



RAILWAY HUMAN FACTORS RESEARCH PROGRAMME (RHFRP)
ENHANCING HUMAN PERFORMANCE • STRENGTHENING SAFETY CULTURE • ADVANCING
RESEARCH FOR SAFER RAILWAYS
A FLAGSHIP RESEARCH INITIATIVE OF THE RAIL SAFETY RESEARCH AND DEVELOPMENT
FORUM (RSRDF)
A UNIT OF THE ALL INDIA RAIL SAFETY COUNCIL (AIRSC)

The Railway Human Factors Research Programme (RHFRP) is a flagship multidisciplinary research initiative of the Rail Safety Research and Development Forum (RSRDF), a unit of the All India Rail Safety Council (AIRSC), established to advance scientific understanding of the human elements that influence railway safety, operational performance, organisational resilience, and decision-making.

While modern railway systems increasingly rely on advanced technologies such as Artificial Intelligence, Intelligent Signalling, Predictive Maintenance, Digital Railways, High-Speed Rail, and Smart Infrastructure, people remain central to every aspect of railway operations. Human judgement, communication, leadership, teamwork, competency, situational awareness, and organisational culture continue to play a decisive role in maintaining safe and efficient railway services.

The Railway Human Factors Research Programme provides a national platform for research, innovation, education, policy development, and professional collaboration to better understand how human behaviour interacts with technology, infrastructure, and operational systems. Through evidence-based research and practical recommendations, the programme aims to minimise operational risks, improve workforce wellbeing, strengthen safety leadership, and foster a proactive safety culture across the railway sector.

The programme aligns with the national priorities of Viksit Bharat 2047, Atmanirbhar Bharat, Digital India, Skill India, Make in India, and the United Nations Sustainable Development Goals (SDGs) by promoting research that places people at the centre of safe, resilient, and future-ready railway systems.

Vision

To establish India as a global leader in railway human factors research by promoting scientific excellence, behavioural safety, leadership development, and human-centred innovation that enhances the safety, reliability, and sustainability of railway transportation.

Mission

The Railway Human Factors Research Programme aims to:

Advance multidisciplinary research on human performance and railway safety.

Promote evidence-based strategies for reducing human error and operational risk.

Strengthen safety leadership and organisational culture.

Improve workforce wellbeing, competence, and resilience.

Support the design of human-centred technologies and work environments.

Encourage collaboration among railway organisations, academia, industry, and research institutions.

Develop practical recommendations that improve railway operations and public safety.

Strategic Objectives

Human-Centred Safety

Promote research that integrates engineering, psychology, ergonomics, management, and behavioural sciences to improve the interaction between people, technology, and railway operations.

Operational Excellence

Enhance human performance through better training, communication, teamwork, competency management, and decision-support systems.

Safety Culture Development

Strengthen organisational values that encourage accountability, learning, reporting, continuous improvement, and shared responsibility for safety.

Workforce Wellbeing

Support research on occupational health, mental wellbeing, fatigue management, stress reduction, work-life balance, and employee engagement to improve long-term operational performance.

Leadership and Decision-Making

Develop leadership models and decision-support frameworks that enable managers and frontline personnel to respond effectively to routine operations, emergencies, and complex operational environments.

Core Research Areas

The programme promotes research in:

Human Factors Engineering

Behavioural Safety

Human Reliability Analysis

Safety Culture Assessment

Leadership and Organisational Behaviour

Crew Resource Management

Human-Machine Interface (HMI)

Ergonomics and Workplace Design

Fatigue and Alertness Management

Cognitive Workload Analysis

Situational Awareness

Decision-Making Under Pressure

Communication and Team Coordination

Safety Reporting and Learning Systems

Occupational Health and Wellbeing

Competency Management

Training Effectiveness

Emergency Response Behaviour

Passenger Behaviour and Public Safety

Human Factors in High-Speed Rail and Metro Rail

Human Factors in Digital Railway Systems

Artificial Intelligence and Human Interaction

Change Management and Digital Transformation

Flagship Research Initiatives

The Railway Human Factors Research Programme includes:

- National Human Factors Research Mission
- Railway Safety Behavioural Science Initiative
- Human Performance Improvement Programme
- Fatigue Risk Management Research Project
- Railway Leadership Excellence Programme
- Safety Culture Assessment Framework
- Human-Machine Interface Innovation Project
- Crew Resource Management Development Initiative
- Passenger Behaviour and Public Safety Study
- Workforce Wellbeing Research Programme
- Railway Cognitive Safety Research Centre
- Human Factors Knowledge Repository

Research Methodology

The programme adopts an evidence-based approach using:

- Field Studies
- Behavioural Observation
- Accident and Incident Analysis
- Human Reliability Assessment
- Risk Assessment Techniques
- Surveys and Questionnaires
- Simulation-Based Research
- Laboratory Studies
- Case Studies
- Data Analytics
- Artificial Intelligence-Based Modelling
- Operational Performance Evaluation
- International Benchmarking

Technology Integration

The programme explores how emerging technologies can support human performance through:

- Artificial Intelligence Decision Support
- Digital Twins for Human-Centred Operations
- Virtual Reality (VR) Training
- Augmented Reality (AR) Learning
- Smart Wearable Technologies
- Human Performance Analytics
- Intelligent Fatigue Monitoring
- Predictive Safety Analytics

Advanced Driver Assistance Systems

Digital Competency Assessment Platforms

These technologies complement human expertise by improving awareness, decision-making, training effectiveness, and operational safety.

Capacity Building

The programme supports professional development through:

- Professional Certification Programmes
- Executive Development Courses
- Human Factors Leadership Training
- Research Fellowships
- Faculty Development Initiatives
- Technical Workshops
- National and International Conferences
- Student Research Competitions
- Internship Programmes
- E-Learning Platforms
- Behavioural Safety Seminars
- Knowledge Exchange Forums

Research Collaboration

The programme encourages collaboration with:

- Indian Railways
- Metro Rail Corporations
- Railway Production Units
- Railway Public Sector Undertakings
- Research Designs and Standards Organisation (RDSO)
- IITs, NITs, Universities, and Engineering Institutions
- Medical and Occupational Health Experts
- Psychology and Human Behaviour Research Centres
- Technology Companies
- Professional Engineering Institutions
- Government Departments
- International Railway Organisations

Collaborative research ensures that findings are scientifically robust, operationally relevant, and aligned with national and international best practices.

Knowledge Dissemination

The programme promotes the publication and sharing of knowledge through:

- Research Journals
- Technical Papers
- White Papers
- Human Factors Guidelines
- Safety Bulletins
- Best Practice Manuals
- Case Studies
- Technical Reports
- National Conferences
- International Symposia
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Digital Knowledge Repository

Webinars and Expert Forums

Expected Outcomes

The Railway Human Factors Research Programme aims to achieve:

Stronger safety culture across railway organisations.

Improved human performance and operational reliability.

Reduction in human-factor-related safety risks.

Better leadership and decision-making capabilities.

Enhanced workforce health, wellbeing, and resilience.

Improved training systems and competency management.

Human-centred technology integration.

Greater collaboration between engineering, behavioural science, and operational disciplines.

Evidence-based policy recommendations for railway safety.

Internationally recognised research in railway human factors.

National Significance

Human performance remains one of the most critical elements of railway safety. By understanding how people interact with technology, infrastructure, procedures, and organisational systems, India can build a railway network that is not only technologically advanced but also safer, more resilient, and more responsive to operational challenges.

The Railway Human Factors Research Programme contributes to national development by creating a scientific foundation for improving safety, strengthening workforce capability, enhancing public confidence, and supporting sustainable railway growth.

The Rail Safety Research and Development Forum (RSRDF) is committed to promoting research that recognises people as the cornerstone of railway safety.

Through the Railway Human Factors Research Programme, we seek to unite engineers, psychologists, safety professionals, railway administrators, academic institutions, researchers, healthcare experts, and policymakers in developing practical, research-driven solutions that improve human performance and operational excellence.

By combining behavioural science, engineering innovation, and professional leadership, the programme will help shape a future where every railway employee is empowered, every operational decision is informed, and every journey is safer.

As India moves towards Viksit Bharat 2047, RHFRP will play a pivotal role in building a world-class railway system founded on knowledge, competence, innovation, and an enduring commitment to protecting human life.

"People First • Performance Always • Safety Without Compromise."

"Understanding Human Behaviour to Build Safer Railways."

ALL INDIA RAIL SAFETY COUNCIL
— Safety First • Safety Always —

RAILWAY HUMAN FACTORS RESEARCH PROGRAMME (RHFRP)

Enhancing Human Performance • Strengthening Safety Culture
• Advancing Research for Safer Railways

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The Railway Human Factors Research Programme provides a national platform for research, innovation, education, policy development, and professional collaboration to better understand how human behaviour interacts with technology, infrastructure, and operational systems. Through evidence-based research and practical recommendations, the programme aims to minimise operational risks, improve workforce wellbeing, strengthen safety leadership, and foster a proactive safety culture across the railway sector.

The programme aligns with the national priorities of Viksit Bharat 2047, Atmanirbhar Bharat, Digital India, Skill India, Make in India, and the United Nations Sustainable Development Goals (SDGs) by promoting research that places people at the centre of safe, resilient, and future-ready railway systems.



VISION

To establish India as a global leader in railway human factors research by promoting scientific excellence, behavioural safety, leadership development, and human-centred innovation that enhances the safety, reliability, and sustainability of railway transportation.



MISSION

The Railway Human Factors Research Programme aims to:

- Advance multidisciplinary research on human performance and railway safety.
- Promote evidence-based strategies for reducing human error and operational risk.
- Strengthen safety leadership and organisational culture.
- Improve workforce wellbeing, competence, and resilience.
- Support the design of human-centred technologies and work environments.
- Encourage collaboration among railway organisations, academia, industry, and research institutions.
- Develop practical recommendations that improve railway operations and public safety.

STRATEGIC OBJECTIVES



HUMAN-CENTRED SAFETY

Promote research that integrates engineering, psychology, ergonomics, management, and behavioural sciences to improve the interaction between people, technology, and railway operations.



OPERATIONAL EXCELLENCE

Enhance human performance through better training, communication, teamwork, competency management, and decision-support systems.



SAFETY CULTURE DEVELOPMENT

Strengthen organisational values that encourage accountability, learning, reporting, continuous improvement, and shared responsibility for safety.



WORKFORCE WELLBEING

Support research on occupational health, mental wellbeing, fatigue management, stress reduction, work-life balance, and employee engagement to improve long-term performance.



LEADERSHIP AND DECISION-MAKING

Develop leadership models and decision-support frameworks that enable managers and frontline personnel to respond effectively to routine operations, emergencies, and complex environments.

CORE RESEARCH AREAS

- Human Factors Engineering
- Behavioural Safety
- Human Reliability Analysis
- Safety Culture Assessment
- Leadership and Organisational Behaviour
- Crew Resource Management
- Human-Machine Interface (HMI)
- Ergonomics and Workplace Design
- Fatigue and Alertness Management
- Cognitive Workload Analysis
- Situational Awareness
- Decision-Making Under Pressure
- Communication and Team Coordination
- Safety Reporting and Learning Systems
- Occupational Health and Wellbeing
- Competency Management
- Training Effectiveness
- Emergency Response Behaviour
- Passenger Behaviour and Public Safety
- Human Factors in High-Speed Rail and Metro Rail
- Human Factors in Digital Railway Systems
- Artificial Intelligence and Human Interaction
- Change Management and Digital Transformation

FLAGSHIP RESEARCH INITIATIVES

- National Human Factors Research Mission
- Railway Safety Behavioural Science Initiative
- Human Performance Improvement Programme
- Fatigue Risk Management Research Project
- Railway Leadership Excellence Programme
- Safety Culture Assessment Framework
- Human-Machine Interface Innovation Project
- Crew Resource Management Development Initiative
- Passenger Behaviour and Public Safety Study
- Workforce Wellbeing Research Programme
- Railway Cognitive Safety Research Centre
- Human Factors Knowledge Repository

RESEARCH METHODOLOGY

- Field Studies
- Behavioural Observation
- Accident and Incident Analysis
- Human Reliability Assessment
- Risk Assessment Techniques
- Surveys and Questionnaires
- Simulation-Based Research
- Laboratory Studies
- Case Studies
- Data Analytics
- Artificial Intelligence-Based Modelling
- Operational Performance Evaluation
- International Benchmarking

EXPECTED OUTCOMES

- ✓ Reduction in human errors and operational risks
- ✓ Improved safety culture and leadership practices
- ✓ Enhanced workforce competence and wellbeing
- ✓ Better integration of humans, technology and processes
- ✓ Evidence-based policy and operational improvements
- ✓ Strengthened public confidence in railway safety
- ✓ Contribution to Viksit Bharat 2047 and global SDG goals





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Aligned with Viksit Bharat 2047, Atmanirbhar Bharat, Digital India, Skill India, Make in India and the UN Sustainable Development Goals, the programme places people at the centre of safe, resilient and future-ready railway systems.



People
at the Centre



Safety
as a Culture



Performance
Excellence



Research for
Future Railways

VISION



To establish India as a global leader in railway human factors research by promoting scientific excellence, behavioural safety, leadership development, and human-centred innovation that enhances the safety, reliability, and sustainability of railway transportation.

MISSION

- Advance multidisciplinary research on human performance and safety
- Promote evidence-based strategies to reduce human error and risk
- Strengthen safety leadership and organisational culture
- Improve workforce wellbeing, competence and resilience
- Support human-centred technologies and work environments
- Encourage collaboration across railway, academia, industry and research institutions
- Develop practical recommendations that improve operations and public safety

STRATEGIC OBJECTIVES



Human-Centred Safety



Operational Excellence



Safety Culture Development



Workforce Wellbeing



Leadership & Decision-Making

CORE RESEARCH AREAS

- Human Factors Engineering
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- Emergency Response Behaviour
- Human Factors in High-Speed & Metro
- Digital Systems, AI & Human Interaction
- Passenger Behaviour & Public Safety
- Change Management & Transformation

TECHNOLOGY INTEGRATION



AI Decision Support & Analytics



Digital Twins for Operations



Virtual Reality (VR) Training



Augmented Reality (AR) Learning



Smart Wearable Technologies



Human Performance Analytics



Intelligent Fatigue Monitoring



Predictive Safety Analytics



Advanced Driver Assistance Systems



Digital Competency Platforms

CAPACITY BUILDING

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KNOWLEDGE DISSEMINATION

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- Technical Papers & White Papers
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- Safety Bulletins & Best Practices
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EXPECTED OUTCOMES

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- ✓ Better leadership and decision-making capabilities
- ✓ Enhanced workforce health, wellbeing and resilience
- ✓ Improved training and competency management
- ✓ Human-centred technology integration
- ✓ Greater collaboration across disciplines
- ✓ Evidence-based policy recommendations
- ✓ Internationally recognised research in human factors

NATIONAL SIGNIFICANCE

Human performance is one of the most critical elements of railway safety. By understanding how people interact with technology, infrastructure, procedures and organisational systems, India can build a railway network that is safer, more resilient and responsive to operational challenges, contributing to national development and public confidence.



SAFER
OPERATIONS



RESILIENT
WORKFORCE



INNOVATIVE
SOLUTIONS



SUSTAINABLE
FUTURE



VIKSIT BHARAT
2047



OUR COMMITMENT

The Rail Safety Research and Development Forum (RSRDF) is committed to promoting research that recognises people as the cornerstone of railway safety.

- Through RHFRP, we unite engineers, psychologists, safety professionals, researchers and policymakers to develop practical, research-driven solutions that improve human performance and operational excellence.
- Together, we build a future where every employee is empowered, every decision is informed, and every journey is safer.



METHODOLOGY

- Field Studies & Behavioural Observation
- Accident & Incident Analysis
- Human Reliability & Risk Assessment
- Surveys, Data Analytics & AI Modelling
- Simulation-Based & Laboratory Research
- Case Studies & Operational Evaluation
- International Benchmarking



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