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EDITORIAL ANALYSIS

Tracks to Transformation – Modernisation Is Powering a Safer, Faster Indian Railways

 **INDIAN EXPRESS**

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ECONOMY**SCIENCE & TECH****GS3**

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Tracks to Transformation — Modernisation Is Powering a Safer, Faster Indian Railways

 The Indian Express 23 April 2026 **GS3**

IE The Indian Express

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INTERVIEW ANGLE

"India has renewed 55,000+ km of tracks since 2014 and accidents have fallen dramatically. But with a 98.43% operating ratio and falling freight share, is India's Railway transformation financially sustainable — and what does it still need to fix?"

THE CORE ARGUMENT

India's railway modernisation under the 2014-26 period has delivered tangible safety improvements — track renewal at scale, advanced flaw detection, Kavach deployment, and electrification — reducing accidents dramatically. The editorial celebrates these gains while identifying three unresolved structural challenges: **unsustainable operating ratio (~98%), declining freight modal share, and the slow pace of Kavach rollout** relative to the 64,000-km network. It argues that technology adoption (AI maintenance, green-hydrogen trains) must be complemented by financial restructuring to ensure the transformation is durable.

INDIAN RAILWAYS — SCALE AND SIGNIFICANCE

Network Overview

INDICATOR	FIGURE
Route km	~68,000 km (4th largest in world)
Track km	~1.35 lakh km
Daily passengers	~2.4 crore
Daily trains	~13,000+
Freight handled (FY26)	~1,700 MT (million tonnes)
Employees	~12.5 lakh (one of world's largest employers)
Revenue (FY26 estimate)	~₹2.65 lakh crore

India's railways are central to national integration, freight movement, and affordable mass transit.

THE MODERNISATION RECORD (2014-26)

Track Infrastructure

INITIATIVE	ACHIEVEMENT
Track renewal	55,000+ km renewed since 2014
Long Welded Rail (LWR)	Eliminates rail joints — reduces vibration, fracture risk, maintenance cost
Rail Ultrasonic Flaw Detection (USFD)	Automated detection of internal rail cracks before failure
Mechanised track maintenance	Multi-purpose machines replacing manual patrolling
High-speed corridors	Delhi-Mumbai (NHSRCL bullet train under construction); Vande Bharat tracks upgraded

Electrification

INDICATOR	DETAIL
Electrification coverage	~95% of broad gauge routes electrified (2024-25)
Electric traction share	~80% of freight; near-total for passenger
Annual fuel saving	~₹14,000 crore (vs. diesel)
CO ₂ reduction	Substantial; India Railways targeting net-zero by 2030

Safety Improvement

INDICATOR	2013-14	2024-25	CHANGE
Train accidents	118/year	~40/year	-66%
Passenger fatalities	High	Significantly reduced	Sharp decline
Derailments	~60/year	~20/year	-67%

The **Balasore train accident (June 2023)** — 296 killed in Odisha’s triple-train collision — was a major setback, but post-Balasore safety reforms (Kavach acceleration, signalling upgrade) have shown improvement.

KAVACH — INDIA’S AUTOMATIC TRAIN PROTECTION SYSTEM

Kavach (Hindi: “armour”) is the Indian Railways’ **Automatic Train Protection (ATP)** system:

FEATURE	DETAIL
Function	Automatic brake application to prevent Signal Passed at Danger (SPAD) and collision
Technology	Radio frequency (RF) + RFID + GPS integration
Maximum speed	Works up to 160 km/h
Kavach 4.0	Latest version with enhanced features
Deployed (as of 2026)	~3,000 km (vs. target of 64,000 km network)
Cost	~₹50 lakh/km

Problem: At current deployment pace, full Kavach coverage of Indian Railways would take 20+ more years. The editorial identifies this as the critical gap — collisions like Balasore are preventable with Kavach.

THE FINANCIAL CHALLENGE — OPERATING RATIO

What Is Operating Ratio?

$$\text{Operating Ratio} = \frac{\text{Operating Expenses}}{\text{Revenue}} \times 100$$

A ratio of 98% means ₹98 is spent for every ₹100 earned — leaving only ₹2 for capital investment.

YEAR	OPERATING RATIO
FY2013-14	~93%
FY2019-20	~98.4%
FY2025-26 (estimated)	~98.43%

What makes OR high:

- Massive staff costs (~60-65% of revenue)
- Below-cost passenger fares (cross-subsidised by freight)
- Capex burden (station redevelopment, rolling stock, electrification)

Freight Modal Share Decline

YEAR	INDIAN RAILWAYS FREIGHT MODAL SHARE
1990s	~65%
2010	~36%
2024-25	~26%

Freight is cross-subsidising passengers, but road (trucks) has eaten into freight market share due to speed, flexibility, and last-mile connectivity.

THE TECHNOLOGY FRONTIER

AI in Railway Maintenance

- **Predictive maintenance:** AI systems analyse vibration, thermal, and acoustic data to predict wheel, axle, and rail failures before they occur

- **CMRS (Centralised Monitoring and Reporting System):** Real-time train tracking and performance monitoring
- **Drones:** Bridge inspection, track inspection in inaccessible areas

Green Hydrogen Trains

- India Railways announced pilot for **hydrogen-powered trains** on Jind-Sonipat section (Haryana) – using hydrogen fuel cells to power traction
- Potential to decarbonise non-electrified heritage sections

Vande Bharat Express

Vande Bharat (Made-in-India semi-high-speed trains):

- Self-propelled (no separate locomotive) – Electric Multiple Unit (EMU) design
- Maximum speed: 160 km/h
- Features: Automatic doors, bio-vacuum toilets, CCTV, GPS information system
- Network: 100+ trains by 2026 across major routes

UPSC ANGLE

PAPER	ANGLE
GS3 – Economy	Railway finances, operating ratio, freight modal share
GS3 – Infrastructure	Kavach, electrification, Vande Bharat, track modernisation
GS3 – S&T	AI in railways, green hydrogen, Kavach ATP system
GS2 – Governance	Indian Railways reform, PPP in stations, RLDA

Mains Keywords: Kavach, operating ratio, Balasore accident, Vande Bharat, freight modal share, railway electrification, Long Welded Rail, USFD, ATP system, green hydrogen trains, NHRCL

Probable Question: “Despite significant modernisation, Indian Railways faces structural financial challenges that threaten long-term viability. Critically examine.” (GS3 Mains)

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