



ALL INDIA RAIL SAFETY COUNCIL

www.railsafety.co.in

ARTIFICIAL INTELLIGENCE IN TRAFFIC & SAFETY MANAGEMENT

Smarter Decisions • Earlier Warnings • Safer Railways



Traffic
Optimisation



Predictive
Safety



Real-Time
Intelligence



Human-Led
Control



AI can analyse railway data, identify emerging risks and support faster, better-informed decisions.



Viksit Bharat 2047



Make in India



Net Zero 2070



Digital India



Vision Zero

Technology Supporting People. Intelligence Protecting Lives.



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UNDERSTANDING AI IN THE RAILWAY ENVIRONMENT

Recognise Patterns • Predict Risks • Support Decisions



PATTERN
RECOGNITION



PREDICTION



CLASSIFICATION



DECISION
SUPPORT

DETERMINISTIC SAFETY SYSTEMS



Certified rules and
fail-safe control

VS

AI-BASED SUPPORT



AI prioritises information and detects unusual conditions; safety-critical authority remains with validated systems and trained professionals.



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Know the Technology. Define Its Limits. Protect Every Journey.



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INTELLIGENT TRAFFIC, TIMETABLES & DELAY MANAGEMENT

Optimise Capacity • Predict Disruption • Keep India Moving



Timetable Planning

Design feasible, efficient timetables aligned with demand, infrastructure and operating priorities.



Capacity Optimisation

Maximise line capacity and asset utilisation through simulation, bottleneck analysis and smart planning.



Real-Time Regulation

Monitor live traffic and infrastructure to make dynamic decisions and keep trains moving smoothly.



Delay Prediction

Use AI/ML models to forecast delays and propagate impact across the network early.



Disruption Response

Rapidly assess, re-plan and communicate to minimise disruption and recover faster.



AI can compare operating options, forecast network effects and present ranked recommendations—while trained controllers retain authority.

Right Train • Right Route • Right Time • Safer Network



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AI-ASSISTED SIGNALLING & HUMAN CONTROL

AI Supports • Certified Systems Protect • Professionals Decide



AI must **never** casually replace deterministic, independently validated, fail-safe railway controls.



EXPLAINABLE
ADVICE



TECHNICAL
VALIDATION



REGULATORY
OVERSIGHT



SAFE HUMAN
OVERRIDE

Innovation Within Safety. Automation With Accountability.



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PREDICTIVE MAINTENANCE & AI-BASED TRACK INSPECTION

Detect Early • Maintain Proactively • Prevent Failure



CONDITION SENSORS



Continuous data on track components and environment.

FAILURE PREDICTION



AI models predict degradation and potential failures.

TRACK IMAGE ANALYSIS



High-resolution imaging detects anomalies with precision.

VERIFIED MAINTENANCE ACTION



Confirm, plan and execute targeted maintenance.

MONITOR → ANALYSE → ALERT → INSPECT → REPAIR → VERIFY



A prediction improves safety only when it leads to a defined, timely and accountable maintenance response.

See the Risk Before It Becomes a Failure.



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MACHINE VISION, WHEEL & BEARING MONITORING

Inspect Every Train • Detect Every Defect • Act Without Delay



Loose & Hanging Parts



Wheel Impact Detection



Bearing Temperature



Automated Safety Alerts



AI combines images, vibration, impact, sound and temperature data to identify emerging rolling-stock defects.

DETECT → CLASSIFY → ALERT → STOP & INSPECT → CLEAR FOR SERVICE

Every Component Matters. Every Alert Requires Action.



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DRONES & ENHANCED VISION FOR SAFER INFRASTRUCTURE

Inspect Remotely • See Through Adverse Weather • Protect Railway Teams



Bridge
Inspection



Overhead
Equipment



Thermal
Detection



Fog
Assistance



Engineer
Verification



AI-assisted vision can reveal cracks, overheating, vegetation intrusion and low-visibility hazards—but qualified professionals must assess every critical finding.



Driver-assistance tools support vigilance; they do not replace operating rules.

Better Vision. Earlier Detection. Safer Operations.



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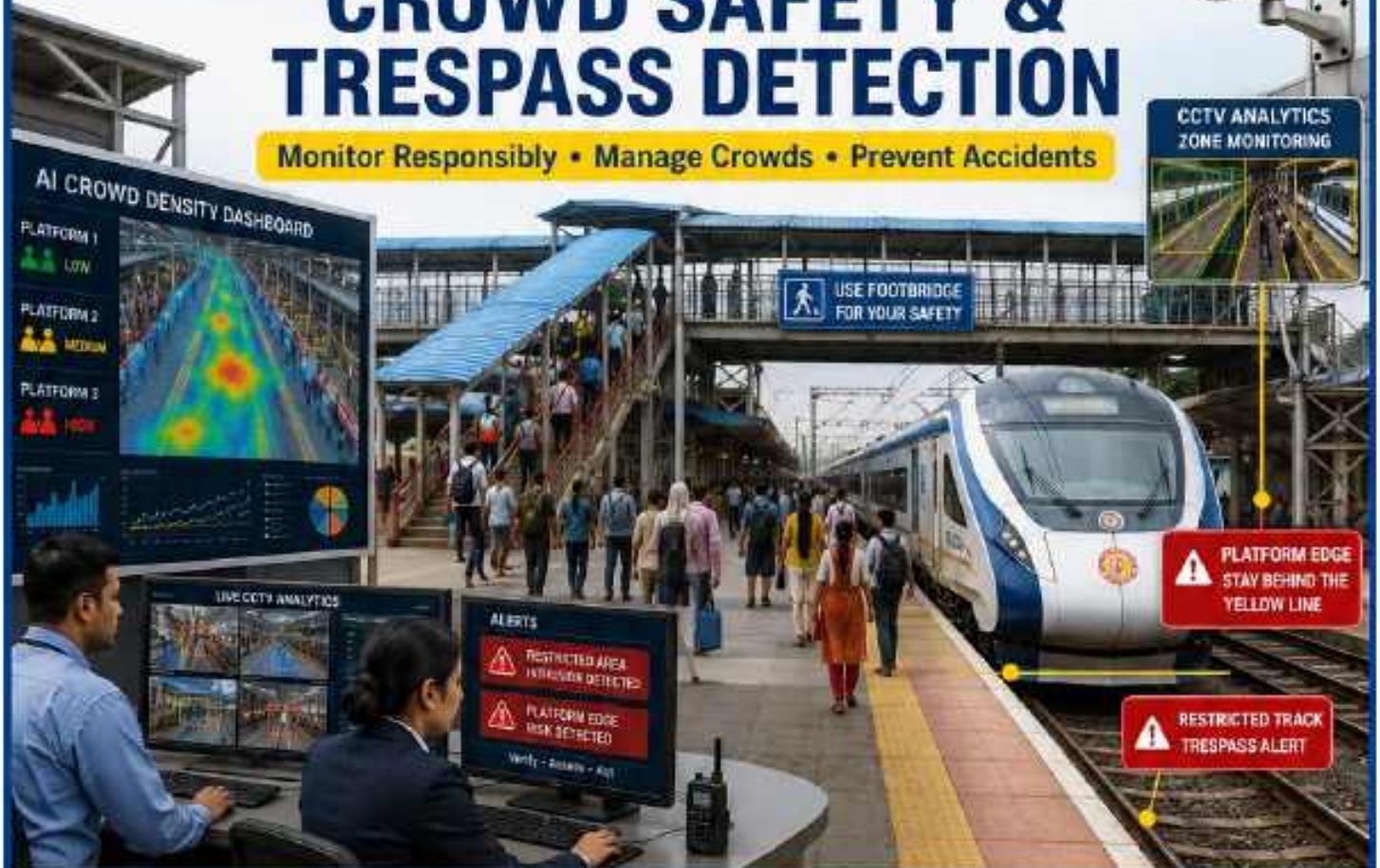


Vision Zero



SMART STATIONS, CROWD SAFETY & TRESPASS DETECTION

Monitor Responsibly • Manage Crowds • Prevent Accidents



Crowd Density

AI monitors crowd concentration in real time to help manage load and prevent congestion.



Intrusion Alerts

Detects entry into restricted or track areas and alerts authorised personnel.



Unattended Objects

Identifies unattended baggage for early detection and quick verification.



Safe Passenger Flow

Guides orderly movement through stations and footbridges for safer, smoother journeys.



Human Verification

Authorised personnel verify alerts and take appropriate action based on context.



KEY MESSAGE

AI can direct attention to potential risks; every alert requires contextual assessment by authorised personnel.



SAFETY FIRST

Technology complements barriers, fencing, footbridges, public awareness and enforcement.



PRIVACY FIRST

Purpose-Limited Data • Controlled Access • Responsible Retention

Smart Surveillance. Responsible Action. Safer Stations.



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WEATHER HAZARDS & AI-ASSISTED EMERGENCY RESPONSE

— Predict Risk • Prepare Resources • Respond Rapidly —



Flood Alerts

Monitor rainfall, river levels and drainage conditions in real time.



Landslide Risk

Detect slope instability and issue early warnings for vulnerable stretches.



Heat & Wind Monitoring

Track extreme heat and wind for safe train operations.



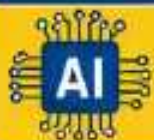
Incident Location

Accurate detection and rapid communication of incident locations.



Resource Coordination

AI-prioritised deployment of the right teams and equipment.



AI can provide earlier warning and prioritise limited resources, but **field inspection and human command** remain central.



— Prepared Networks Save Time. Coordinated Response Saves Lives. —



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RESPONSIBLE AI FOR SAFE, TRUSTED & FUTURE-READY RAILWAYS

Innovation • Integrity • Accountability • Vision Zero



Quality Data



Explainable & Auditable AI



Human Oversight



Cybersecurity



Privacy & Ethics



Continuous Validation



AI is a decision-support and risk-detection tool—

not a substitute for professional judgement, certified protection systems or regulatory responsibility.

VISION ZERO PLEDGE

Every Model Tested • Every Alert Traceable • Every Decision Accountable • Every Life Valued

Human Wisdom + Responsible Technology =
Safer Railways for **Viksit Bharat**



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AI • Safety Culture • Innovation • Research