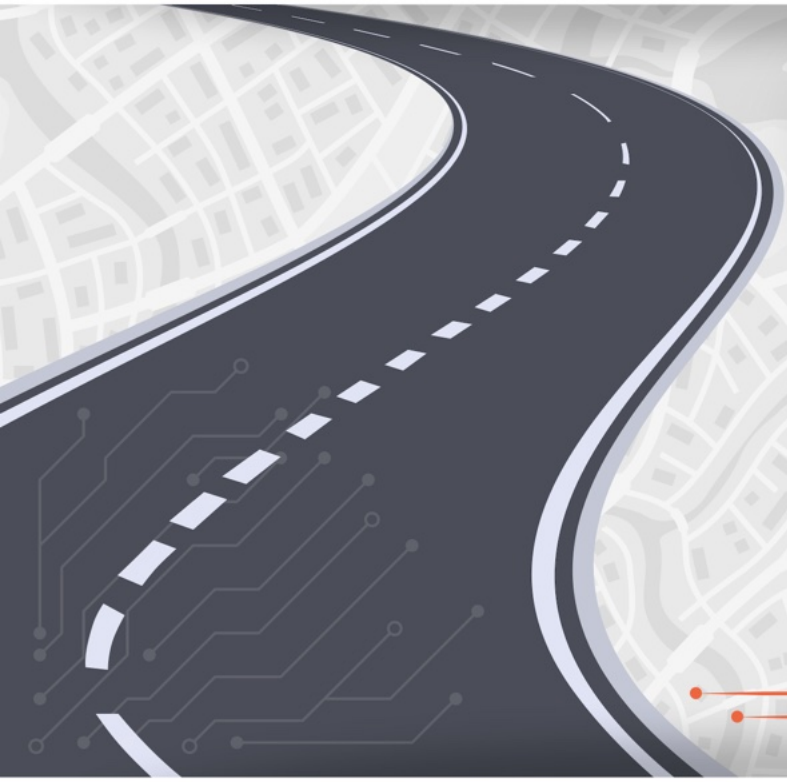
iRASTE Nagpur:

Executive Summary

APRIL
2024

Project iRASTE

INTELLIGENT SOLUTIONS FOR ROAD SAFETY
THROUGH TECHNOLOGY AND ENGINEERING



NAGPUR MUNICIPAL CORPORATION · CSIR · mahindra Rise · iNAI · International Institute of Information Technology Hyderabad · intel

01. Acknowledgements

With deepest gratitude, we would like to thank Shri Nitin Ji Gadkari, Hon'ble Union Minister of Road, Transport, and Highways; Dr. Vikas Mahatme, Former Member of Rajya Sabha, Dr. Abhijeet Chaudhari (I.A.S.), Commissioner and Administrator (C & A), Nagpur Municipal Corporation (NMC), and Mr. Radhakrishnan B (I.A.S), Former C & A, NMC, for their unflinching support to Project iRASTE from the stage of conception through to execution.

Project iRASTE Nagpur team comprised of Dr. S. Velmurugan, Dr. K. Ravinder, Dr. Mukti Advani, Dr. A. Mohan Rao, Dr. Neelima Chakrabarty, from Council of Scientific & Industrial Research - Central Road Research Institute (CSIR - CRRI), New Delhi; Prof. C. V. Jawahar from International Institute of Information Technology Hyderabad (IIIT - H); Mr. Varma S. Konala, Dr. Anbumani Subramanian, Mr. Govind Krishnan, and Mr. Dev Singh Thakur from INAI, IIIT - H; Ms. Juby Jose from Intel - India, Mr. Nirmal Parmar from Mahindra & Mahindra Rise Group, and Officials of Nagpur Municipal Corporation (NMC).

Team would like to express sincere gratitude to the members of the Steering Committee for their invaluable contributions, insights, review comments, and guidance, that significantly influenced the successful completion of this endeavour. Steering Committee Members: Dr. Shekhar C. Mande, Former Director General (DG), CSIR, Dr. (Ms.) N. Kalaiselvi, DG, CSIR, Dr. Manoranjan Parida, Director, CSIR - CRRI, Prof. Satish Chandra, Former Director, CSIR-CRRI, Prof. P.J. Narayanan, Director, IIIT - H, Ms. Nivruti Rai, Managing Director of Invest India, Former Country Head - Intel India, Mr. Avilash Dwivedi, Head of Corporate Social Responsibility (CSR), Mahindra and Mahindra Limited, Automotive and Farm Equipment Business, and Mr. Kishore Ramisetty, VP & General Manager, Vertical Solutions and Services Group at Intel Corporation.

We express profound gratitude to various department of NMC such as Regional Transport Office (RTO) Nagpur, Public Works Department (PWD), National Highway (NH) Division, World Bank Division, Traffic Police Branch, Road Safety Committee; Private bus operators such as Hansa Group of Companies, Travel Time City Bus Services Pvt. Limited, R. K. City Bus Services Private Limited, and Olectra Greentech for believing in the vision of the immense potential of ADAS technology in reducing road crashes / fatalities and supporting the implementation efforts at each step of the project's journey. We also thank Intel Onboard Fleet Services (IOFS), Intel - India, Bangalore for managing the installed ADAS devices during this engagement.

We appreciate the contributions of our project partners: Another Earthling (AE) Studio for executing road infrastructure improvements, RoadMarc Foundation for mobilizing volunteers and engaging with local communities for the city-level road safety awareness campaigns, trafficrewards for its novel contribution to developing a system to reward drivers for following traffic rules, Ashok Leyland Institute for Driver Training & Research (ALIDTR), Chindwara branch, M .P., for assisting us in the driver training programs that we conducted for the NMC bus drivers and operators.

02. Executive Summary

In February 2021, Shri Nitin Ji Gadkari, Hon'ble Union Minister of Road, Transport, and Highways, called for all-round efforts by stakeholders in the road safety and mobility ecosystem to reduce road fatalities by 50% by year 2025. In September 2021, a brainstorming session was convened with the following stakeholders - NMC, CSIR - CRRI, Mahindra & Mahindra, INAI (Applied Research Center for AI at IIIT-H), International Institute of Information Technology, Hyderabad (IIIT-H), and Intel India and a program of road safety intervention for Nagpur city was put together with the core idea of leveraging Artificial Intelligence (AI) in the road safety space to help the city achieve a 50% reduction in road crashes / fatalities. Project iRASTE (Intelligent solutions for RoAd Safety through Technology and Engineering) was launched with a clear scope and action plans with a timeline of 2 years – from Sept '21 through Sept '23.

For the first time in India, Artificial Intelligence (AI) Scientists and Road Engineering & Safety Experts came together to transform road safety engineering by leveraging the predictive power of AI. The key lever of the intervention was to harness the installation of Advanced Driver Assistance System (ADAS) in public transit fleets (i.e., NMC Buses) that has the capacity to generate various collision alerts and the utilization of ADAS generated data to study bus driver's driving behaviour and patterns and use this as a basis to nudge them toward safer driving practices. Surrounding this central element, this project had multiple vectors (Vehicle Safety, Mobility Safety, Infrastructure Safety, and Education, Awareness & Emergency Care) aligned with the 4E framework for road safety: Engineering, Education, Enforcement & Emergency Care.

This executive summary captures the efforts and initiatives that were made under all these 4 vectors from the time of the launch, in Sept '21 until Dec '23.

Key Highlights

- In the Jan '23–Aug '23 period, ADAS equipped buses recorded **41% lower accidents** compared to non-ADAS buses, demonstrating the higher level of safety induced by the advantage of ADAS technology.
- Rapid upgrade in skilling drivers: Driver risk scores are calculated on a monthly basis by normalizing the ADAS alerts accumulated for each driver by kilometers driven by them. This metric across all drivers of ADAS buses has **dropped by 30%** since the start of the project, signaling that the drivers have become more careful (defensive) in their driving habits.
- To enable stakeholders for infrastructure improvements to resolve road geometry and road inventory aspects, detailed Geometric Design Plans (GDP) were delivered to NMC and concerned road authority for all 38 Blackspot locations, and remedial measures were implemented at 4 Blackspot locations that can potentially reduce accidents by 60 %.
- Under the Mobility Safety vector, we introduced the novel technique of predicting Greyspots (potential blackspots) on the road network for the first time in India by integrating ADAS data with road geometry parameters. Through this analysis, the team has delivered a set of short and long term measures for the top 16 Greyspots and two of the Most Unsafe Corridors in the Nagpur city.
- Community-based emergency first responder networks (i.e., 'Trystander cells') were installed at 8 Blackspot locations, equipped with First - Aid resources such as foldable stretchers and first - aid kits, which have enabled the local first responder volunteer teams to **save 36 road crash victims** (Aug '23 – April '24) who were involved in crashes around these blackspots.

03. Vehicle Safety

Nagpur is the 3rd largest city in Maharashtra and is located in the geographically central part of the country. Two major National Highways (NH), namely, NH-44 and 53 intersect, and State Highways, 248, 255, and 260 passes through the city. The overall length of the road network in the Nagpur metropolitan region is around 1,907 Km, of which 1,150 Km is under the control of the Nagpur Municipal Corporation (NMC). Nagpur Mahanagar Parivahan Limited (NMPL), a special purpose vehicle of NMC, runs a fleet of 437 buses to provide public transport services to the residents in the Nagpur metropolitan region. The operations of NMC service are done mainly by three operators: Hansa city bus services, RK Travels city bus services and TravelTime city bus services.

ADAS Intervention – NMC Fleet

As a first step, a total of 150 buses of NMPL's fleet were equipped with ADAS systems, referred to as "primary fleet" hereafter. Additionally, a fleet of 50 school buses ("school fleet") was used to study the driving behaviour of school bus drivers. During the intervention period, the ADAS equipped NMC fleet was driven for more than 65 Lakh kilometers, covering the various arterial, sub-arterial roads and State and National highways in the Nagpur metropolitan area. While initially, the driver risk scores fluctuated indicating that the drivers were adapting to the new technology, by September 2022, these stabilized within the 50-55 range once the drivers acclimatized themselves to the ADAS technology. This metric translates into one ADAS alert for every 2 kilometers of the trip on an ADAS vehicle and is reasonable given the heterogeneous nature of traffic on urban roads.

What is Advanced Driver Assistance System (ADAS) and how does it work?

AI-powered ADAS has the capacity to continuously monitor the road environment ahead and to detect some features in the vicinity of subjected vehicle and warn the driver a few seconds (i.e., 2 seconds) before a potential collision. Such real-time warnings / alerts improve driver reaction time by up to 2X. This in turn reduces the likelihood of collisions. The alerts warn the driver of risk from other vehicles as well as Vulnerable Road Users (VRUs) like pedestrians, two-wheelers, auto-rickshaws. The alerts also encouragedefensive driving practices such as lane discipline, maintain safe headway from vehicle ahead, and over-speeding.

The main components of an ADAS device include a camera unit focused on the road and a display unit. The single-camera unit has a powerful processor that processes video data locally and uses advanced AI algorithms to detect risk in real time. All computations are done locally which avoids the inefficiency of sending video data to a cloud for processing. Once the camera unit detects imminent risk, the driver is alerted via the display unit fixed at eye-level of the driver. The display unit generates visual as well as audio alerts that captures attention of the driver. The alert information is also sent to a cloud portal which archives all such events for detailed offline analysis.

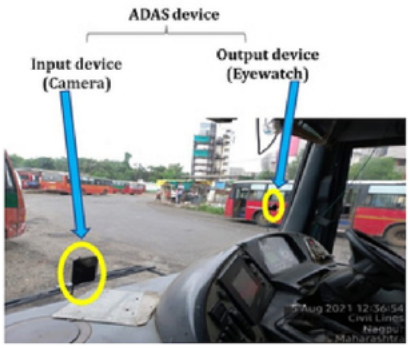


Figure 1: ADAS Device

New Data for Driver Behaviour Analyses – Risk Scores

ADAS device provides 4 types of visual / audio alerts to drivers in-cabin. These include Forward Collision Warning (FCW), Headway Monitoring Warning (HMW), Lane Departure Warning (LDW), and Pedestrian Collision Warning (PCW). A driver risk score is computed as a sum of 4 alerts (FCW,PCW, LDW, HMW) generated by the driver, normalized by the total trip distance over which alerts were generated. A fleet risk score is then computed as the median of all individual driver scores. The team utilized this data as a leading indicator of accident risk to conduct driver trainings, provide personalized coaching, and to felicitate the drivers who performed well on this metric (i.e., driver risk score).

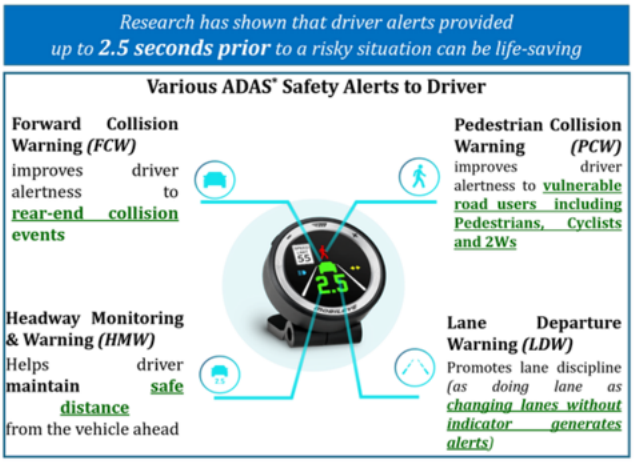


Figure 2: ADAS Safety Alerts delivered to the Driver

In the initial observation periods, the risk scores fluctuated indicating that drivers were adapting to the new technology. By Sept '22, around the time when workshop training was conducted, these scores stabilized, and the fleets has demonstrated a consistent decline in risk since then.

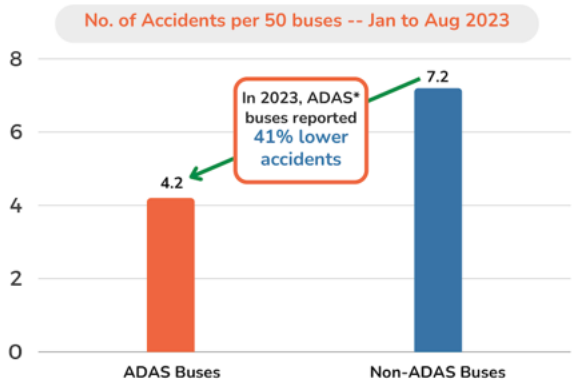


Figure 3: Accident rate comparison

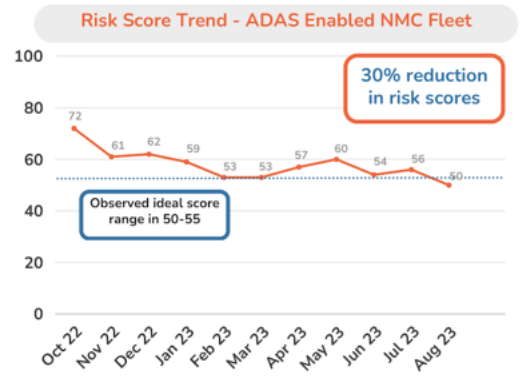


Figure 4: Driver risk scores

Outcomes

- From the NMC crash statistics of Jan '23 – Aug '23 period, the 150 ADAS buses reported 41% lower accidents compared to 250 non-ADAS buses. This comparison was done by normalizing for a set of 50 buses.

- The driver risk scores have shown a consistent decline, and these are about 30% lower as compared to the values at the launch of the intervention (Figure 4).

04. Infrastructure Safety

Road geometry plays an important role in ensuring the safety of all road users on the road network. The objective of this vector is to develop remedial measures for the identified blackspots in Nagpur city. The project team met with NMC officials and members of the Nagpur District Road Safety Committee to understand the broad characteristics of local traffic, the condition of blackspots, traffic management, and enforcement challenges. The project team studied the First Information Reports (FIRs) from the last 3 years (Jan '19 – Nov '21) obtained from Nagpur Traffic Police (NTP), mapped the locations of each crash, studied 110 spots from multiple agencies, and identified 38 blackspots in the city. Several traffic studies were carried out at selected blackspots from this set to understand the traffic patterns and speed characteristics. Equipped with primary data collected on Topographical Maps, Classified Traffic Volume Counts (CTVC), Pedestrian Volume Counts (PVCs), Spot Speed, and Road User's Opinions, the team prepared Detailed Project Reports (DPR) in the form of Geometric Design Plans (GDP) for all 38 blackspots.

Factors such as lack of adequate Non-Motorized Transport (NMT) infrastructure, errors in road geometry, absence of road signs, markings, channelizing islands and medians, obstructions on footpaths, etc., increase the risk of crashes for VRUs. In the first phase, an Economic Benefit Impact Assessment (EBIA) was carried out at 4 Blackspot locations – 2 Intersections (Chikli Square and Jhansi Rani Square) and 2 Midblock locations (Prakash High School and Telephone Exchange to C. A. Road). Additionally, the team developed a pictorial illustration of the detailed Geometric Design Plan (GDP) through 3D visualization for four blackspots: Prakash High School (Midblock), Jhansi Rani Square (Intersection), Manewada Square (Intersection), and Omkar Nagar (also known as Veerghav Square Intersection). These will serve as an eye-opener for the stakeholders in terms of understanding steps towards implementing the suggested blackspot remedial measures. In the second phase, we engaged Another Earthling (AE) Studio, a Nagpur based consultancy, to drive the implementation of the recommended remedial work at 8 blackspots.

As per MoRT&H circular (2015), a BLACKSPOT is "a 500-meter length road stretch in which either 5 road accidents in all three years put together involving fatalities and injuries or 10 fatalities took place during the last 3 calendar years."

Figure 5: Before intervention: No median

Figure 6: After intervention: Introduced a median August 2023

Fig 7: Near Ajni Square - After intervention: Built a pedestrian walkway Aug 2023

They contributed by developing site specific solutions for street geometry correction, installed standard signage and bollards to channelize and restrict vehicle movement, organized and reconfigured crossing facilities for pedestrians at major turns and intersections as per Indian Road Congress (IRC). As of April '24, remedial interventions have been completed at 4 locations: Ajni Square, Chhatrapati Square, Jaiprakash Nagar Square and Wadhamna. The team conducted observation studies and noted significant improvement in the driving patterns of the road users as a result of these interventions.

Black Spot – Ajni Square Junction

Before

- Reclaimed the residual spaces, reduced the pedestrian crossing distance, larger channelizers for vehicles.
- Traffic islands for traffic controls.
- Tabletop slip lanes for safer left turns.
- Dividers for easier traffic movement at junction.
- Reclaimed extra spaces on the sides of the road for: Organized parking, cycle track, wider footpaths, green spaces and public sitting spaces with proper lightings.

Figure 8: Improper traffic and pedestrian movements

After

Figure 9: Proper pedestrian movement

Figure 10: Proper traffic movement

Black Spot – Chhatrapati Square Junction

Before

- Reclaimed the residual spaces, reduced the pedestrian crossing distance, larger channelizers for vehicles, & elongated traffic islands for traffic control.
- Tabletop slip lanes for safer left turns.
- Extended the dividers for easier traffic movement at the junction.
- Reclaimed the extra spaces on the sides for: Organized parking, cycle track, wider footpaths and green spaces

Figure 11: Improper traffic and pedestrian movements

After

Fig 12: Proper traffic and pedestrian movements

Fig 13: Proper traffic and pedestrian movements

Fig 14: Proper traffic and pedestrian movements

Black Spot: Nagpur - Wadhammna National Highway (NH 53)

Before

- Blackspot Improvements using Two Coloured Cold Plastic Paints:
- Soft Traffic Calming Measures in the form of Transverse Bar Markings (TBMs) for gradual speed reduction
- Enhancement of Preview Distance
- Colored Pedestrian crossings and Mixing Zone Markings

Figure 15: Before intervention

After

Figure 16: After intervention

Economic Benefit Impact Assessment (EBIA)

The assessment concluded that around 60-66% reduction in the overall road crashes coupled with a 40% reduction in fatalities, assuming the current rate of road crashes in the next 5-year period, are possible when the full remedial measures are implemented. The team also studied the impact of these interventions in terms of future risk reduction for a period of 5 years by applying 3 methods of economic analysis – Benefit - Cost Analysis (BCA), Net Present Value (NPV) method, and Economic Internal Rate of Return (EIRR).

The results indicate that, on average, cost savings of ₹89 lakhs in the midblock locations and ₹ 1.26 Crores in the intersections will be achieved after one year of proposed remedial measures implementation. EIRR was found to be ranging between 54% - 63% for 5 years, and even the 1st year Rate of Return (FYRR) was estimated to be ranging between 1.42% - 2.76%.

Outcomes

In Sept '22, the Geometric Design Plans for all 38 blackspots were submitted to the various concerned road owning agencies – Nagpur Municipal Corporation (NMC), and various road agencies of Nagpur such as Public Works Department (PWD), National Highway Division, and World Bank Division – to enable them to execute the improvements and safety interventions. Remedial measures have been implemented at 4 blackspots, and work is in progress at other 4 locations as of April 2024.

05. Mobility Safety (Greyspots)

Blackspots are places where accidents & fatalities have happened in the past. Under this vector, we harnessed the capability of the installed ADAS systems to predict potential areas and stretches called 'Greyspots' on Nagpur City's Road network where built environment factors (road geometry) interact with the human factors (driving behavior, mix of traffic) to increase the likelihood of road crashes.

The ADAS system installed on the buses generates huge volumes of alert data along the road network as a result of the warnings that the drivers accumulate as they deal with a range of traffic conditions when they traverse the network. When this dynamic data is combined with static data of the road network and geometry, spatial concentration of alerts data at specific place signals that there may be issues in the road environment that need immediate attention. Any corrective actions or interventions taken at Greyspots are proactive (not reactive) by nature, and hence can possibly help save lives due to accidents in future. Greyspots will serve as a leading indicator of road risk and can enable city authorities to plan or implement more safety interventions for better on-ground impact.

This novel technique of Greyspot prediction and modelling is the first instance of the applicationon urban roads in India. As buses fitted with ADAS devices ply on the road network regularly, our analysis can calculate road risk data periodically and hence can be made up-to-date and accurate. Our real-time data-based approach is more accurate than traditional one-time surveys or other manual data collection methods and is suitable for a large-scalable deployments at multiple levels - be it for a city or state, across the country.

Figure 17: Grey today, Black tomorrow. Take preventive measures and avoid accidents.

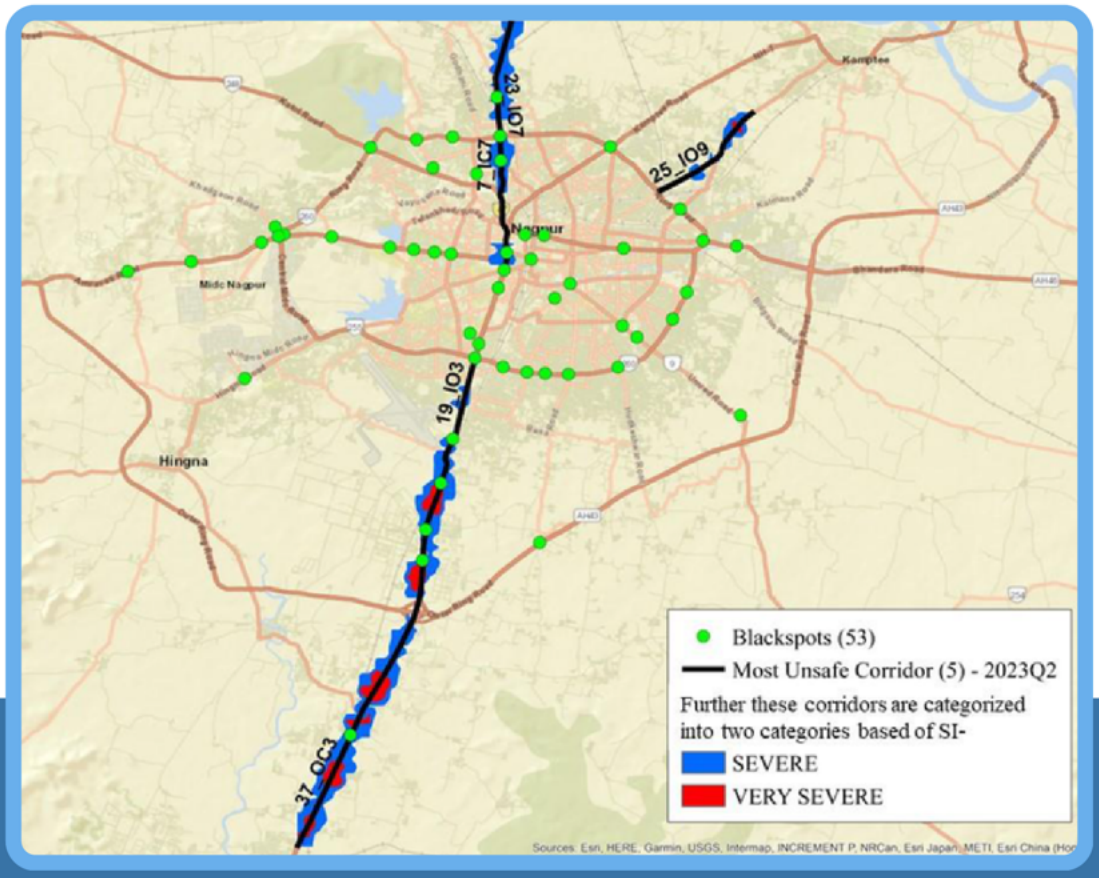


Figure 18: Greyspots from 2023: Q2

Methodology:

Four kinds of data were used to develop the statistical models for predicting greyspots at intersections and midblock locations – road network of Nagpur metropolitan region (~1600 Km) was sourced from NMC, road crash reports (3224) for the period from Jan '19 to May '23 from Nagpur Traffic Police, ADAS alerts from the cloud (1.2 M alert data points) and finally, 12-hour CTVC from the videography analysis that the project team had conducted at 21 out of 38 blackspot locations.

Nagpur city's road network was divided into cells (grids) of size 500m*500m. For each of these cells, the number of ADAS alerts is calculated using advanced tools of GIS, and road geometry parameters are also identified for each of the cells. The identified greyspots included the top 33 locations of Nagpur city, among which are 24 Intersections and 9 Midblock locations. In this set, 8 locations exactly matched with the existing blackspots, and hence, the effective greyspots locationsare 25 (new ones) among which are 16 Intersections and 9 Midblock locations. The project team conducted a field survey to validate their findings and noted the following common factors that contributed to high severity values – (i) speed violation due to the absence of soft traffic calming measures at the midblock locations, (ii) damaged road infrastructure, and (iii) poor traffic management measures.

Outcomes

The Greyspots are calculated dynamically based on the data generated by ADAS devices. To support NMC in making decisions for the purpose of road maintenance, a web-based dashboard was created to visualize the changing road environment conditions for a range of time windows – hours, days, and months.

06. Education, Awareness and Emergency Care

Driver Education & Training

iRASTE collaborated with Ashok Leyland Institute of Driving Training Research (ALIDTR) to educate bus drivers and train them for defensive driving. These training programs emphasized the themes of defensive driving methods, the role of bus drivers in achieving the city's road safety goals, first aid and mental health topics, and included experience sessions with the latest ADAS and simulation technologies.

Figure 19: Driver training programme

A total of 1337 drivers were trained through four sessions. We also used these opportunities to felicitate 250 Safety Champions drawn from the organization's unit responsible for the safety of operations.

Awareness and Emergency Care

Beyond Technology, Vision ZERO can only be accomplished if the vehicle & road users comply with safe driving practices. To help improve this compliance quotient, various awareness campaigns were undertaken.

Avagatkara Campaign

In Feb '23, iRASTE team and RoadMarc Foundation, a Nagpur-based Non-Governmental Organization (NGO), ran a campaign and engaged with youth, families, and communities to create awareness and educate residents to follow traffic rules at all times and avoid human errors. The project began with the inauguration of the 'Avagatkara : Learn the Art of Living Road Accident-Free' initiative and engaged around 75 families in one neighborhood. The program had 2 components: 9 days ofsurvey and 21 days intense daily awareness sessions. The 30-day public awareness program culminated in each participant taking an oath to follow the traffic rules every day.

Boards, posters, and doorstickers that displayed traffic rules were stuck in most of the houses and establishments in the neighborhood and reinforced the key messages of the campaign. The team also made great effort to explain to the youth the social, educational, psychological, and economic costs of road crashes that fall upon the families and dear ones of the injured.

Figure 20: Family members taking Oath to follow Traffic Rules Nagpur, Feb 2023

Figure 21: Youth at a Gym being educated to follow Traffic Rules Nagpur, Feb 2023

Citizen Awareness Campaigns & Good Samaritan Event

Project iRASTE and RoadMarc Foundation launched a program called 'Get First Aid Training, Become an Accident Defender.' Its goal was to train people with the basic first-aid techniques that bystanders can apply during the golden hour of a road accident to save lives. The team conducted 8 training programs near traffic police stations with support from the Traffic Police personnel and had an attendance of 50-60 people from neighboring localities for each session.

A more comprehensive version of the program called the "Good Samaritan Training" event was inaugurated by Hon'ble Mr. Nitin ji Gadkari, Minister of Road, Transport and Highways, at Suresh Bhat Auditorium in Nagpur which gathered an audience of 2000 people drawn from various schools, colleges, and social organizations in the city. Expert doctors were invited to conduct a demonstration on how to give first aid to an accident victim, handle the victim, and get him/her to the hospital in minimum time.

Figure 22: Audience taking an oath to Follow Traffic Rules, Nagpur, June 2023

Figure 23: Shri Nitin Ji Gadkari speaking at the Good Samaritan Event, Nagpur, June 2023

Trystander Cells

The objective of the 'Blackspot Trystander Cell' is to act quickly in the first hour (Golden Hour) of any accident near the blackspot location. Whenever there is an accident, the first people who go there or help are usually tea vendors, car mechanics, hotel vendors, fruit sellers, vegetable vendors, and local shopkeepers who live there. Project iRASTE has partnered with Nagpur NGO RoadMarc to install Trystander Cells (kiosks) at 8 locations. RoadMarc Team worked on the ground to register and screen all the people and shopkeepers in both directions of the movement of the area within a radius of 2 kilometers of each black spot. After registration, these volunteers formed a committee and took the pledge to help crash victims who are affected in the vicinity of the Trystander cell

Figure 24: Road Accident Disaster Management Center launched at Wathoda Square, Nagpur, Nov 2023

Their contact details, along with the details of the nearest hospital and police stations, are made available (painted) on the top panel of the kiosk, and they have also been added to a local WhatsApp group. These members were trained by expert doctors on the use of tools available in a first aid box, how to access emergency services, how to admit the injured to the nearest hospital during the golden hour, and how to administer first aid to save lives

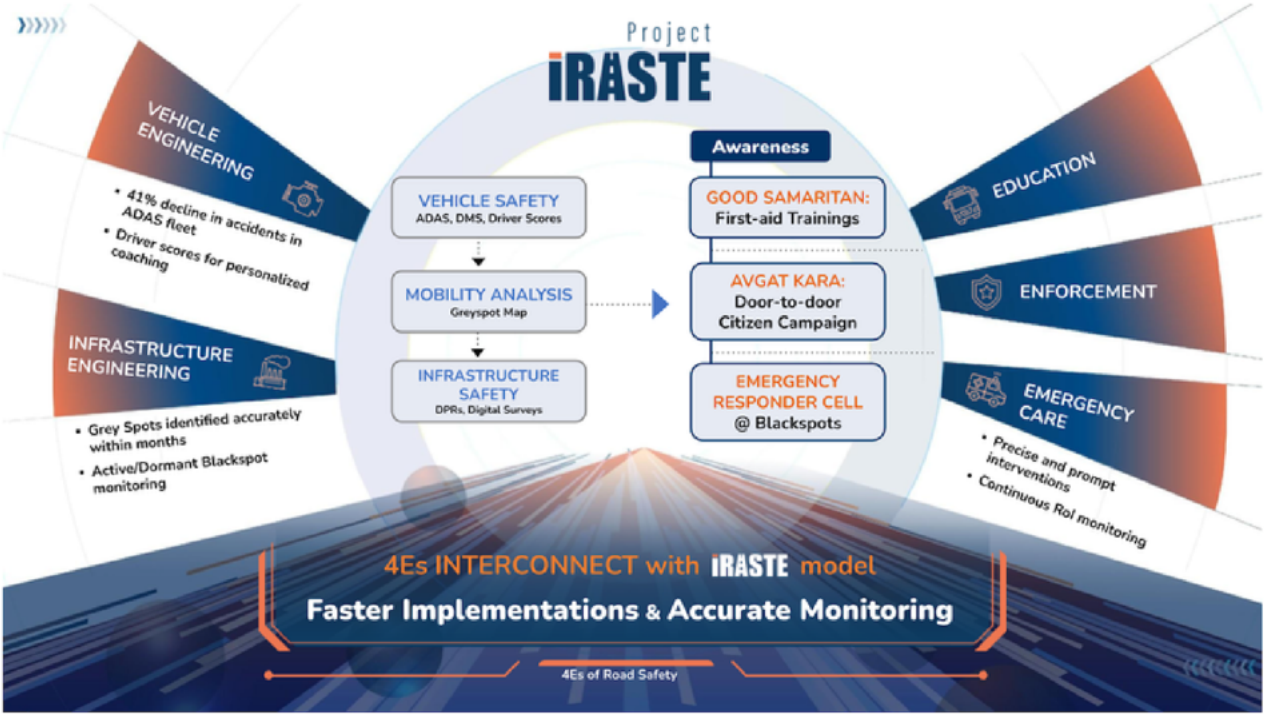
Outcomes

- Our driving training sessions and workshops benefited 1337 commercial vehicle drivers over the course of the project.
- The Good Samaritan event held in Nagpur engaged an audience of more than 2000 people and illuminated them on the steps of first aid techniques.
- Trystander cells have enabled the local first responder volunteer teams to save 36 road crash victims who were involved in crashes around these blackspots.

5 th E in road safety: Encouragement

With TrafficRewards organization, our project partner in Nagpur, we piloted a new RFID-based technology that nudges the NMC bus drivers to follow traffic rules based on the principle of "positive reinforcement." RFID scanners, installed at ten traffic signals across Nagpur, identify the buses with the Traffic Rewards custom tags once they halt at the traffic intersections following the signals. Each time the driver adheres to the traffic rules, he will receive points which get added to his account in real time. These reward points can be redeemed and utilized to avail benefits from empaneled merchant establishments. As of January 2024, 438 NMC buses have been tagged. The data from the sensors across all the vehicles in Nagpur show that there has been a 24% improvement in signal adherence.

Figure 25: Traffic Rewards installation Nagpur, Aug 2023



Way Forward

Project iRASTE Nagpur was the first initiative in India to integrate AI into the 4E framework for road safety and was the largest and longest-running study of ADAS for commercial vehicles. This iRASTE model has led to faster and more precise implementations with promising results: a **41% reduction in accidents** in the NMC ADAS enabled bus fleet and a reduction in driver risk scores by 30%. A novel technique for Greyspot prediction and modelling was developed. We have gained experience in executing a multi-vector strategy to address the urgent challenge of road safety. Moving forward, our plan is to replicate this model in other cities and metropolitan regions in India and engage with the Union Ministry of Road Transport and Highways (MoRTH) to institutionalize the components that have yielded consistent results.

Glimpses from Events & Training Programmes

Project

iRASTE

RE-IMAGINE ROAD SAFETY WITH THE PREDICTIVE POWER OF AI