering
- Benchmarking – An Engineered Approach
- Electromagnetic Compatibility (EMC) for 2W Vehicles
- Vehicle, Emission & Engine Testing

- Battery Management System of Electric Vehicle
- Fundamentals of EV Technologies
- Thermal Management of Electric Vehicle
- Electric Vehicle Development & Certification
- EV Technology
- Electric Vehicle Basics
- Electric Vehicle – NVH
- Electric Vehicles Batteries and Energy Storage Systems
- Thermal Runaway for Electric Vehicles
- Electric Vehicle – Electrification
- Future Trends in Automotive Lighting
- Innovative Technologies and Regulations Governing Safety Glasses
- Success Quotient for Future '10X' Leaders
- Automotive Regulations
- Online conference on Sustainability & Circular Economy of Materials through understanding of ELV, RoHS (SoC), IMDS, REACH and CDX

e-Learning Courses (ePIPs) :

- Reliability Engineering
- Engine Electronics & Management Systems
- Fuel Cell Technology
- Real Driving Emissions (RDE)
- Selective Catalytic Reduction (SCR)
- Emission Type Approval (including BS-VI): 2, 3, 4 Wheeled Vehicles
- Combustion in IC Engines
- HC/CO Emission Formation
- Emission Measurement Techniques
- NOx Emission Formation
- PM Emission Formation
- Diesel Particulate Filter
- Hybrid & Electric Vehicles Architecture

DTP on Vehicle, Emission & Engine Testing

DTP on Thermal Runaway for Evs

PIP on EMC for 2W Vehicles

PIP on Electric Vehicle – Electrification

Independent Auditor's Report
&
Annual Statement of Accounts

To -

The members of
THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

Report on the Audit of the Financial Statements

OPINION -

We have audited the financial statements of THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA, PUNE ("ARAI") which comprise the Balance Sheet as at March 31, 2023, and the Income and Expenditure Account for the year then ended, and notes to the financial statements, including a summary of significant accounting policies. In our opinion, the accompanying financial statements give a true and fair view of the financial position of the entity as at March 31, 2023 for the year then ended in accordance with the Accounting Standards issued by the Institute of Chartered Accountants of India (ICAI).

BASIS OF OPINION-

We conducted our audit in accordance with the Standards on Auditing (SAs) issued by ICAI. Our responsibilities under those Standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are independent of the entity in accordance with the Code of Ethics issued by ICAI and we have fulfilled our other ethical responsibilities in accordance with the Code of Ethics. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

RESPONSIBILITIES OF MANAGEMENT AND THOSE CHARGED WITH THE GOVERNANCE FOR THE FINANCIAL STATEMENTS -

Management of ARAI is responsible for the preparation of the financial statements in accordance with relevant laws as applicable and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error. In preparing the financial statements, management is responsible for assessing the entity's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the entity or to cease operations, or has no realistic alternative but to do so. Those charged with governance are responsible for overseeing the entity's financial reporting process.

AUDITOR'S RESPONSIBILITIES FOR THE AUDIT OF FINANCIAL STATEMENTS -

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with SAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

As part of an audit in accordance with SAs, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.
- Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the entity's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the entity to cease to continue as a going concern.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

For Kirtane & Pandit LLP
Chartered Accountants
Firm Registration No.105215W/W100057

Parag Pansare
(Partner)
Membership No: 117309
UDIN:
Pune, Dated 28th June 2023

Balance Sheet as on 31st March 2023

(RS IN LAKHS)

PARTICULARS	SCHEDULE NO	31 MARCH 2023	31 MARCH 2022
I EQUITY AND LIABILITIES			
1. OWNERS' FUNDS			
A RESERVES AND SURPLUS	3	1,67,098.73	1,55,068.13
		1,67,098.73	1,55,068.13
2. NON-CURRENT LIABILITIES			
A OTHER LONG-TERM LIABILITIES	4	4,050.05	4,049.77
B LONG-TERM PROVISIONS	5	2,250.22	3,175.01
		6,300.27	7,224.78
3. CURRENT LIABILITIES			
A TRADE PAYABLES			
I TOTAL OUTSTANDING DUES OF MICRO, SMALL AND MEDIUM ENTERPRISES	6	-	218.58
II TOTAL OUTSTANDING DUES OF CREDITORS OTHER THAN MICRO, SMALL AND MEDIUM ENTERPRISES	6	2,481.46	1,910.16
B OTHER CURRENT LIABILITIES	7	14,318.39	11,596.13
C SHORT-TERM PROVISIONS	5	173.58	161.50
		16,973.42	13,886.37
TOTAL		**1,90,372.41**	**1,76,179.28**
II ASSETS			
1. NON-CURRENT ASSETS			
A PROPERTY, PLANT AND EQUIPMENT AND INTANGIBLE ASSETS	8		
I PROPERTY, PLANT AND EQUIPMENT		70,669.48	72,711.81
II INTANGIBLE ASSETS		402.74	480.08
III CAPITAL WORK IN PROGRESS		3,925.32	2,995.36
IV INTANGIBLE ASSET UNDER DEVELOPMENT		-	-
B NON-CURRENT INVESTMENTS	9	66,582.83	68,550.10
		1,41,580.37	1,44,737.35
2. CURRENT ASSETS			
A INVENTORIES	10	21.03	27.43
B TRADE RECEIVABLES	11	6,416.49	5,500.03
C CASH AND BANK BALANCES	12	36,635.49	22,267.60
D SHORT TERM LOANS AND ADVANCES	13	5,225.00	3,267.67
E OTHER CURRENT ASSETS	14	494.04	379.19
		48,792.05	31,441.93
TOTAL		**1,90,372.41**	**1,76,179.28**
BRIEF ABOUT THE ENTITY	**1**		
SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES	**2**		
THE ACCOMPANYING NOTES ARE AN INTEGRAL PART OF THE FINANCIAL STATEMENTS			

Dr.Reji Mathai
Director

Dr. N. Saravanan
Vice President

Rajendra Petkar
President

AS PER OUR REPORT OF
EVEN DATE ATTACHED
FOR M/S KIRTANE AND PANDIT LLP
CHARTERED ACCOUNTANTS
Firm's Reg. No. W10057

Parag Pansare
PARTNER
Membership No. 117309

Date : 28th June 2023
Place : Pune

Statement of Income and Expenditure for the Year Ended 31st March 2023

(RS IN LAKHS)

PARTICULARS	SCHEDULE NO	31 MARCH 2023	31 MARCH 2022
I REVENUE FROM OPERATIONS	15	41,951.57	37,037.59
II OTHER INCOME	16	3,836.53	3,346.33
III TOTAL INCOME (I+II)		**45,788.10**	**40,383.92**
IV EXPENSES:			
A OPERATIONAL EXPENSES		4,597.00	2,897.29
B EMPLOYEE BENEFITS EXPENSES	17	19,818.99	18,690.41
C DEPRECIATION AND AMORTIZATION EXPENSES	18	4,424.02	4,362.70
D OTHER EXPENSES	19	5,669.67	4,737.25
TOTAL EXPENSES		**34,509.68**	**30,687.65**
V SURPLUS/(DEFICIT) BEFORE TAX (III- IV)		**11,278.42**	**9,696.27**
VI SIAT SURPLUS / (DEFICIT) TRANSFERRED TO GENERAL FUND		(0.33)	173.56
VII SURPLUS/(DEFICIT) TRANSFERRED TO GENERAL FUND (V-VI)		**11,278.75**	**9,522.71**

Dr.Reji Mathai
Director

Dr. N. Saravanan
Vice President

Rajendra Petkar
President

AS PER OUR REPORT OF
EVEN DATE ATTACHED
FOR M/S KIRTANE AND PANDIT LLP
CHARTERED ACCOUNTANTS
Firm's Reg. No. W10057

Parag Pansare
PARTNER
Membership No. 117309

Date : 28th June 2023
Place : Pune

NOTES TO ACCOUNTS :

1. BRIEF ABOUT THE ENTITY -

Automotive Research Association of India (ARAI), established in 1966, is the leading automotive R&D organization of the country set up by the Automotive Industry with the Government of India. ARAI is an autonomous body affiliated to the Ministry of Heavy Industries, Government of India. The Department of Scientific and Industrial Research, Ministry of Science and Technology, Government of India, has recognized ARAI as a Scientific and Industrial Research Organisation (SIRO). Further, ARAI is one of the prime Testing and Certification Agency notified by Government of India under Rule 126 of Central Motor Vehicle Rules, 1989.

2. SIGNIFICANT ACCOUNTING POLICIES:

i. Accounting Convention:

The financial statements have been prepared under the historical cost convention, having due regards to fundamental accounting assumptions of going concern, consistency and accrual, in compliance with the accounting standards issued by the Institute of Chartered Accountants of India.

ii. Fixed Assets:

The Association has been adopting uniform policy as regards to capitalisation of assets acquired out of Government Funds, Sponsored Projects, and own funds from 2004-05. Attributable finance costs and expenses of bringing the respective assets to working condition for their intended use are capitalised.

Group of 'Buildings & Roads' include Air-conditioning systems, electrical fittings and other infrastructural facilities, which are integral part of building and are depreciated as per useful economic life.

Intangible Assets:

Knowledge gathered by the Association (solely or jointly with the sponsor) in the form of Patents during the execution of sponsored projects which are capable of being registered with the Patent Authority are capitalized at the nominal value of Re. 1 per patent as an intangible asset. Computer software has also been classified under intangible assets.

iii. Depreciation:

a. Depreciation rates have been determined on the basis of estimated useful life of the Fixed Assets and provided on written down value method from the year of their capitalization, including assets created out of government grants and equipments received in kind as 'Grant-in-Aid'.

Depreciation on, assets acquired out of government grants and equipments received in kind as 'Grant-in-Aid', is drawn back from General Fund and credited to Income & Expenditure Account.

b. As decided in the Meeting of the Committee for Depreciation Policy for ARAI held on 11th December 2013 depreciation rates have been revised from financial year 2013-14. The revised rates are as follows:

BUILDING & ROADS ETC	
1. BUILDING	4.87%
2. ROADS	25.89%
3. WATER PUMPS & PIPELINE	18.10%
4. ELECTRICAL INSTALLATION	18.10%
5. COOLING TOWERS	18.10%
PLANT & MACHINERY	
6. PLANT & MACHINERY	9.50%
7. LAB & TESTING EQUIPMENT	9.50%
8. MEASURING INSTRUMENTS-8 YEARS	31.23%
9. MEASURING INSTRUMENTS- 15 YEARS	18.10%
10. MEASURING INSTRUMENTS- 25 YEARS	11.29%
11. TEST RIGS	9.50%
12. TEST BEDS	9.50%
13. CRANE	9.50%
FURNITURE & FIXTURES	
14. FURNITURE & FIXTURES	25.89%
OFFICE EQUIPMENTS	
15. OFFICE EQUIPMENTS	45.07%
COMPUTERS & PERIPHERALS	
16. COMPUTERS & PERIPHERALS	63.16%
17. SERVERS	39.30%
VEHICLES	
18. VEHICLES	39.30%
AIR-CONDITIONERS	
19. AIR-CONDITIONERS	25.89%
INTANGIBLE ASSETS	
20. COMPUTER SOFTWARE	45.07%

iv. Government Grants:

The Association is showing the cost of asset acquired out of the Grants received at gross value and amount of grant received to the extent of Fixed Assets purchased is credited to General Fund A/c. With effect from financial year 2004-05, General Fund A/c is reduced to the extent of depreciation charged on such assets acquired out of the grants received.

v. Inventories:

a. Inventory is valued at lower of cost or net realisable value. Stock of fuel is determined at Weighted Average cost.

b. In view of the technical complications involved in valuation of partly completed sponsored projects, cost incurred is debited to Income & Expenditure Account.

c. Consumable stores and spares are expensed upon purchases.

vi. Foreign Exchange Transactions:

Transactions in foreign currency are recorded at the exchange rates prevailing on the date of transaction. The outstanding amounts denominated in foreign currency are shown at rates prevailing on the Balance Sheet date. The difference between the rate prevailing on the date of transaction and on the date of settlement is recognized as income or expense.

vii. Revenue Recognition:

a. R&D -Sponsored Projects & Development Testing

Revenue is recognised based on specific contracts, either on association's specific benchmark or on achieving of specific results.

b. Other testing:

Revenue is recognised as and when service is completed as per terms of contract.

c. Membership Subscription

Revenue is recognised on accrual basis based on preceding year's turnover of member companies.

d. Symposium on International Automotive Technology (SIAT)

SIAT is an International event organized biannually to share knowledge and innovative ideas in Automotive Technology. Income is recognised on accrual basis in form of Delegate fees, Sponsorships, advertisements and stalls.

e. Learning Centre

Fees received are accounted on accrual basis.

f. Interest

Interest is recognized on accrual basis.

g. Training Centre

These are the training sessions organized for industry. Income is recognized on completion of service performance.

viii. Employee Benefits

a. Defined Contribution Plan (Provident Fund, Superannuation Fund & National Pension System (NPS)):

Association's contributions paid/payable during the year to Approved Superannuation Fund, NPS, Provident Fund are recognised in Income & Expenditure Account when contributions to respective funds are due. There are no other obligations other than the contribution payable to the respective trusts.

In respect of Provident Fund, the shortfall in respect of interest, if any, is made good by the association and is recognized as expense.

b. Compensated Absences (Leave Encashment):

Short term compensated Absences are provided for based on estimate. Long term compensated absences are provided for on the basis of actuarial valuation by using Projected Unit Credit Method (PUCM).

Actuarial gains and losses arising on such valuation are recognised immediately in Income & Expenditure account.

c. Defined Benefit Plan (Gratuity):

Association's liability towards gratuity is determined using the Projected Unit Credit Method (PUCM) which considers each period of service as giving rise to an additional unit of benefit entitlement and measures each unit separately to build up the final obligation. Past Service Gratuity Liability is computed with

reference to the service put in by each employee till the date of valuation as also the projected terminal salary at the time of exit. Actuarial gain or losses are recognized immediately in the Statement of Income & Expenditure as income or expense. Obligation is measured at the present value of estimated future Cash Flow using a discount rate that is determined by reference to market yields at the Balance Sheet date on government bonds where the currency and terms of the government bonds are consistent with the currency and estimated terms of the defined benefit obligation.

ix. Bad debts/Reserve for doubtful debts:

a. For debtors outstanding for the period between 1-3 years, 20% amount of receivables has been provided as Reserve for Doubtful debts.

b. Debtors outstanding for more than 3 years are written off as bad debts. However, if any outstanding less than 3 years is known certainly to be non-recoverable is also written off as bad debts.

OTHER NOTES -

1. Annual Membership Subscription written off Rs. Nil for current year is shown in current year's statement as net of this amount. (Previous Year Rs. Nil)
2. From the year 2019-2020, Association has adopted a policy to Capitalize only those items having total Purchase Value more than Rs. 5,000/- and to write off the Fixed Assets having WDV less than Rs. 1000/-
3. In the 115th Governing Council meeting held on 28-8-98, it was decided to set up the following funds:

i. Replacement of equipment/machinery Fund:

This fund was set up by earmarking specific investments corresponding to the amount of depreciation for the year. The interest earned from the earmarked investments is specifically set aside towards financing replacements of equipment and machinery and to meet ARAI's periodic capital expenditure other than projects.

ii. R & D Reserve Fund:

The surplus from the Income & Expenditure Account is transferred to the credit of this fund, to be invested in appropriate deposits as per approved norms. The interest earned thereon is to be set aside and exclusively used for ARAI's research projects not involving procurement of capital equipment.

However, in the 158th Governing Council meeting held on 5th June, 2009 it was decided as under:

From the financial year 2008-09 depreciation for the year and the amount of surplus/deficit for the year will not be transferred to respective funds. The amount of surplus will be transferred to General Fund and no fresh investments will be made.

Further, it has been decided to utilize these funds as under:

i. Replacement of equipment/machinery Fund:

The accumulated balance in the Replacement of equipment/machinery fund is to be used for ARAI Capital expenditure.

ii. R & D Reserve Fund:

The accumulated balance in the R & D Reserve fund is to be used for meeting expenditure on internal R&D projects (both revenue & capital). During the current year expenditure amounting to Rs. 103.48 Lakhs (Previous Year Rs.67.94Lakhs) on ARAI R&D projects has been transferred from this fund to the income and expenditure account.

4. Contingent Liability

a. Bank Guarantees given by the Association:

The liability of the Association towards Bank Guarantees given as on 31.03.2023 is Rs. 172.02Lakhs (Previous Year Rs.27.32 Lakhs).

b. Claim against the society not acknowledged as debt(Legal claim)

The Society is in appeal with "Hon'ble High Court of Bombay"and as per the directive of high court the application is pending with Labour Court Pune against the claim made under The Industrial Dispute Act, 1947 for 50% of back wages i.e. Rs 60.15 Lakhs. The Society has deposited an amount of Rs.60.15 Lakhs under protest which has been shown under 'Other Deposits'.

c. Income tax dues -

ARAI is a Scientific and Industrial Research Organisation (SIRO) approved by Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology, Government of India is exempt from Income Tax. ARAI is registered under Section 35 (1) (ii) of the Income Tax Act, 1961 has been claiming exemption from Income Tax. ARAI has received an order dated 02/03/2021 u/s 143(3) of the Income Tax Department for AY 2018-19 communicating a demandof Rs.20.62 Crores.ARAI has filed an appeal on 31stMarch 2021 against the demand and has obtained a stay order bypaying Rs.4.20 Crores on 9th April 2021 under protest.The appeal is pending for hearing.

d. Contribution Payable to the office of Charity Commissioner

Every public trust not exempt having gross annual income exceeding Rs. 25,000/- has to pay contribution to Public Trust Administration Fund at rates notified by State Government from time-to-time (present rate 2%). However as per interim order passed by the Mumbai High Court on 25/09/2009, The Charity Commissioner of Maharashtra is restrained from collecting such contribution till further orders in the matter by the Mumbai High Court. Based on this, the Society has not made any provision of such contribution payable to the Charity Commissioner in the books of accounts.

5. Capital Commitments

Estimated amount of contracts remaining to be executed on capital account (net of advances paid), not provided for is Rs.2,713.01Lakhs (Previous Year Rs.108.59lakhs).

6. Inventory

The Inventory has been physically verified by management during the year. The total stock of Fuel as on 31.3.2023 is valued at cost Rs. 21.03Lakhs (Previous Year Rs.27.43 Lakhs).

7.Foreign Exchange Earnings: The Foreign Exchange Earnings in 2022-23 are as under:

(Currency In lakhs)

Sr. No.	Particulars	F.Y 2022-23					F.Y 2021-22				
		US $	EURO	GBP	JPY	Equivalent Amount in Rs.	US $	EURO	GBP	JPY	Equivalent Amount in Rs.
1	Total Income in Foreign Exchange	15.64	9.15	0.37	41.12	2078.19	11.39	3.77	0.56	6.27	1224.78
	Total	**15.64**	**9.15**	**0.37**	**41.12**	**2078.19**	**11.39**	**3.77**	**0.56**	**6.27**	**1224.78**

The above earnings are grouped under respective heads of income.

8. Learning Centre & Training Centre

The Association has entered into Understanding with various Reputed Institutes for conducting joint Programme in Automotive Engineering, Training Programs etc.

In the 174th meeting of the Governing Council of ARAI held on 20th February, 2013, it was decided to consider income of Learning Centre & Training Centre as operating income of ARAI from the financial year 2012-13. Hence income and expense of current year relating to learning center and training center is clubbed with operational income and expenses.

9. Employee Benefits

The Association has recognized following amounts in the Income and Expenditure Account for the year –

(Rs. In lakhs)

Sr. No.	Particulars	F.Y 2022-23 Amount	F.Y 2021-22 Amount
1. Defined Contribution Plans			
i.	Contribution to Employees Provident Fund	857.33	797.13
ii.	Contribution to Superannuation Fund	106.85	608.11
iii.	Contribution to NPS	572.09	-

i. Compensated absences – as per Actuarial Valuation on March 31, 2023

Reconciliation of opening and closing balances of the present value of the Defined Benefit Obligation (DBO):

(Rs. In lakhs)

Sr No	Particulars	F.Y 2022-23	F.Y 2021 22
1.	Opening Defined Benefit Obligation	2178.47	2069.78
2.	Current Service Cost	412.19	572.17
3.	Benefits Paid	(319.83)	(463.48)
4.	Closing Defined Benefit Obligation [(1+2-3) =4]	2270.83	2178.47

ii. Gratuity – as per Actuarial Valuation on March 31, 2023

(Rs. In lakhs)

Statement showing changes in present value of obligation as on 31st March 2023	March 31, 2023	March 31, 2022
Present value of obligation as at the beginning of the year	2938.55	2866.42
Interest Cost	207.12	185.28
Past Service Cost	0.00	0.00
Current service cost	200.74	193.42
Benefits paid	(202.70)	(362.55)
Actuarial (gain)/loss on obligation	(42.08)	55.98
Present value of obligation as at the end of year	3101.63	2938.55

Table showing changes in the fair value of plan assets as on 31st March 2023	March 31, 2023	March 31, 2022
Fair value of plan assets at the beginning of the year	2358.77	2247.78
Expected return on plan assets	200.61	161.26
Contributions	1019.27	315.53
Mortality charges and taxes	0	(0.06)
Benefits paid	(202.70)	(362.55)
Actuarial gain/(loss) on plan assets	(8.46)	(3.20)
Fair value of plan assets at the end of the year	3367.49	2358.77

Amounts to be recognised in the Balance Sheet	March 31, 2023	March 31, 2022
Present value of obligation at the end of the year	3101.63	2938.55
Fair value of plan assets at the end of the year	3367.49	2358.77
Surplus/(Deficit)	265.86	(579.78)
Net Asset/(Liability) recognised in balance sheet	265.86	(579.78)

Expenses recognised in statement of Income & Expenditure Account	March 31, 2023	March 31, 2022
Current service cost	200.73	193.42
Past service cost	0.00	0.00
Interest cost	207.12	185.28
Expected return on plan assets	(200.61)	(161.26)
Net Actuarial (gain)/Loss recognised during the year	(33.62)	59.17
Expenses/(Income) recognised in statement of Income & Expenditure	173.62	276.61

Percentage of each category of plan assets to total fair value of plan assets	March 31, 2023	March 31, 2022
Administered by LIC	3367.49	2358.76
Total	**3367.49**	**2358.77**

Actuarial Assumptions:	March 31, 2023	March 31, 2022
Discounted rate	7.50%p.a.	7.30%p.a.
Rate of return on assets	7.25%p.a.	7.25%p.a.
Salary escalation	5.00%p.a.	5.00%p.a.
Attrition rate	2.00%p.a.	2.00%p.a.
Mortality	Indian Assured Lives Mortality (2012-14) Ultimate (IALM ult).	

	March 31, 2023	March 31, 2022
Experience adjustments		
On plan liability (gain)/loss	18.22	174.51
On plan asset (gain)/loss	8.46	3.20

Actuarial (gain)/loss recognized	March 31, 2023	March 31, 2022
Actuarial (gain)/Loss for the year – obligation	(42.09)	55.98
Actuarial (gain)/Loss for the year - plan assets	8.46	3.20
Total (gain)/Loss for the year	(33.62)	59.18

Future salary increases considered in actuarial valuation takes into account inflation, seniority, promotion and other relevant factors, such as supply and demand in the employment market.

10. PAYABLE TO NATRIP:

Ministry of Heavy Industries (MHI) set up National Automotive Testing and R&D Infrastructure Project (NATRiP) in 2005, as an important initiative to establish testing and R&D facilities in automotive sector at various locations in India. As per the terms and conditions of this project, Out of total spending on NATRiP, share pertaining to ARAI was worked out to Rs. 296.19 Crores. This included Machinery/ Equipments, Revenue expenditure etc.

This amount of Rs. 296.19 crores was funded by Grant-In-Aid from Central Government to the tune of Rs. 255.75 Crores and balance Rs.40.44 Crores is an interest free loan given to ARAI with a moratorium of 7 years starting from FY 2021-22. This loan is to be repaid to Government of India in 8 annual equal instalments of Rs. 5.055 Crores from FY 2028-29 to 2035-36. Accordingly, ARAI has created liability of Rs.40.44 Crores as payable to NATRiP by debiting General Fund. ARAI has invested equivalent amount in Government Securities as per the decision taken in the 210th Governing Council meeting on 14 December 2021.

11. DISCLOSURE OF ASSETS FUNDED BY NATRiP

Internal Audit Wing, Ministry of Industry, Government of India,in their Internal Audit Observations received vide letter No. G-25017/IAW/ARAI/768/2022-23/766 dated 29 March 2023 have mentioned that 'The Assets received or created out of NATRiP funds have not been disclosed distinctively in the Balance Sheet for FY 2021-2022'.

To comply the above observation, from this year, the Assets received or created out of NATRiP funds are disclosed distinctively to the value Rs. 223.54Crores. This value has been calculated as per details below.

Particulars	Rs. In Crores
Total NATRiP Project Value for ARAI	296.19
Less User Charges Paid by ARAI	32.21
Less Loan to be Repaid by ARAI	40.44
Total Assets Funded by NATRiP to ARAI	223.54

12. Wherever information has been received from the Suppliers of their being Micro and Small Enterprises, amounts due to them are generally being paid in time. Hence no liability exists in respect of interest payable to Suppliers under Micro, Small and Medium Enterprises Development Act 2006 (MSMEDA).

13. ARAI is already been registered as a Society under Societies Registration Act, 1860. The application for registration under Maharashtra (Bombay) Public Trust Act was made by the Association on 21st April 2015 as per legal advice obtained in this matter. The Association received registration certificate under Maharashtra (Bombay) Public Trust Act on 12th April 2016.

14. Current Assets, Loan & Advances and Debtors shown in Balance Sheet have a value on realization in the ordinary course of business at least equal to the amount at which they are stated therein.

15. Figures of the Previous Year have been restated and regrouped, wherever necessary, to confirm to the current year's classification.

FOR M/S KIRTANE AND PANDIT LLP,
Chartered Accountants

Parag Pansare
(Partner)
(Firm's Reg. No. W10057)
(Membership No. 117309)
Pune, Dated 28thJune 2023,

Schedules forming part of Financial Statements as on 31st March 2023

(RS IN LAKHS)

PARTICULARS			AS ON 31/3/2023	AS ON 31/3/2022
3 RESERVES AND SURPLUS				
GENERAL FUND - AS PER ANNEXURE			1,18,449.27	1,09,025.68
R&D RESERVE FUND			33,287.82	31,566.34
REPLACEMENT OF EQUIPMENT/ MACHINERY FUND			15,361.63	14,476.11
TOTAL			**1,67,098.73**	**1,55,068.13**
4 OTHER LONG -TERM LIABILITIES				
OTHERS - PAYABLE TO NATRIP			4,044.00	4,044.00
ENDOWNMENT FUND			6.05	5.77
TOTAL OTHER LONG-TERM LIABILITIES			**4,050.05**	**4,049.77**
5 PROVISIONS	**LONG TERM**		**SHORT TERM**	
	31/3/2023	**31/3/2022**	**31/3/2023**	**31/3/2022**
A PROVISION FOR EMPLOYEE BENEFITS				
PROVISION FOR GRATUITY	152.97	1158.04	-	-
PROVISION FOR LEAVE ENCASHMENT	2097.25	2016.97	173.58	161.5
TOTAL PROVISIONS	**2250.22**	**3175.01**	**173.58**	**161.50**
6 TRADE PAYABLES				
A TOTAL OUTSTANDING DUES OF MICRO, SMALL AND MEDIUM ENTERPRISES				218.58
B TOTAL OUTSTANDING DUES OF CREDITORS OTHER THAN MICRO, SMALL AND MEDIUM ENTERPRISES			2,481.46	1,910.16
TOTAL TRADE PAYABLES			**2,481.46**	**2,128.74**
DISCLOSURE RELATING TO SUPPLIERS REGISTERED UNDER MSMED ACT BASED ON THE INFORMATION AVAILABLE WITH THE ENTITY ORGANISATION				
7 OTHER CURRENT LIABILITIES				
A INCOME RECEIVED IN ADVANCE			37.12	46.67
B GOODS AND SERVICE TAX PAYABLE			575.83	625.01
C TDS PAYABLE			50.27	30.33
D ADVANCE RECEIVED FROM CUSTOMERS			3,348.11	1,907.37
E EMPLOYEE INCENTIVE			7,219.96	6,119.66
F INTEREST PAYABLE TO GOVT.			203.62	183.52
G DEPOSITS RECEIVED FROM CUSTOMERS			212.91	226.60
H OTHERS LIABILITIES			1,224.50	585.00
I PROJECT FUNDS			574.71	956.66
J PROVISION FOR BILLS			871.36	915.31
TOTAL OTHER CURRENT LIABILITIES			**14,318.39**	**11,596.13**

(RS IN LAKHS)

PARTICULARS	AS ON 31/3/2023	AS ON 31/3/2022
ANNEXURE TO SCHEDULE NO. 3 : RESERVE & SURPLUS		
A) GENERAL FUND		
AS PER LAST BALANCE SHEET	1,09,025.68	1,05,308.14
ADD: PROJECTS CAPITALISED	26.19	202.90
ADD: MEMBERSHIP ENTRANCE FEE	0.40	0.80
LESS: DEPRECIATION ON GOVT.PROJECTS	1711.46	2087.21
ADD: SURPLUS (DEFICIT) OF SIAT 2021	-0.33	173.57
LESS: DE-CAPITALISATION OF ASSETS	115.00	26.25
LESS : ARAI's SHARE IN GOVT. PROJECTS	54.96	24.98
LESS : PAYABLE TO NATRIP	0.00	4044.00
ADD: EXCESS OF INCOME OVER EXPENDITURE FOR THE YEAR	11,278.75	9,522.71
TOTAL	**1,18,449.27**	**1,09,025.68**
B) R&D RESERVE FUND		
AS PER LAST BALANCE SHEET	31,566.34	29,895.02
ADD: INTEREST	1824.96	1739.27
LESS : UTILISED DURING THE YEAR	103.48	67.94
TOTAL	**33,287.82**	**31,566.34**
C) REPLACEMENT OF EQUIPMENT/MACHINERY FUND		
AS PER LAST BALANCE SHEET	14,476.11	13,649.05
ADD : INTEREST	885.52	827.06
TOTAL	**15,361.63**	**14,476.11**
ANNEXURE TO SCHEDULE NO. 4: ENDOWMENT FUND		
AS PER LAST BALANCE SHEET	5.77	4.53
ADD : FUND RECEIVED DURING THE YEAR	0.00	1.00
ADD: INTEREST	0.28	0.24
LESS : UTILISED DURING THE YEAR	0.00	0.00
TOTAL	**6.05**	**5.77**
ANNEXURE TO SCHEDULE NO. 7: PROJECT FUND		
(A) FUNDS FOR CESS PROJECTS (CAQM)		
AS PER LAST BALANCE SHEET	0.00	0.00
ADD: RECEIVED DURING THE YEAR	25.73	0.00
ADD: EXCESS EXPENSES BORNE BY ARAI	0.00	0.00
TOTAL FUNDS AVAILABLE	25.73	0.00
LESS: REFUNDED TO MINISTRY	0.00	0.00
LESS: EXPENDITURE INCLUDING ADVANCES	0.95	0.00
NET AMOUNT AVAILABLE	**24.78**	**0.00**
(B) FUNDS FOR IMPC PROJECTS		
AS PER LAST BALANCE SHEET	382.78	310.36
ADD: RECEIVED DURING THE YEAR	160.00	366.40
TOTAL FUNDS AVAILABLE	542.78	676.76
LESS: EXPENDITURE INCLUDING ADVANCES	406.20	293.97
NET AMOUNT AVAILABLE	**136.58**	**382.78**

(RS IN LAKHS)

PARTICULARS	AS ON 31/3/2023	AS ON 31/3/2022
(C) FUNDS FOR PLAN PROJECTS		
AS PER LAST BALANCE SHEET	288.76	438.01
ADD: RECEIVED DURING THE YEAR	0.00	0.00
ADD: ARAI'S SHARE IN PROJECT	1.70	7.56
TOTAL FUNDS AVAILABLE	290.46	445.57
LESS: REFUNDED TO MINISTRY	183.82	0.00
LESS: EXPENDITURE INCLUDING ADVANCES	105.07	156.81
NET AMOUNT AVAILABLE	**1.57**	**288.76**
(D) FUNDS FOR DCAAI PROJECTS		
AS PER LAST BALANCE SHEET	153.56	454.39
ADD: RECEIVED DURING THE YEAR	55.00	33.50
ADD: ARAI's SHARE IN PROJECT	37.44	7.92
TOTAL FUNDS AVAILABLE	246.00	495.81
LESS: REFUNDED TO MINISTRY	0.00	74.19
LESS: EXPENDITURE INCLUDING ADVANCES	238.46	268.06
NET AMOUNT AVAILABLE	**7.54**	**153.56**
(E) FUNDS FOR DST PROJECTS		
AS PER LAST BALANCE SHEET	126.62	16.13
ADD: RECEIVED DURING THE YEAR	21.92	291.38
TOTAL FUNDS AVAILABLE	148.54	307.51
LESS: EXPENDITURE INCLUDING ADVANCES	0.00	176.06
LESS: REFUNDED TO MINISTRY	146.54	4.83
NET AMOUNT AVAILABLE	**2.00**	**126.62**
(F) FUNDS FOR CAPITAL GOODS SECTOR PROJECTS		
AS PER LAST BALANCE SHEET	4.94	84.01
ADD: RECEIVED DURING THE YEAR	557.09	0.00
ADD: ARAI'S SHARE IN PROJECT	15.81	
TOTAL FUNDS AVAILABLE	577.84	84.01
LESS: EXPENDITURE INCLUDING ADVANCES	209.07	79.07
NET AMOUNT AVAILABLE	**368.77**	**4.94**
(F) FUNDS FOR CDAC-MEIT		
AS PER LAST BALANCE SHEET	0.00	0.00
ADD: RECEIVED DURING THE YEAR	10.00	0.00
TOTAL FUNDS AVAILABLE	10.00	0.00
LESS: EXPENDITURE INCLUDING ADVANCES	0.00	0.00
NET AMOUNT AVAILABLE	**10.00**	**0.00**
(F) FUNDS FOR PSA		
AS PER LAST BALANCE SHEET	0.00	0.00
ADD: RECEIVED DURING THE YEAR	23.46	0.00
TOTAL FUNDS AVAILABLE	23.46	0.00
LESS: EXPENDITURE INCLUDING ADVANCES	0.00	0.00
NET AMOUNT AVAILABLE	**23.46**	**0.00**
TOTAL (A+B+C+D+E+F)	**574.70**	**956.66**

8 - A Property, Plant and Equipment and Tangible Assets (owned assets)

(Rs in Lakhs)

Particulars / Assets	TANGIBLE ASSETS										
	Freehold land	Land Leashold	Land Total	Buildings	Plant and Equipment Total	Office Equipment	Furniture & Fixtures	Vehicles	Computers & Peripherals	Air Conditioner	Total
Gross Block											
At 31 March 2022	14,921.66	1,156.22	16,077.88	17,523.89	78,635.30	563.83	781.25	815.21	1,348.50	765.52	1,16,511.39
At 1 April 2022				85.38	3,458.46	55.99	29.27	168.57	272.51	6.72	4,076.90
Additions											
At 1 April 2022				0.40	428.73	46.92	13.01	69.28	184.32	12.93	755.59
Deductions											
At 31 March 2023	**14,921.66**	**1,156.22**	**16,077.88**	**17,608.87**	**81,665.03**	**572.90**	**797.51**	**914.50**	**1,436.69**	**759.31**	**1,19,832.69**
Depreciation/Adjustments											
At 31 March 2022	-	-	-	6,485.69	34,028.73	416.25	584.83	603.93	1,104.26	575.88	43,799.57
At 1 April 2022				719.20	4,608.47	81.84	56.31	130.55	233.49	50.43	5,880.29
Additions											
At 1 April 2022				0.39	193.87	46.15	12.07	69.88	181.68	12.61	516.65
Deductions											
At 31 March 2023	**-**	**-**	**-**	**7,204.50**	**38,443.33**	**451.94**	**629.07**	**664.60**	**1,156.07**	**613.70**	**49,163.21**
Net Block											
At 31 March 2022	14,921.66	1,156.22	16,077.88	11,038.20	44,606.57	147.58	196.42	211.28	244.24	189.64	72,711.81
At 31 March 2023	**14,921.66**	**1,156.22**	**16,077.88**	**10,404.37**	**43,221.70**	**120.96**	**168.44**	**249.90**	**280.62**	**145.61**	**70,669.48**

8 - B INTANGIBLE ASSETS

Particulars / Assets	Computer Software	Total
Gross Block		
At 31 March 2022	3,654.09	3,654.09
Additions 2022-23	181.85	181.85
Deductions 2022-23	75.92	75.92
At 31 March 2023	**3,760.02**	**3,760.02**
Depreciation/Adjustments		
At 31 March 2022	3,174.01	3,174.01
At 1 April 2022 Additions	255.18	255.18
At 1 April 2022 Deductions	71.91	71.91
At 31 March 2023	**3,357.28**	**3,357.28**
Net Block		
At 31 March 2022	480.08	480.08
At 31 March 2023	402.74	402.74

Schedules forming part of the Financial Statements for the year ended 31st March , 2023

(RS IN LAKHS)

PARTICULARS	AS ON 31/3/2022		AS ON 31/3/2021	
9 INVESTMENTS - NON CURRENT	**FACE VALUE**	**BOOK VALUE**	**FACE VALUE**	**BOOK VALUE**
(VALUED AT HISTORICAL COST UNLESS STATED OTHERWISE)				
OTHER INVESTMENTS				
GOVERNMENT SECURITIES	12,777.10	13,239.95	4,077.10	4,545.90
FIXED DEPOSITS (LESS THAN ONE YEAR MATURITY)				
BANK DEPOSITS	20,596.01	22,582.41	31,753.42	33,640.82
EARMARKED BANK DEPOSITS	28,207.00	30,197.39	28,515.81	30,013.38
EARMARKED BANK DEPOSITS - CPF INVESTMENT FLUCTUATION	500.00	563.09	350.00	350.00
TOTAL INVESTMENTS	**62,080.11**	**66,582.83**	**64,696.33**	**68,550.10**

PARTICULARS	AS ON 31/3/2023	AS ON 31/3/2022
10 INVENTORIES		
A) FUEL	21.03	27.43
TOTAL	**21.03**	**27.43**
11 TRADE RECEIVABLES		
OUTSTANDING FOR A PERIOD LESS THAN 6 MONTHS FROM THE DATE THEY ARE DUE FOR RECEIPT	-	-
A) SECURED CONSIDERED GOOD		
B) UNSECURED CONSIDERED GOOD	6,265.02	5,313.57
C) DOUBTFUL	-	-
LESS: PROVISION FOR DOUBTFUL RECEIVABLES	-	-
	6,265.02	5,313.57
OUTSTANDING FOR A PERIOD EXCEEDING 6 MONTHS FROM THE DATE THEY ARE DUE FOR RECEIPT		
A) SECURED CONSIDERED GOOD		
B) UNSECURED CONSIDERED GOOD	151.47	186.46
C) DOUBTFUL	10.46	12.95
LESS: PROVISION FOR DOUBTFUL RECEIVABLES	10.46	12.95
	151.47	186.46
TOTAL	**6,416.49**	**5,500.03**
12 CASH AND BANK BALANCES		
A CASH AND CASH EQUIVALENTS		
CASH IN HAND	-	-
A) ON CURRENT ACCOUNTS	259.60	144.99
- BALANCE IN SWEEP-IN AND FLEXI DEPOSITS	5,837.74	2,897.78
TOTAL (I)	**6,097.34**	**3,042.77**
B OTHER BANK BALANCES		
A) BANK DEPOSITS	11,982.61	4,495.93
B) EARMARKED BANK DEPOSITS	18,555.54	14,728.90
C) EARMARKED BANK DEPOSITS - CPF INVESTMENT FLUCTUATION		- -
	30,538.15	19,224.83
TOTAL OTHER BANK BALANCES (II)	36,635.49	22,267.60
TOTAL CASH AND BANK BALANCES (I+II)	**36,635.49**	**22,267.60**

(RS IN LAKHS)

PARTICULARS	LONG TERM		SHORT TERM	
	31/3/2023	31/3/2022	31/3/2023	31/3/2022
13 LOANS AND ADVANCES (UNSECURED)				
A CAPITAL ADVANCES				
CONSIDERED GOOD			1,653.28	166.00
TOTAL (A)			**1,653.28**	**166.00**
B LOANS ADVANCES TO PARTNERS OR RELATIVE OF PARTNERS			**-**	**-**
C OTHER LOANS AND ADVANCES (SPECIFY NATURE)				
STAFF ADVANCES			27.87	15.31
LOAN TO EMPLOYEES			141.18	0.35
PREPAID EXPENSES			365.03	338.05
ADVANCES TO SUPPLIERS AND OTHERS			820.13	418.93
CLAIMS RECEIVABLE				
(A) INCOME TAX			2,212.15	2,304.62
(B) VAT				16.13
OTHER ASSETS			5.35	8.28
TOTAL (C)			**3,571.72**	**3,101.67**
TOTAL (A + B + C)			**5,225.00**	**3,267.67**

	AS ON 31/3/2023	AS ON 31/3/2022
14 OTHER NON-CURRENT ASSETS		
A DEPOSIT WITH PMC	-	3.00
B DEPOSIT WITH MSEDCL	414.82	296.81
C DEPOSITS FOR TELEPHONE AND TELEX	-	0.03
D DEPOSITS WITH GAS AGENCIES	2.42	1.97
E DEPOSIT WITH MPCB	3.75	3.75
F DEPOSIT WITH MIDC, CHAKAN	7.61	7.61
G OTHER DEPOSITS	65.44	66.03
TOTAL OTHER NON-CURRENT ASSETS	**494.04**	**379.19**
15 REVENUE FROM OPERATIONS		
A SALE OF SERVICES	41,951.57	37,037.59
REVENUE FROM OPERATIONS (NET)	**41,951.57**	**37,037.59**
16 OTHER INCOME		
A INTEREST INCOME	5,490.22	4,730.87
LESS : INTEREST ON R&D RESERVEFUND INVESTMENTS	1,824.96	1,739.27
LESS : INTEREST ON REPLACEMENT OF EQUPIPMENT/MACHINERY FUND INVESTMENTS	885.52	827.06
NET INTEREST	**2,779.74**	**2,164.54**
B OTHER NON-OPERATING INCOME		
1 PROVISION WRITTEN BACK- DOUBTFUL DEBTS	12.94	20.63
2 SALE OF SCRAP	117.66	95.25
3 MISCELLANEOUS INCOME	44.42	62.68
4 KNOWLEDGE CENTRE	3.19	3.55
5 ANNUAL MEMBERSIP SUBSCRIPTION	775.10	703.56
6 SIAT INCOME	-	228.18
7 ARAI R&D PROJECTS	103.48	67.94
TOTAL	**3,836.53**	**3,346.33**

Schedules forming part of the Financial Statements for the year ended 31st March, 2023

(RS IN LAKHS)

PARTICULARS	AS ON 31/3/2023	AS ON 31/3/2022
17 EMPLOYEE BENEFITS EXPENSE (INCLUDING CONTRACT LABOUR)		
A SALARIES, WAGES, BONUS AND OTHER ALLOWANCES	17,698.80	16,244.86
B CONTRIBUTION TO PROVIDENT AND OTHER FUNDS	857.33	797.13
C EMPLOYER'S CONTRIBUTION TO SUPERANNUATION FUND	678.94	608.11
D GRATUITY EXPENSES	29.03	584.52
E STAFF WELFARE EXPENSES INCLUDING EMPLOYEE RELATED EXPENSES	554.88	455.79
TOTAL	**19,818.99**	**18,690.41**
18 DEPRECIATION AND AMORTIZATION EXPENSE		
A ON TANGIBLE ASSETS (REFER NOTE 8)	5,880.29	6,129.27
B ON INTANGIBLE ASSETS (REFER NOTE 8)	255.18	320.64
LESS : DEPRECIATION ON GOVT PROJECT ASSETS	1,711.46	2,087.21
TOTAL	**4,424.02**	**4,362.70**
19 OTHER EXPENSES		
A POWER AND FUEL	2,709.57	2,167.26
B REPAIRS AND MAINTENANCE - MACHINERY	610.41	587.95
C INSURANCE	55.99	46.04
D RENT, RATES AND TAXES, EXCLUDING, TAXES ON INCOME	69.64	54.68
E LABOUR CHARGES	1,436.91	1,179.85
F TRAVELLING EXPENSES	67.95	19.36
G AUDITOR'S REMUNERATION (REFER NOTE BELOW)	2.35	1.75
H PRINTING AND STATIONERY	13.82	21.03
I COMMUNICATION EXPENSES	62.16	61.65
J LEGAL AND PROFESSIONAL CHARGES	45.14	64.30
K BUSINESS PROMOTION EXPENSES	70.33	26.91
L LOSS ON SALE OF PROPERTY, PLANT AND EQUIPMENT	30.53	47.64
M LOSS ON FOREIGN EXCHANGE TRANSACTIONS (NET)	13.48	8.42
N ARAI R&D EXPENDITURE	103.48	67.94
O PROVISION FOR DOUBTFUL DEBTS	10.46	12.95
P MISCELLANEOUS EXPENSES	367.13	314.90
Q SIAT EXPENSES	0.33	54.62
TOTAL	**5,669.67**	**4,737.25**

Table - 25

(RS IN LAKHS)

Capital Work in Progress	31st March 2023	31st March 2022	Intangible assets under development	31st March 2023	31st March 2022
Opening Balance	2995.36	13504.08	Opening Balance	-	-
Add: Additions during the year	5188.71	5705.78	Add: Additions during the year	-	-
Less: Capitalized during the year	4258.75	16214.50	Less: Capitalized during the year	-	-
Closing Balance	**3925.32**	**2995.36**	**Closing Balance**	**-**	**-**

The Institute of Chartered Accountants of India vide their Guidelines dated 2nd June 2022 on Financial Statements of Non-Corporate Entities, have changed the format of presentation of Financial Statements w.e.f. FY 2021-22. Accordingly, the Financial Statements are presented in the said format from page 56 to page 72.

However, for the better understanding and to match with previous year's Balance Sheet and Income & Expenditure Accounts the same Financial Statements are printed from page 74 to page 92 in the old format, only for reference.

Balance Sheet as on 31st March 2023

(RS IN LAKHS)

PARTICULARS	SCH NO		AS ON 31-03-2023		AS ON 31-03-2022
SOURCES OF FUNDS					
1. GENERAL & OTHER FUNDS					
A) GENERAL FUND	1	1,18,449.27		1,09,025.68	
B) R & D RESERVE FUND	2	33,287.82		31,566.34	
C) REPLACEMENT OF EQUIPMENT / MACHINERY FUND	3	15,361.63		14,476.11	
			1,67,098.73		1,55,068.14
2. ENDOWMENT FUND	4		6.05		5.77
3. PROJECT FUNDS (NET)	5		574.71		956.66
4. NATRIP FUND			4,044.00		4,044.00
5. CURRENT LIABILITIES AND PROVISIONS	6		18,648.94		16,104.72
TOTAL			**1,90,372.41**		**1,76,179.28**
APPLICATION OF FUNDS					
1. FIXED ASSETS	7		74,997.54		76,187.24
2. NON CURRENT INVESTMENTS	8		13,239.95		4,545.90
3. CURRENT ASSETS, DEPOSITS AND ADVANCES					
A) INVENTORIES	9(A)	21.03		27.43	
B) SUNDRY DEBTORS	9(B)	6,416.49		5,500.03	
C) DEPOSITS, CASH & BANK BALANCES	9(C)	89,978.38		86,271.81	
D) ADVANCES AND OTHER ASSETS	9(D)	5,225.00		3,267.67	
E) SUNDRY DEPOSITS	9(E)	494.04	1,02,134.93	379.19	95,446.13
TOTAL			**1,90,372.41**		**1,76,179.28**

Income and Expenditure Account for the Year Ended 31st March 2023

(RS IN LAKHS)

PARTICULARS	SCH NO		YEAR ENDED 31-03-2023		YEAR ENDED 31-03-2022
INCOME					
OPERATIONAL INCOME			41,951.57		37,037.59
ANNUAL MEMBERSHIP SUBSCRIPTION (NET)			775.10		703.56
SIAT INCOME			0.00		228.18
FUNDS TRANSFERRED FROM R&D RESERVE FUND			103.48		67.94
INTEREST	10		5,490.22		4,730.87
OTHER INCOME	11		178.21		182.10
TOTAL INCOME			**48,498.58**		**42,950.26**
EXPENDITURE					
OPERATIONAL EXPENSES			4,597.00		2,897.29.
ARAI R&D PROJECTS			103.48		67.94
SALARIES & OTHER ALLOWANCES	12		19,351.13		18,260.10
EMPLOYEE RELATED EXPENSES			467.86		430.31
ESTABLISHMENT EXPENSES	13		5,565.87		4,614.68
DEPRECIATION		6,135.48		6,449.91	
LESS: DEPRECIATION ON GOVT. FUNDED ASSETS		1,711.46	4,424.02	2,087.21	4,362.70
SIAT EXPENSES			0.33		54.62
TOTAL EXPENDITURE			**34,509.69**		**30,687.64**
EXCESS OF INCOME OVER EXPENDITURE			13,988.90		12,262.61
APPROPRIATION					
A) INTEREST ON EARMARKED FUNDS TRANSFERRED TO RESPECTIVE FUNDS					
- R &D RESERVE FUND		1,824.96		1,739.27	
- REPLACEMENT OF EQUIPMENT/ MACHINERY FUND		885.52	2,710.48	827.06	2,566.33
B) SIAT SURPLUS / (DEFICIT) TRANSFERRED TO GENERAL FUND			(0.33)		173.57
EXCESS OF INCOME OVER EXPENDITURE (NET)			11,278.75		9,522.72
TOTAL			**48,498.58**		**42,950.26**

Schedules Forming Part of Balance Sheet as on 31st March 2023

(RS IN LAKHS)

PARTICULARS	AS ON 31-03-2023	AS ON 31-03-2022
SCHEDULE NO. 1: GENERAL FUND		
AS PER LAST BALANCE SHEET	1,09,025.68	1,05,308.14
ADD : PROJECTS CAPITALISED	26.19	202.90
ADD : MEMBERSHIP ENTRANCE FEE	0.40	0.80
LESS : DEPRECIATION ON GOVT.PROJECTS	1,711.46	2,087.21
ADD : SURPLUS (DEFICIT) OF SIAT 2021	(0.33)	173.57
LESS : DE-CAPITALISATION OF ASSETS	115.00	26.25
LESS : ARAI's SHARE IN GOVT. PROJECTS	54.96	24.98
LESS : NATRIP FUND	0.00	4,044.00
ADD : EXCESS OF INCOME OVER EXPENDITURE FOR THE YEAR	11,278.75	9,522.71
TOTAL	**1,18,449.27**	**1,09,025.68**
SCHEDULE NO. 2: R&D RESERVE FUND		
AS PER LAST BALANCE SHEET	31,566.34	29,895.02
ADD : INTEREST	1,824.96	1,739.27
LESS : UTILISED DURING THE YEAR	103.48	67.94
TOTAL	**33,287.82**	**31,566.34**
SCHEDULE NO. 3: REPLACEMENT OF EQUIPMENT/MACHINERY FUND		
AS PER LAST BALANCE SHEET	14,476.11	13,649.05
ADD : INTEREST	885.52	827.06
TOTAL	**15,361.63**	**14,476.11**
SCHEDULE NO. 4: ENDOWMENT FUND		
AS PER LAST BALANCE SHEET	5.77	4.53
ADD : FUND RECEIVED DURING THE YEAR	0.00	1.00
ADD : INTEREST	0.28	0.24
LESS : UTILISED DURING THE YEAR	0.00	0.00
TOTAL	**6.05**	**5.77**

Schedules Forming Part of Balance Sheet as on 31st March 2023

(RS IN LAKHS)

PARTICULARS	AS ON 31/3/2023	AS ON 31/3/2022
SCHEDULE NO. 5: PROJECT FUNDS (NET)		
(A) FUNDS FOR CESS PROJECTS (CAQM)		
AS PER LAST BALANCE SHEET	0.00	0.00
ADD: RECEIVED DURING THE YEAR	25.73	0.00
ADD: EXCESS EXPENSES BORNE BY ARAI	0.00	0.00
TOTAL FUNDS AVAILABLE	25.72	0.00
LESS: REFUNDED TO MINISTRY	0.00	0.00
LESS: EXPENDITURE INCLUDING ADVANCES	0.94	0.00
NET AMOUNT AVAILABLE AS PER APPENDIX I ATTACHED	**24.78**	**0.00**
(B) FUNDS FOR IMPC PROJECTS		
AS PER LAST BALANCE SHEET	382.78	310.36
ADD: RECEIVED DURING THE YEAR	160.00	366.40
TOTAL FUNDS AVAILABLE	542.78	676.76
LESS: EXPENDITURE INCLUDING ADVANCES	406.20	293.97
NET AMOUNT AVAILABLE AS PER APPENDIX II ATTACHED	**136.58**	**382.78**
(C) FUNDS FOR PLAN PROJECTS		
AS PER LAST BALANCE SHEET	288.76	438.01
ADD: RECEIVED DURING THE YEAR	0.00	0.00
ADD: ARAI'S SHARE IN PROJECT	1.70	7.56
TOTAL FUNDS AVAILABLE	290.47	445.57
LESS: REFUNDED TO MINISTRY	183.82	0.00
LESS: EXPENDITURE INCLUDING ADVANCES	105.06	156.81
NET AMOUNT AVAILABLE AS PER APPENDIX III ATTACHED	**1.59**	**288.76**
(D) FUNDS FOR DCAAI PROJECTS		
AS PER LAST BALANCE SHEET	153.56	454.39
ADD: RECEIVED DURING THE YEAR	55.00	33.50
ADD: ARAI's SHARE IN PROJECT	37.44	7.92
TOTAL FUNDS AVAILABLE	246.00	495.81
LESS: REFUNDED TO MINISTRY	0.00	74.19
LESS: EXPENDITURE INCLUDING ADVANCES	238.46	268.06
NET AMOUNT AVAILABLE AS PER APPENDIX IV ATTACHED	**7.54**	**153.56**
(E) FUNDS FOR DST PROJECTS		
AS PER LAST BALANCE SHEET	126.62	16.13
ADD: RECEIVED DURING THE YEAR	21.92	291.38
TOTAL FUNDS AVAILABLE	148.54	307.51
LESS: EXPENDITURE INCLUDING ADVANCES	146.55	176.06
LESS: REFUNDED TO MINISTRY	0.00	4.83
NET AMOUNT AVAILABLE AS PER APPENDIX V ATTACHED	**1.99**	**126.62**

Schedules Forming Part of Balance Sheet as on 31st March 2023

(RS IN LAKHS)

PARTICULARS	AS ON 31/3/2023	AS ON 31/3/2022
(F) FUNDS FOR CAPITAL GOODS SECTOR PROJECTS		
AS PER LAST BALANCE SHEET	4.94	84.01
ADD: ARAI'S SHARE IN PROJECT	15.82	0.00
ADD: RECEIVED DURING THE YEAR	557.09	0.00
TOTAL FUNDS AVAILABLE	577.84	84.01
LESS: EXPENDITURE INCLUDING ADVANCES	209.08	79.07
NET AMOUNT AVAILABLE AS PER APPENDIX VI ATTACHED	**368.77**	**4.94**
(G) FUNDS FOR CDAC-MEIT		
AS PER LAST BALANCE SHEET	0.00	0.00
ADD: RECEIVED DURING THE YEAR	10.00	0.00
TOTAL FUNDS AVAILABLE	10.00	0.00
LESS: EXPENDITURE INCLUDING ADVANCES	0.00	0.00
NET AMOUNT AVAILABLE AS PER APPENDIX VII ATTACHED	**10.00**	**0.00**
(H) FUNDS FOR PSA		
AS PER LAST BALANCE SHEET	0.00	0.00
ADD: RECEIVED DURING THE YEAR	23.46	0.00
TOTAL FUNDS AVAILABLE	23.46	0.00
LESS: EXPENDITURE INCLUDING ADVANCES	0.00	0.00
NET AMOUNT AVAILABLE AS PER APPENDIX VIII ATTACHED	**23.46**	**0.00**
TOTAL (A+B+C+D+E+F+G+H)	**574.71**	**956.66**
SCHEDULE NO. 6: CURRENT LIABILITIES & PROVISIONS		
SUNDRY CREDITORS	2,481.46	1,723.01
ADVANCES RECEIVED FROM CUSTOMERS	3,348.11	1,907.37
EMPLOYEE INCENTIVE	7,219.96	6,119.66
PAYABLE TO CPF TRUST	915.75	706.62
EMPLOYEE DUES	262.36	230.97
UNPAID EARNED LEAVE BALANCES/LEAVE ENCASHMENT	2,270.83	2,178.47
GRATUITY LIABILITY	152.97	1,158.04
OTHER LIABILITIES		
INTEREST PAYABLE TO GOVERNMENT	203.62	183.52
PROVISION OF BILLS/EXPENSES	871.36	915.31
DEPOSITS RECEIVED FROM CUSTOMERS	212.91	227.91
DUTIES & TAXES	626.10	655.32
INCOME RECEIVED IN ADVANCE	37.12	46.67
OTHERS	46.39	51.85
TOTAL	**18,648.94**	**16,104.72**

Schedules Forming Part of Balance Sheet as on 31st March 2023

(RS IN LAKHS)

PARTICULARS	AS ON 31/3/2023	AS ON 31/3/2022
SCHEDULE NO. 7: FIXED ASSETS		
GROSS BLOCK	1,23,592.71	1,20,165.47
LESS: ACCUMULATED DEPRECIATION	52,520.49	46,973.58
NET BLOCK	71,072.22	73,191.89
CWIP	3,925.32	2,995.36
TOTAL	**74,997.54**	**76,187.24**
SCHEDULE NO. 8 : NON CURRENT INVESTMENTS		
INVESTMENT IN GOVT SECURITIES	13,004.50	4,245.75
PREMIUM PAID ON GOVT SECURITIES	235.45	300.15
TOTAL	**13,239.95**	**4,545.90**
SCHEDULE NO. 9(A): INVENTORIES		
FUEL	21.03	27.43
TOTAL	**21.03**	**27.43**
SCHEDULE NO. 9(B): SUNDRY DEBTORS		
UNSECURED, CONSIDERED GOOD, UNLESS STATED OTHERWISE		
OUTSTANDING FOR A PERIOD EXCEEDING SIX MONTHS	151.47	186.46
OTHER DEBTS	6,265.02	5,313.57
CONSIDERED DOUBTFUL	10.46	12.95
LESS: PROVISION	10.46	12.95
TOTAL	**6,416.49**	**5,500.03**
SCHEDULE NO. 9(C): DEPOSITS, CASH & BANK BALANCES		
CASH IN HAND	0.00	0.00
BANK BALANCES WITH SCHEDULED BANKS		
- BALANCE WITH SAVINGS ACCOUNTS	259.60	144.99
- BALANCE IN SWEEP-IN AND FLEXI DEPOSITS	5,837.74	2,897.78
FIXED DEPOSITS WITH SCHEDULED BANKS		
- EARMARKED FUNDS	48,752.93	44,742.28
- EARMARKED - CPF INVESTMENT FLUCTUATION	563.09	350.00
- OTHERS	34,565.02	38,136.76
TOTAL	**89,978.38**	**86,271.81**

Schedules Forming Part of Income & Expenditure Account as on 31st March 2023

(RS IN LAKHS)

PARTICULARS	AS ON 31/3/2022	AS ON 31/3/2021
SCHEDULE NO. 9(D): ADVANCES		
STAFF ADVANCES FOR EXPENSES	27.87	15.31
LOAN TO EMPLOYEES	141.18	0.35
ADVANCE AGAINST CAPITAL EXPENDITURE	1,653.28	166.00
PREPAID EXPENSES	365.03	338.05
ADVANCES TO SUPPLIERS AND OTHERS	820.13	418.93
BALANCES WITH GOVT. AUTHORITIES		
(A) GST	0.00	0.00
(B) INCOME TAX	2,212.15	2,304.62
(C) VAT	0.00	16.13
OTHER ASSETS	5.35	8.28
TOTAL	**5,225.00**	**3,267.67**
SCHEDULE NO. 9(E): SUNDRY DEPOSITS		
DEPOSIT WITH PMC	0.00	3.00
DEPOSIT WITH MSEDC	414.82	296.81
DEPOSITS FOR TELEPHONE	0.00	0.03
DEPOSITS WITH GAS AGENCIES	2.42	1.97
DEPOSIT WITH MPCB	3.75	3.75
DEPOSIT WITH MIDC, CHAKAN	7.61	7.61
OTHER DEPOSITS	65.44	66.03
TOTAL	**494.04**	**379.19**
SCHEDULE NO. 10: INTEREST		
RECEIVED	1,680.04	938.01
ACCRUED	3,810.18	3,792.86
TOTAL	**5,490.22**	**4,730.87**
SCHEDULE NO. 11: OTHER INCOME		
PROVISIONS WRITTEN BACK-		
- DOUBTFUL DEBTS	12.94	20.63
FOREIGN EXCHANGE FLUCTUATIONS	0.00	0.00
SALE OF SCRAP	117.66	95.25
MISCELLANEOUS INCOME	44.43	62.68
KNOWLEDGE CENTRE	3.19	3.55
TOTAL	**178.21**	**182.10**

Schedules Forming Part of Income & Expenditure Account as on 31st March 2023

(RS IN LAKHS)

PARTICULARS	AS ON 31/3/2022	AS ON 31/3/2021
SCHEDULE NO. 12: SALARIES & OTHER ALLOWANCES		
SALARIES & ALLOWANCES	17,698.80	16,244.86
EMPLOYER'S CONTRIBUTION TO PROVIDENT FUND	857.33	797.13
EMPLOYER'S CONTRIBUTION TO SUPERANNUATION FUND	678.94	608.11
GRATUITY EXPENSES	29.03	584.52
LEAVE TRAVEL CONCESSION	87.02	25.48
TOTAL	**19,351.13**	**18,260.10**
SCHEDULE NO. 13 ESTABLISHMENT EXPENSES		
AMORTISATION OF PREMIUM PAID ON GOV SEC	95.29	2.79
ASSETS WRITTEN OFF	0.00	119.12
AUDIT FEES	2.35	1.75
BAD DEBTS AND CLAIMS WRITTEN OFF	22.12	5.75
BOOKS & PERIODICALS	23.45	23.69
COMMUNICATION EXPENSES	62.16	61.65
ELECTRICITY CHARGES	2,709.57	2,167.26
EXTERNAL LABOUR/SECURITY AND STIPEND ETC.	1,436.91	1,179.85
FOREIGN EXCHANGE FLUCTUATION	13.48	8.42
INSURANCE CHARGES	55.99	46.04
ISO 9000/TUV CERTIFICATION EXPENSES	10.43	10.99
LEGAL AND PROFESSIONAL FEES	45.14	64.30
LOSS ON SALE OF ASSET	30.53	47.64
MARKETING EXPENSES	70.33	26.91
MISCELLANEOUS EXPENSES	35.82	28.91
NABL ACCREDITATION EXPENSES	9.21	5.28
PRINTING & STATIONERY	13.82	21.03
PROVISION FOR DOUBTFUL DEBTS	10.46	12.95
RATES & TAXES	69.64	54.68
REPAIRS & MAINTENANCE	610.41	587.95
SIX SIGMA EXPENSES AND QUALITY AWARDS	0.00	0.00
TRAINING AND CONFERANCE EXPENSES	24.25	5.31
TRANSPORT CHARGES	91.05	70.47
TRAVELLING & CONVEYANCE	65.55	19.36
WATER CHARGES	55.50	42.59
WP 29 SEMINAR EXPENSES	2.40	0.00
TOTAL	**5,565.87**	**4,614.68**

Statement of Receipts & Payments on Cess Projects (CAQM)

APPENDIX-I

(RS IN LAKHS)

Sr. No.	NAME OF THE PROJECT	PROJECT COST	RECEIPTS			PAYMENTS			REFUND	NET FUNDS AVAILABLE
			UPTO 2021-2022	FOR 2022-23	TOTAL (4+5)	UPTO 2021-2022	FOR 2022-23	TOTAL (7+8)		(6-9-10)
1	2	3	4	5	6	7	8	9	10	11
1	Evaluation of Retro-fitment of 2 wheelers & 3 wheeler Auto-rickshaws with Electric Drive as an option for improvement in air quality in NCR	105.00	0.00	25.73	25.73	0.00	0.95	0.95	0.00	24.78
	TOTAL	**105.00**	**0.00**	**25.73**	**25.73**	**0.00**	**0.95**	**0.95**	**0.00**	**24.78**

APPENDIX-II

(RS IN LAKHS)

SR NO	NAME OF THE PROJECT	TOTAL PROJECT COST	ARAI PROJECT COST	RECEIPTS			PAYMENTS			NET FUND AVAILABLE
				UPTO 2021-22	2022-23	TOTAL(5+6)	UPTO 2021-22	2022-23	TOTAL(8+9)	(7-10)
1	2	3	4	5	6	7	8	9	10	11
1	SETTING UP OF A MODEL INSPECTION & CERTIFICATION CENTRE AT NASIK IN MAHARASHTRA	1440.00	735.00	841.28	0.00	841.28	834.52	0.00	834.52	6.76
2	SETTING UP OF A MODEL INSPECTION & CERTIFICATION CENTRE AT RAILMAGARA IN RAJASTHAN	1440.00	735.00	828.55	0.00	828.55	734.76	82.00	816.76	11.79
3	SETTING UP OF A MODEL INSPECTION & CERTIFICATION CENTRE AT NELAMANGALA, BANGALORE DISTRICT IN KARNATAKA	1440.00	730.00	886.34	0.00	886.34	864.87	0.00	864.87	21.47
4	SETTING UP OF A MODEL INSPECTION & CERTIFICATION CENTRE AT MALKAPUR IN HYDERABAD DISTRICT IN ANDHRA PRADESH	1440.00	65.00	70.06	0.00	70.06	51.78	0.00	51.78	18.27
5	SETTING UP OF A MODEL INSPECTION & CERTIFICATION CENTRE AT OLPADA IN SURAT DISTRICT IN GUJARAT	1440.00	65.00	70.13	0.00	70.13	58.53	0.00	58.53	11.60
6	SETTING UP OF A MODEL INSPECTION & CERTIFICATION CENTRE AT CUTTACK IN ODISHA	1794.41	835.00	1034.81	0.00	1034.81	1069.06	0.00	1069.06	-34.25
7	SETTING UP OF A MODEL INSPECTION & CERTIFICATION (I & C) CENTRE IN MALAPPURAM, KERALA	1575.00	870.00	110.00	0.00	110.00	26.69	0.00	26.69	83.31
8	SETTING UP OF A MODEL INSPECTION & CERTIFICATION (I & C) CENTRE IN GOA	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.04	-0.04
9	SETTING UP OF A MODEL INSPECTION & CERTIFICATION (I & C) CENTRE IN PUDUCHERRY	1750.00	845.00	485.00	160.00	645.00	400.34	243.30	643.64	1.36
10	PDI FOR ODISHA	0.00	0.00	18.92	0.00	18.92	18.92	0.00	18.92	0.00
11	SETTING UP OF A MODEL INSPECTION & CERTIFICATION (I & C) CENTRE IN VISHAKHAPATTANAM	1650.00	910.00	115.00	0.00	115.00	17.77	80.92	98.68	16.32
	TOTAL	**13969.41**	**5790.00**	**4460.08**	**160.00**	**4620.08**	**4077.28**	**406.21**	**4483.50**	**136.58**

APPENDIX-III

(RS IN LAKHS)

SR NO	NAME OF THE PROJECT	PROJECT COST	RECEIPTS			EXPENDITURE			EXPENSES BORNE BY ARAI	EXPENSES BORNE BY ARAI	REFUND	NET FUNDS AVALIABLE
			UPTO		TOTAL	UPTO		TOTAL				
			2021-22	2022-23	(4+5)	2021-22	2022-23	(7+8)	2021-2022	2022-23	(10+11)	(6-9+12)
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Establishment of Testing Infrastructure for Certification Testing Of Electric & Hybrid Vehicles	5,000.00	3,000.00	-	3,000.00	2,717.45	98.73	2,816.18	-	-	183.82	-
2	Decelopment of AC-DC Combined Public Charging Station suitable of Indian Application	350.00	175.00	-	175.00	336.88	6.34	343.22	168.10	1.70		1.59
	TOTAL	**5,350.00**	**3,175.00**	**-**	**3,175.00**	**3,054.33**	**105.07**	**3,159.40**	**168.10**	**1.70**	**183.82**	**1.59**

APPENDIX- IV

(RS IN LAKHS)

SR NO	NAME OF THE PROJECT	PROJECT COST	RECEIPTS			PAYMENTS			ARAI & INDUSTRY PARTNER'S SHARE IN DCAAI PROJECTS				NET FUNDS AVALIABLE
			UPTO	FOR	TOTAL	UPTO	FOR	TOTAL	UPTO	FOR	TOTAL		
			2021-22	2022-23	(4+5)	2021-22	2022-23	(7+8)	2021-22	2022-23	(10+11)	REFUND	(6 - 9 + 12-13)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Development of guidelines for accelerated validation of safety critical axle components due to increase in axle load speicifications/norms and charge in driving pattern and infrastructure	350.00	260.00	55.00	315.00	146.10	199.50	345.60	0.00	32.65	32.65	0.00	2.05
2	Development of Efficient Battery Thermal Management System for Two and Three Wheeler EV application through design of Innovative Packaging Material FAME-II	170.24	152.63	0.00	152.63	117.20	37.72	154.92	4.22	3.56	7.78	0.00	5.50
3	Development of an E axle Power train Kit for 3-wheeler application in India	119.00	104.00	0.00	104.00	118.02	1.23	119.25	14.02	1.23	15.25	0.00	0.00
	TOTAL	**639.24**	**516.63**	**55.00**	**571.63**	**381.32**	**238.46**	**619.78**	**18.25**	**37.44**	**55.69**	**0.00**	**7.54**

Statement of Receipts & Payments on DST Projects

APPENDIX-V

(RS IN LAKHS)

Sr. No.	NAME OF THE PROJECT	PROJECT COST	RECEIPTS			PAYMENTS			REFUND	NET FUNDS AVAILABLE
			UPTO 2021-22	FOR 2022-2023	TOTAL (4+5)	UPTO 2021-22	FOR 2022-2023	TOTAL (7+8)		(6-9-10)
1	2	3	4	5	6	7	8	9	10	11
1	Green manufacturing of Automobile Forgings by Precision Forging	48.57	48.57	0.00	48.57	39.59	8.98	48.57	0.00	0.00
2	Design, Development and Prototyping of Light Electric Vehice (2&3- Wheeler) AC Charge Point with Indian EV charger Manufacturers	39.00	36.00	0.00	36.00	30.46	7.05	37.51	0.00	-1.51
3	Performance Evaluation of M15 Fuel on Gasoline 2 & 4 wheelers (Vehicle and Engine)	270.00	243.00	0.00	243.00	130.91	130.50	261.42	0.00	-18.42
4	Development of prototype aluminium seat frame for passenger buses	40.00	0.00	21.92	21.92	0.00	0.00	0.00	0.00	21.92
	TOTAL	**397.57**	**327.57**	**21.92**	**349.49**	**200.96**	**146.54**	**347.50**	**0.00**	**1.99**

Statement of Receipts & Payments on Captial Goods Sector Projects (industry Partner's Fund)

APPENDIX-VI (A)

(RS IN LAKHS)

Sr. No.	NAME OF THE PROJECT	PROJECT COST	RECEIPTS			PAYMENTS			NET FUNDS AVAILABLE
			UPTO 2021-22	FOR 2022-2023	TOTAL (4+5)	UPTO 2021-22	FOR 2022-2023	TOTAL (7+8)	(6-9)
1	2	3	4	5	6	7	8	9	10
1	Development of Technology web- based Innovation Platform namely "Technovuus"	352.00	90.00	191.12	281.12	85.07	192.05	277.11	4.01
2	Establishment of Digital Twin Centers for Emerging Automotive Systems	3,360.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Augmentation of existing facilities at ARAI, viz. Battery Safety Lab, Modular Infrastructure for V&V of ADAS and Cylinder Testing	5,445.00	0.00	0.05	0.05	0.00	0.00	0.00	0.05
4	Establishment of Centre of Excellence (CoE) for Intelligent Vehicle Technology (IVT)	2,164.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	TOTAL	**11,321.00**	**90.00**	**191.17**	**281.17**	**85.07**	**192.05**	**277.11**	**4.06**

APPENDIX-VI (B)

(RS IN LAKHS)

Sr. No.	NAME OF THE PROJECT	PROJECT COST	RECEIPTS			PAYMENTS			NET FUNDS AVAILABLE
			UPTO 2021-22	FOR 2022-2023	TOTAL (4+5)	UPTO 2021-22	FOR 2022-2023	TOTAL (7+8)	(6-9)
1	2	3	4	5	6	7	8	9	10
1	Establishment of Digital Twin Centers for Emerging Automotive Systems								
	Industry Partner as below								
	Micelio Mobility Pvt. Ltd	840.00	0.00	170.00	170.00	0.00	1.21	1.21	168.79
2	Establishment of Centre of Excellence (CoE) for Intelligent Vehicle Technology (IVT)								
	Industry Partners as below								
	Qualitas Global Services LLP	274.00	0.00	129.40	129.40	0.00	0.00	0.00	129.40
	Starkenn Technologies P Ltd	78.00	0.00	13.12	13.12	0.00	0.00	0.00	13.12
	Continental Automotive Components India P Ltd	104.00	0.00	21.00	21.00	0.00	0.00	0.00	21.00
	Loopway Private Limited	85.00	0.00	32.40	32.40	0.00	0.00	0.00	32.40
	TOTAL	**1,381.00**	**0.00**	**365.92**	**365.92**	**0.00**	**1.21**	**1.21**	**364.71**

APPENDIX-VI (C)

(RS IN LAKHS)

SR NO	NAME OF THE PROJECT	PROJECT COST	RECEIPTS			PAYMENTS			ARAI'S SHARE IN CGS PROJECTS			NET FUNDS AVALIABLE
			UPTO	FOR	TOTAL	UPTO	FOR	TOTAL	UPTO	FOR	TOTAL	
			2021-22	2022-23	(4+5)	2021-22	2022-23	(7+8)	2021-2022	2022-23	(10+11)	(6-9)
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Development of Technology web-based Innovation Platform namely "Technovuus	88.00	0.00	0.00	0.00	9.50	15.82	25.32	9.50	15.82	25.32	0.00
2	Augmentation of existing facilities at ARAI, viz. Battery Safety Lab, Modular Infrastructure for V&V of ADAS and Cylinder Testing	1,580.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	TOTAL	**1,668.00**	**0.00**	**0.00**	**0.00**	**9.50**	**15.82**	**25.32**	**9.50**	**15.82**	**25.32**	**0.00**

APPENDIX-VII

(RS IN LAKHS)

Sr. No.	NAME OF THE PROJECT	PROJECT COST	RECEIPTS			PAYMENTS			REFUND	NET FUNDS AVAILABLE (6 - 9 - 10)
			UPTO 2021-2022	FOR 2022-23	TOTAL (4+5)	UPTO 2021-2022	FOR 2022-23	TOTAL (7+8)		
1	2	3	4	5	6	7	8	9	10	11
1	Development of SiC device based Battery Emulator and Functional Test systems for Electric Vehicle Supply Equipment (Battery Emulator)	30.00	0.00	10.00	10.00	0.00	0.00	0.00	0.00	10.00
	TOTAL	**30.00**	**0.00**	**10.00**	**10.00**	**0.00**	**0.00**	**0.00**	**0.00**	**10.00**

APPENDIX-VIII

(RS IN LAKHS)

Sr. No.	NAME OF THE PROJECT	PROJECT COST	RECEIPTS			PAYMENTS			REFUND	NET FUNDS AVAILABLE (6 - 9 - 10)
			UPTO 2021-2022	FOR 2022-23	TOTAL (4+5)	UPTO 2021-2022	FOR 2022-23	TOTAL (7+8)		
1	2	3	4	5	6	7	8	9	10	11
1	Project Management & Assistance for Development of R&D Roadmap Document for e-Mobility in India	46.93	0.00	23.46	23.46	0.00	0.00	0.00	0.00	23.46
	TOTAL	**46.93**	**0.00**	**23.46**	**23.46**	**0.00**	**0.00**	**0.00**	**0.00**	**23.46**

APPENDIX- IX (A)

(RS IN LAKHS)

Particulars	GROSS BLOCK				ACCUMULATED DEPRECIATION				NET BLOCK	
	As on 31-03-2022	Additions during the year	Deductions during the year	As on 31-03-2023	As on 31-03-2022	Deductions during the year	Provided during the year	As on 31-03-2023	As on 31-03-2023	As on 31-03-2022
I LAND	16,077.88	0.00	0.00	16,077.88	0.00	0.00	0.00	0.00	16,077.88	16,077.88
A) FREE HOLD LAND	14,921.66			14,921.66					14,921.66	14,921.66
B) LEASE HOLD LAND	1,156.22			1,156.22					1,156.22	1,156.22
II BUILDING & ROADS	17,523.89	85.38	0.40	17,608.87	6,485.69	0.39	719.20	7,204.51	10,404.35	11,038.20
III PLANT & MACHINERY	78,635.30	3,458.46	428.73	81,665.03	34,028.73	193.87	4,608.47	38,443.33	43,221.70	44,606.57
IV FURNITURE & FIXTURES	781.25	29.27	13.01	797.51	584.83	12.07	56.31	629.06	168.45	196.42
V OFFICE EQUIPMENTS	563.83	55.99	46.92	572.90	416.25	46.15	81.84	451.94	120.96	147.58
VI COMPUTERS& PERIPHERALS	1,348.50	272.51	184.32	1,436.69	1,104.26	181.68	233.49	1,156.07	280.63	244.24
VII VEHICLES	815.21	168.57	69.28	914.50	603.93	69.88	130.55	664.60	249.90	211.28
VIII AIR CONDITIONERS	765.52	6.72	12.93	759.31	575.88	12.61	50.43	613.70	145.61	189.64
IX INTANGIBLE ASSETS	3,654.09	181.85	75.92	3,760.02	3,174.01	71.91	255.18	3,357.28	402.74	480.08
TOTAL	**1,20,165.47**	**4,258.75**	**831.51**	**1,23,592.71**	**46,973.58**	**588.56**	**6,135.47**	**52,520.49**	**71,072.22**	**73,191.89**
CAPITAL WORK IN PROGRESS	2,995.36	5,188.71	4,258.75	3,925.32					3,925.32	2,995.36
GRAND TOTAL	**1,23,160.83**	**9,447.46**	**5,090.26**	**1,27,518.03**	**46,973.58**	**588.56**	**6,135.47**	**52,520.49**	**74,997.54**	**76,187.25**
PREVIOUS YEAR TOTAL	1,05,240.81	16,214.50	1,289.84	1,20,165.48	41,571.71	1,048.05	6,449.91	46,973.58	76,187.25	77,173.17

APPENDIX - IX (B)

(RS IN LAKHS)

Particulars	GROSS BLOCK				ACCUMULATED DEPRECIATION				NET BLOCK	
	As on 31-03-2022	Additions during the year	Deductions during the year	As on 31-03-2023	As on 31-03-2022	Deductions during the year	Provided during the year	As on 31-03-2023	As on 31-03-2023	As on 31-03-2022
I LAND	20.92	0.00	0.00	20.92	0.00	0.00	0.00	0.00	20.92	20.92
II BUILDING & ROADS										
a NATRiP FUNDED	6,297.09	0.00	0.00	6,297.09	1,619.67	227.79	0.00	1,847.46	4,449.62	4,677.41
b OTHERS	2,268.66	0.00	0.40	2,268.26	1,301.85	50.12	0.39	1,351.59	916.68	966.82
BUILDING & ROADS TOTAL	**8,565.75**	**0.00**	**0.40**	**8,565.35**	**2,921.52**	**277.91**	**0.39**	**3,199.05**	**5,366.30**	**5,644.23**
III PLANT & MACHINERY										
a NATRiP FUNDED	16,056.92	0.00	0.00	16,056.92	6,768.63	882.39	0.00	7,651.02	8,405.90	9,288.29
b OTHERS	16,073.87	47.44	278.05	15,843.27	10,554.92	529.86	167.20	10,917.58	4,925.69	5,518.95
PLANT & MACHINERY TOTAL	**32,130.79**	**47.44**	**278.05**	**31,900.19**	**17,323.55**	**1,412.25**	**167.20**	**18,568.60**	**13,331.59**	**14,807.24**
IV FURNITURE & FIXTURES	72.31	0.00	0.62	71.69	67.72	1.19	0.60	68.31	3.38	4.59
V OFFICE EQUIPMENTS	13.26	0.74	5.45	8.55	10.07	1.74	5.42	6.40	2.16	3.19
VI COMPUTERS& PERIPHERALS	17.52	8.30	1.70	24.12	16.50	4.83	1.68	19.65	4.47	1.02
VII VEHICLES	28.33	0.00	10.74	17.59	28.18	0.05	10.70	17.54	0.05	0.14
VIII AIR CONDITIONERS	81.71	0.00	3.01	78.71	69.83	3.08	2.92	69.99	8.72	11.88
IX INTANGIBLE ASSETS	344.74	1.08	3.94	341.89	318.96	10.41	0.00	329.37	12.51	25.78
TOTAL NATRiP FUNDED ASSETS	**22,354.01**	**0.00**	**0.00**	**22,354.01**	**8,388.30**	**1,110.18**	**0.00**	**9,498.48**	**12,855.52**	**13,965.70**
TOTAL OTHER ASSETS	**18,921.32**	**57.56**	**303.91**	**18,675.00**	**12,368.03**	**601.28**	**188.91**	**12,780.43**	**5,894.58**	**6,553.29**
TOTAL GOVERNMENT FUNDED ASSETS	**41,275.33**	**57.56**	**303.91**	**41,029.01**	**20,756.33**	**1,711.46**	**188.91**	**22,278.91**	**18,750.10**	**20,518.99**
CAPITAL WORK IN PROGRESS	31.38	26.19	57.56	0.01					0.01	31.38
GRAND TOTAL	**41,306.71**	**83.75**	**361.47**	**41,029.02**	**20,756.33**	**1,711.46**	**188.91**	**22,278.91**	**18,750.11**	**20,550.37**

Fixed Assets Schedule of Goverment Funded Assets - From 1.4.22 to 31.3.23 (These Government Funded Assets are Included in Total ARAI Assets in APPENDIX IX (A))

ARAI Management Committee

Dr. Reji Mathai
Director - ARAI
director@araiindia.com

Akbar Badusha
Senior Deputy Director

Nitin Dhande
Senior Deputy Director

Anand Deshpande
Senior Deputy Director

Ms. Medha Mainkar
Senior Deputy Director

Sanjay Nibandhe
Senior Deputy Director

Dr. Sukrut Thipse
Senior Deputy Director

Vikram Shinde
Senior Deputy Director

Ms. Medha Jambhale
Senior Deputy Director

Sandeep Medane
Senior Deputy Director

Dr. Nagesh Walke
Senior Deputy Director

Atul Bhide
Deputy Director

Vijay Pankhawala
Deputy Director

Charudatta Mukhedkar
Deputy Director

Shirish Dabir
General Manager

ARAI

Progress through Research

The Automotive Research Association of India

(Under the Administrative Control of Ministry of Heavy Industries, Govt. of India)

Postal Address :

P. O. Box No. 832, Pune - 411 004, India

Address :

Survey No. 102, Vetal Hill, Off Paud Road,
Kothrud, Pune - 411 038. Maharashtra, India
Tel.: +91-20-6762 1122 , 6762 1111 | Fax: +91-20-6762 1104
E-mail: director@araiindia.com
Website: www.araiindia.com

Design & Printed @ United Multicolour Printers Private Limited