

MargRakshak

Protecting every road,
saving every life in Uttarakhand.



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PSITECH
PARTNERS IN PRECISION INNOVATION

Every road accident is a preventable tragedy. We design the technology to engineer accident-free future.

The Uttarakhand Crisis

11,000 Families Lost — A Decade of Unending Tragedy



The Numbers That Demand Action

Metric	Current Reality	Impact
Total Fatalities (2025)	1,242 deaths	One family lost every 7 hours
Year-over-Year Increase	+13.9%	Getting worse, not better
10-Year Death Toll	11,347 deaths	11,347 families devastated
Total Accidents (2025)	1,846 accidents	5 accidents every single day

2020: 674 deaths → **2025:** 1,242 deaths (+84% increase)

Kumaon Region (2024): 34% spike in deaths despite safety measures

The Most Painful Reality

"Despite 165 black spots identified, 129 rectified, and ₹74,100 crore invested, fatalities increased 84% from 2020 to 2025. Physical infrastructure alone cannot save lives."

Statistics



Metric	Number
Total road accidents (2023)	480,583 cases nextias+1
Total fatalities (2023)	172,890 lives (highest ever recorded) nextias+1
Fatal accidents increase (2023 vs 2022)	+3.04% nextias
Accidents on curved road sections (2022)	54,593 accidents (10% of total, increased from 2021) frontiersin
Fatalities at blind curves annually	~7,000 deaths ijirset
Overspeeding as leading cause	68% of fatalities nextias

Year	Total Accidents	Fatalities	Injuries	Source
2025	1,846	1,242	2,056	pioneeredge+2
2024	1,747	1,090	1,547	pioneeredge+1
2024 (up to Oct)	1,443	848	1,240	pioneeredge
2025 (up to Oct)	1,484	988	1,728	pioneeredge

Key Uttarakhand Trends

- Accidents increased **+2.84%** (2025 vs 2024 up to October)
- Fatalities increased **+16.51%** (2025 vs 2024 up to October)
- **11,347 deaths** over the past decade (2014–2024)
- **15,994 injuries** over the same decade

National Highways in Uttarakhand (2025):

Accidents: **828** → **875** (+5.7%)
Fatalities: **543** → **605** (+11.4%)

Almora bus accident (Nov 4, 2024): Bus fell into gorge near Marchula on hill curve — **38 deaths, 27 injured**



India National Trends (2020–2024)

Year	Total Accidents	YoY Change	Fatalities	YoY Change
2020	372,181	—	138,383	—
2021	412,432	+10.8%	153,972	+11.3%
2022	461,312	+11.9%	168,491	+9.4%
2023	480,583	+4.2%	172,890	+2.6%
2024	<i>~490,000</i>	<i>~+2%</i>	177,177	+2.5% hindustanimes

Key Trends:

- **Steady increase** every year post-COVID (2020 was lowest due to restrictions)
- **Peak growth in 2021–2022:** +10–12% YoY in accidents and fatalities
- **Slowing growth 2023–2024:** +2–4% YoY
- **2023 was highest ever recorded:** 172,890 deaths



Uttarakhand State Trends (2018–2025)

Year	Total Accidents	YoY Change	Fatalities	YoY Change
2018	1,418	—	1,047	—
2019	1,353	-4.6%	868	-17.1%
2020	1,041	-23.2%	674	-22.0%
2021	1,405	+35.0%	820	+21.7%
2022	1,674	+19.2%	1,042	+27.1%
2023	1,691	+1.0%	1,054	+1.1%
2024	1,747	+3.3%	1,090	+3.4%
2025	1,846	+5.7%	1,242	+13.9%

Key Trends:

- **COVID dip 2020:** -23% accidents, -22% fatalities
- **Sharp recovery 2021–2022:** +20–35% YoY growth
- **Stabilization 2023:** Only +1% growth
- **Accelerating again 2024–2025:** +3–14% YoY, with **fatalities surging 13.9% in 2025**
- **10-year total:** 11,347 deaths (2014–2024)

District-wise Blind Turns Identified by Uttarakhand Police



District	Blind Turns Identified	Type
Dehradun	83	Highest in state
Almora	68	2nd highest
Bageshwar	67	3rd highest
US Nagar	65	Plain district
Chamoli	63	Hill district
Tehri Garhwal	61	Hill district
Pithoragarh	55	Hill district
Nainital	54	Hill district
Pauri Garhwal	50	Hill district
Haridwar	37	Plain district
Rudraprayag	27	Hill district
Uttarkashi	28	Hill district
Champawat	24	Plain district
TOTAL	673	Across all 13 districts



Every number represents a life lost, a family shattered. We've tried everything. Now we need intelligent technology

Metric	India (2020→2024)	Uttarakhand (2020→2025)
Accident Growth	+31.7% (372K→490K)	+77.3% (1,041→1,846) pib.gov+1
Fatality Growth	+28.1% (138K→177K)	+84.3% (674→1,242) pib.gov+1

Uttarakhand's fatality growth (84.3%) is nearly 3x faster than India's (28.1%) — making it a critical region for blind curve safety interventions like the Curve Alert System.

The **13.9% spike in Uttarakhand fatalities in 2025 alone** shows the problem is worsening, not improving.





Why people die on mountain roads?

Three Killers: Blind Curves, Broken Infrastructure, Ignored Warnings

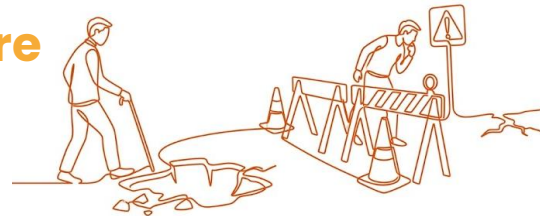
Problem 1: Blind Curve Accidents



Statistic	Reality
India's blind curve deaths	7,000 lives/year
Uttarakhand blind turns	673 blind turns statewide
Almora bus tragedy (Nov 2024)	38 deaths at Marchula blind curve
Overspeeding on curves	692 fatalities (57% of total)

The Pain: Drivers approach blind curves at 100+ km/h. They see danger too late. Collision is inevitable.

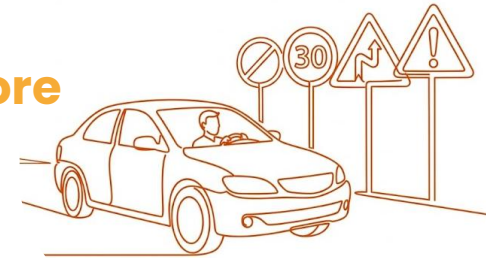
Problem 2: Infrastructure Defects



Statistic	Reality
Defective roads cause	6.3% of all accidents
Potholes, degraded barriers	Common on hill roads
Landslides	Close highways for days (Almora-Haldwani: 5 days, Sept 2025)
No real-time monitoring	Repairs delayed, accidents happen

The Pain: A pothole at 80 km/h on a hairpin bend = vehicle rolls. No warning system exists.

Problem 1: Drivers Ignore Warnings



Statistic	Reality
Sign boards erected	553 warning signs statewide
Driver compliance	<10% ignore warnings
34% death spike in Kumaon	Despite signs
Tourists drive 100+ km/h	Unaware of mountain dangers

The Pain: Signs are passive. Drivers see them, ignore them, and die. We need active warnings drivers cannot ignore.

Government made efforts, yet lost impact

165 Black Spots Rectified. Yet 1,242 Families Lost in 2025 Alone.

Initiative	Status	Result
Road Safety Policy (2016)	Implemented	First state policy timesofindia.indiatimes
165 Black Spots Identified	129 rectified (78%)	Only 33% successful hindustantimes
553 Sign Boards Erected	Throughout state	Drivers ignore them sites.ndtv
544 Accident Spots (Char Dham)	Identified	Identified ≠ Fixed newindianexpress
Blind Turn Alert App (2020)	Launched	Passive info, no active warning hindustantimes
₹74,100 Crore Road Plan (2026)	Announced	₹4,250 crore for safety egov.eletsonline

Failure	Data
Fatalities still rising	+13.9% in 2025 alone timesofindia.indiatimes
33% black spot success	129 rectified, still 86 have accidents hindustantimes
Sign boards useless	34% death spike despite signs timesofindia.indiatimes
No intelligent technology	Technology gap remains unfilled

The Core Problem

Physical barriers catch vehicles AFTER accidents happen. Sign boards are IGNORED. We need ACTIVE warnings that PREVENT accidents BEFORE they occur.

Now we need intelligent technology that works 24/7, in all weather, that drivers cannot ignore.

The Solution – Uttarakhand Smart Road Safety Ecosystem



A Holistic Technology Package to Save 3,500 Lives Per Year

Three Integrated Solutions

Curve Alert System

IoT-based smart signals at blind curves

70% blind curve reduction

Mobile Lidar Pothole and Barrier Detection

Real-time infrastructure monitoring.

40% defect-related reduction

Dynamic LED Signage

Solar-powered warnings that drivers cannot ignore

50% over speeding reduction

Project MargRakshak
Marg {Road} + Rakshak {Protector}
We are on a mission to save lives

Complete road safety transformation

70% OVERALL
FATALITY
REDUCTION

Curve Alert System

HOW IT WORKS



STEP-BY-STEP



TECHNOLOGY SPECS

	Component	Specification
	IR Sensors	Detect vehicles in all weather (day/night/fog/rain)
	Edge Controller	<0.1 second processing time
	LED Lights	15–20 cm diameter, visible from 100+ meters
	Buzzer Alarm	80–100 dB, audible from 50+ meters
	Power	Solar-powered option (sustainable for hills)
	Operating Temperature	-20°C to +60°C (snow & summer)

PERFORMANCE

Metric	Value	
Detection Accuracy	95%+	
Response Time	<0.1 seconds	
Visibility Range	100+ meters	
Audio Range	50+ meters	

Why Curve Alert System addresses the problem perfectly

- **Overspeeding** (692 fatalities/year) → Alerts drivers before blind curves
- **Poor visibility** → Intelligent signalling warns of danger ahead
- **First-time hill drivers** → Provides critical warning tourists miss
- **Night driving** → Signalling works even when visibility is poor
- **Driver fatigue** → Automated alerts compensate for reduced alertness
- The data shows **73% of Uttarakhand's road crashes are speed-related** when combining overspeeding + wrong-side driving + sharp turns on curves.



Curve Alert System

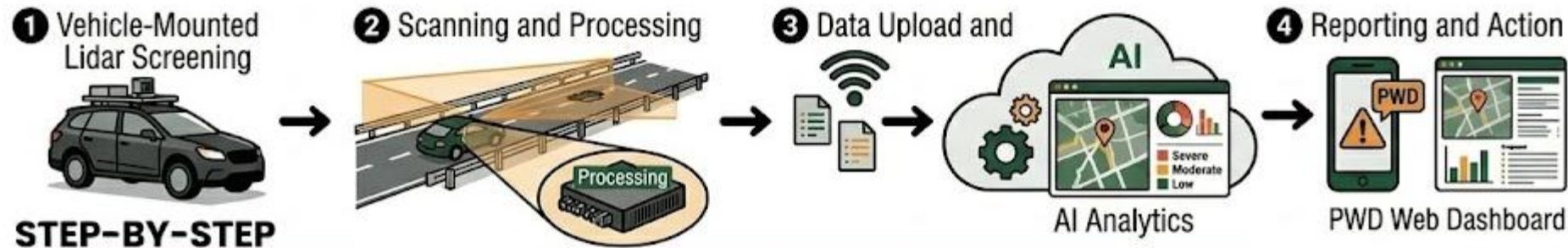
Deployment Model

District	Units	Blind Turns Covered
Almora	68 units	68 blind turns + 3 sensitive spots
Bageshwar	67 units	67 blind turns + Kaphaligair
Pithoragarh	55 units	55 blind turns + 3 sensitive spots
Chamoli	63 units	63 blind turns + 65 Char Dham spots
Tehri Garhwal	61 units	61 blind turns + 297 Char Dham spots
TOTAL (Phase 1)	350 units	350 blind turns (52% statewide)

Fully automated, real-time warnings that drivers cannot ignore. 70% blind curve accident reduction. This is the foundation of our ecosystem.



Mobile LIDAR Pothole and Barrier Detection



TECHNOLOGY SPECS

Component	Specification
Lidar Sensors	30m range, 10 Hz scanning frequency
Cloud Dashboard	Real-time analytics, AI severity assessment
Mobile App	PWD team receives GPS location + severity
Power	Solar-powered (sustainable for hills)
Weather Resistance	IP67-rated (waterproof, dustproof)
Operating Temperature	-20°C to +60°C

WHAT IT DETECTS:

Hazard	Detection
Potholes	Depth > 2 cm flagged
Barrier Damage	Cracks, bends, corrosion
Landslide Debris	Rocks, soil on road surface
Water Accumulation	Flooding risk on curves
System Status	Wear & tear over time



Mobile LIDAR Pothole and Barrier Detection

Deployment Model

District	Screening Frequency	Coverage
Priority Hill Districts (Almora, Tehri, Pithoragarh, Chamoli)	Weekly screening	All Char Dham spots + 673 blind turns
Rest of Hill Districts (Uttarkashi, Rudraprayag, Dehradun Hill)	Bi-weekly screening	All major hill roads
Plain Districts (US Nagar, Haridwar, Nainital)	Monthly screening	National Highways + major roads

Mobile Lidar screening = statewide coverage, weekly updates, 35% cost savings. Real-time road monitoring that prevents accidents before they happen

Dynamic LED Signage



STEP-BY-STEP



TECHNOLOGY SPECS

Component	Specification
LED Signs	5,000+ lumens (high-brightness), visible 200+ meters
Motion Sensors	100m range, detects vehicle speed
Solar Panels	100W panels (sustainable for hills, no electrical grid needed)
Battery Backup	12V battery (24-hour operation without sunlight)
Weather Resistance	IP67-rated (waterproof, dustproof, snow-proof)
Operating Temperature	-20°C to +60°C

SIGN MESSAGES

Situation	LED Message
Blind Curve	⚠️ BLIND CURVE ⚠️ ⚠️ SLOW DOWN ⚠️
Speed Zone	⚠️ SPEED LIMIT 40 KM/H ⚠️
Pothole Detected	⚠️ ROAD HAZARD ⚠️ ⚠️ SLOW DOWN ⚠️
Landslide Risk	⚠️ LANDSLIDE AREA ⚠️ ⚠️ DRIVE CAREFULLY ⚠️
Night Warning	⚠️ NIGHT DRIVING ⚠️ ⚠️ USE LOW BEAM ⚠️



Dynamic LED Signage

Deployment Model

District	Signs	Locations Covered
Almora	40 signs	68 blind turns + 3 sensitive spots
Tehri Garhwal	60 signs	297 Char Dham spots
Bageshwar	30 signs	67 blind turns + Kaphaligair
Pithoragarh	30 signs	55 blind turns + 3 sensitive spots
Chamoli	40 signs	63 blind turns + 65 Char Dham spots
TOTAL (Phase 1)	200 signs	Priority hill districts

Solar-powered, high-brightness flashing warnings. 80% compliance vs. 10% static signs. 50% over speeding reduction. This closes the driver compliance gap.



Let's bring seamlessness of IoT smart signals + Lidar monitoring + Dynamic LED signage to work together for a safer travel experience

Global best practices prove this works. 70% fatality reduction achievable. Uttarakhand can be the first in India to implement this holistically.



Economic Impact

Benefit Analysis

Metric	Impact
Fatalities Prevented	1,242 deaths/year → 70% reduction = 869 lives saved/year
Accidents Prevented	1,846 accidents/year → 70% reduction = 1,292 fewer accidents/year
Economic Loss Avoided	₹1.8 lakh crore/year road accidents → 70% = ₹126,000 crore saved
Tourism Revenue Protected	Uttarakhand tourism ₹25,000 crore/year → safer roads = ₹5,000 crore additional revenue
Healthcare Cost Saved	₹50,000 per accident treatment → 1,292 accidents = ₹65 million saved





Stakeholder alignment for the Vision



Department	Role
Transport Department	Policy approval, funding allocation (₹100–190 million from ₹4,250 crore safety budget)
PWD (Public Works Dept)	Installation on state roads, Lidar sensor maintenance, repair team dispatch
Traffic Police	Enforcement, monitoring, Curve Alert system oversight, driver compliance
Health Department	Emergency response integration, trauma care improvement
Tourism Department	Tourist vehicle awareness program, Dynamic LED signage at entry points
Planning Department	Annual impact assessment, economic impact tracking



Success metrics each department gets

This ecosystem supports ALL government initiatives. It fills the technology gap safety budget can address. Every department gets measurable success.

Department	Metric
Transport	70% fatality reduction (policy goal achieved)
PWD	40% defect-related accident reduction (infrastructure improved)
Traffic Police	80% driver compliance (enforcement effective)
Health	869 fewer emergency cases/year (healthcare burden reduced)
Tourism	₹5,000 crore additional revenue (safer roads = more tourists)





Key Performance Indicators

70% fatality reduction within 5 years. Measurable, trackable, achievable. 869 families saved per year. This is why we do this.

Metric	Current (2025)	Target (2031)	Improvement
Total Fatalities	1,242 deaths	373 deaths	↓ 70%
Blind Curve Deaths	~200 deaths/year	60 deaths/year	↓ 70%
Defect-Related Deaths	~78 deaths/year	47 deaths/year	↓ 40%
Overspeeding Deaths	692 deaths/year	346 deaths/year	↓ 50%
Total Accidents	1,846 accidents	554 accidents	↓ 70%
Black Spot Success	33% effective	90% effective	↑ 173%
Driver Compliance	<10% obey signs	80% obey warnings	↑ 700%



70% fatality reduction within 5 years. Measurable, trackable, achievable.



2025: 1,242 families lost a loved one

2031: 373 families lost a loved one

Difference: 869 families saved

869 children who grow up with their parents

869 spouses who don't become widowers

869 parents who don't become bereaved



Closing note and way forward

- Uttarakhand has invested ₹74,100 crore in physical infrastructure, but **11,347 families lost their loved ones in 10 years**. Sign boards are ignored. Black spots rectified still have accidents. **Physical infrastructure alone cannot save lives**
- Curve Alert System fills the critical technology gap — providing ACTIVE intelligent warnings drivers cannot ignore. Lidar monitoring closes the infrastructure defect gap. Dynamic LED signage closes the driver compliance gap.
- Together, these three solutions create a **complete safety ecosystem** — 70% fatality reduction, 869 lives saved per year, ₹131,000 crore economic savings.
- This is not just safety infrastructure. **This is life-saving technology**. Every day we wait, 7 more families lose someone. Every month we delay, 210 more accidents happen. Every year we postpone, **1,242 more families shattered**.

The time to act is NOW. Approve this ecosystem. Save these lives. Uttarakhand can be the first state in India with integrated smart road safety. Let's make history together.



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