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**EDITORIAL ANALYSIS**

# Beyond Kavach — The Systemic Reforms India's Railways Actually Need

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# Beyond Kavach — The Systemic Reforms India's Railways Actually Need

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**IE** The Indian Express | MAINS RELEVANCE: **GS Paper 3**



## INTERVIEW ANGLE

*"Kavach addresses train-to-train collision, but India's railway fatality figures (~16,000-18,000 per year) are dominated by trespassers and unmanned level crossing accidents — not collisions. Does Kavach address the right problem? What systemic reforms in railway safety, governance, and infrastructure are needed to genuinely reduce India's railway death toll? And is the ₹20,000 crore Kavach deployment the best use of railway safety investment?"*

Kavach reaching 10,000 km is a genuine technological milestone, and it deserves recognition as such. An indigenously developed, SIL-4 certified Automatic Train Protection system — comparable in design principles to Europe's ETCS but at a fraction of the cost — represents years of patient work by RDSO and its three private sector partners. When the Balasore accident killed 296 people in June 2023 because of an electronic interlocking failure, it demonstrated with devastating clarity what train collision without Kavach looks like. The urgency of completing the remaining 30,000 km of high-density network coverage is not in question.

What is in question is whether Kavach, important as it is, is being used to substitute for the harder conversation about why Indian Railways continues to kill more people than almost any other railway system in the world — and whether the allocation of safety investment is optimally directed at the actual causes of death.

## THE RIGHT PROBLEM, INCOMPLETELY ADDRESSED

India's railway system records approximately **16,000 to 18,000 deaths per year**. This figure sounds extraordinary until you understand its composition. The overwhelming majority of these fatalities are **trespassers** — people crossing railway tracks at non-designated points, sleeping on tracks, walking along tracks — and **level crossing accidents** where road vehicles are struck by trains.

Train-to-train collisions, the specific failure mode Kavach prevents, account for a **small fraction** of this death toll. The Balasore accident was catastrophic because of its scale (296 dead) and its media visibility. But numerically, the daily, invisible toll from trespassers and level crossings claims far more lives annually than all collision accidents combined.

This matters for investment prioritisation. Kavach's full deployment on the high-density network will cost approximately ₹20,000-25,000 crore. That is a large capital commitment. If the same investment were directed at fencing the entire network's high-trespass-risk sections, eliminating unmanned level crossings through road underpasses/overbridges, and upgrading signalling across the system, the lives-per-rupee outcome might be significantly better.

## THE SYSTEMIC DEFICITS KAVACH CANNOT ADDRESS

**Track maintenance and infrastructure.** Derailments — not collisions — are Indian Railways' most common accident type. Most derailments result from track defects: rail fractures, worn fishplates, inadequate ballast, and rail geometry failures that are not detected between inspection cycles. Kavach does nothing to address this. Track maintenance requires investment in ultrasonic track-testing equipment, continuous tamping machines, and the organisational culture to prioritise maintenance over operations.

**Signalling system heterogeneity.** Indian Railways has multiple generations of signalling — mechanical, relay-based, and electronic — coexisting across its network. Kavach integration is straightforward on modern electronic interlocking systems but complex and costly on legacy mechanical systems. The challenge is not just deploying Kavach but modernising the signalling layer it depends on. This work has no photogenic milestone to announce.

**The level crossing problem.** India has over 30,000 level crossings, of which several thousand remain unmanned or semi-manned. The Railway Safety Fund and successive Railway Budgets have earmarked resources for eliminating unmanned level crossings, but progress is slow. Road underpasses and overbridges require land acquisition and coordination with state governments — the classic multi-agency problem that India's administrative system handles poorly.

**Crew fatigue and human factors.** Indian Railways operates a 24/7 network with significant pressure on loco pilots (train drivers) to maintain schedules. Fatigue-related incidents — delayed brake application, missed signals — are underreported in the official accident database but documented in safety audit reports. Working hours regulation, rotation policy, and vigilance device enforcement all affect outcomes more directly than Kavach for fatigue-related events.

## THE GOVERNANCE QUESTION

Indian Railways combines in a single organisation the functions of infrastructure manager, train operator, regulator, safety investigator, and capital allocator. This is internationally unusual. Most high-performing railway systems have separated these functions — Europe mandates separation of infrastructure management from train operations, and independent safety authorities investigate accidents.

India's Railway Safety Commission (CCRS — Commissioner of Railway Safety) investigates major accidents and issues recommendations. But implementation of those recommendations is handled by the same organisation that manages operations and is subject to the same budget pressures. There is no independent

safety regulator with statutory power to mandate corrective action on a timeline.

The Balasore accident investigation identified systemic failures in electronic interlocking maintenance and staff accountability. Whether those specific failures have been comprehensively addressed across all zones is not publicly verifiable — because there is no independent body publishing compliance reports.

## WHAT GOOD RAILWAY SAFETY POLICY LOOKS LIKE

Countries with low railway fatality rates — Japan, Switzerland, the Netherlands — share several characteristics: separated infrastructure management, independent safety regulators with statutory power, comprehensive track monitoring using real-time sensors, elimination of grade crossings from high-speed lines, and a safety culture in which operating staff are encouraged to report near-misses without career consequences.

India can build toward this. Kavach is a necessary component — preventing catastrophic collisions on the high-density network is genuinely important. But it is not sufficient, and its deployment should not be allowed to crowd out the harder, less visible investments in track maintenance, level crossing elimination, signalling modernisation, and independent safety oversight.

The 10,000 km milestone is worth celebrating. The other 30,000 km is worth fast-tracking. And the 16,000 deaths a year that Kavach cannot prevent are worth taking equally seriously.

### UPSC RELEVANCE

Kavach ATP, RDSO (Lucknow), SIL-4, SPAD, Balasore accident (June 2, 2023, 296 deaths), RITES, three vendors (Medha/Kernex/HBL), LTE communication, ETCS (European Train Control System), CCRS (Commissioner of Railway Safety).

### MAINS GS-3:

Infrastructure investment; railway safety; Make in India in defence/safety technology; governance of PSUs; public sector R&D.

### INTERVIEW:

“Indian Railways carries 22 million passengers a day but records 16,000+ deaths annually. What institutional reforms would you recommend to bring Indian railway safety closer to Japanese or Swiss standards?”

## ★ FACTS CORNER — KNOWLEDGE PEDIA

### KAVACH ATP SYSTEM (KEY DATA):

Developer: RDSO + 3 private vendors: Medha Servo Drives, Kernex Microsystems, HBL Power Systems

Certifier: RITES (Rail India Technical and Economic Service)

Safety level: SIL-4 — dangerous failure probability less than 10 to negative 8 per hour (highest)

Communication: LTE (Long Term Evolution) radio; 1-second position updates

Coverage (Feb 2026): 10,000 km | Target: 40,000+ km (high-density network)

Cost: approx. Rs. 50-70 lakh per km

Full HDN deployment cost: Rs. 20,000-25,000 crore

### BALASORE ACCIDENT (JUNE 2, 2023):

Location: Bahanaga Bazer, Balasore district, Odisha

Deaths: 296 (India's deadliest railway accident in 3 decades)

Trains: Coromandel Express + stationary goods train + Yesvantpur Express

Cause: Electronic interlocking signal fault — Coromandel routed to wrong line

Investigation: CBI

### INDIA'S RAILWAY SAFETY FIGURES:

Annual railway fatalities: ~16,000-18,000 (includes trespassers, level crossing deaths)

Level crossings: 30,000+ (several thousand unmanned/semi-manned)

Indian Railways: 7,500+ stations; 68,000+ route km; 13,000+ trains/day; 22 million passengers/day

### GLOBAL ATP SYSTEMS:

ETCS/ERTMS (Europe): Gold standard; 100,000+ km; interoperable across EU

PTC (USA): Positive Train Control; mandated on all Class I railroads after 2008 Chatsworth disaster

TPWS (UK): Train Protection Warning System; Network Rail-wide

ATACS (Japan): Advanced Train Administration and Communications System

### SAFETY GOVERNANCE:

CCRS: Commissioner of Railway Safety; statutory investigator under Indian Railway Act

RDSO: Research Designs and Standards Organisation, Lucknow; Indian Railways' technical arm

Railway Safety Fund: Rashtriya Rail Sanraksha Kosh (RRSK) — Rs. 1 lakh crore fund; used for critical safety works

### OTHER RELEVANT FACTS:

SPAD (Signal Passed At Danger): Most common global cause of serious railway collisions; Kavach prevents automatic brake application override

India's railway accident classification: Consequential train accidents (CTA) tracked by Railway Board; includes collisions, derailments, fire, level crossing

Kavach priority zones: South Central Railway and Western Railway were first recipients given high traffic density

Sources: Indian Express, Indian Railways, PIB



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