Project

iRASTE

Intelligent Solutions for Road Safety through Technology & Engineering

NAGPUR MUNICIPAL CORPORATION | CSIR CRRI | Mahindra Rise. | inai | INTERNATIONAL INSTITUTE OF INFORMATION TECHNOLOGY HYDERABAD | intel.

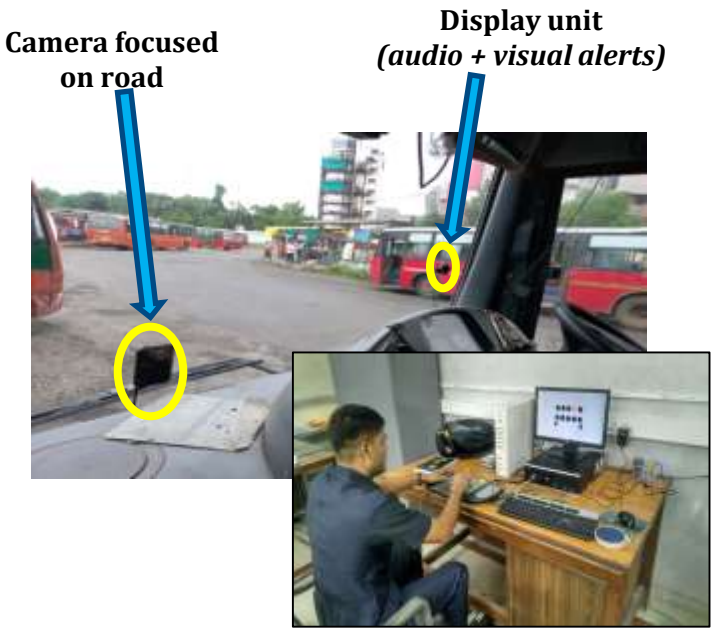
Project iRASTE

Intelligent Solutions for Road Safety through Technology & Engineering

Goal: Implementation of a holistic Safe Systems Approach for **up to 50 % reduction in road crashes** by leveraging **A**rtificial **I**ntelligence.

Vehicle Safety

ADAS + Driver Trainings

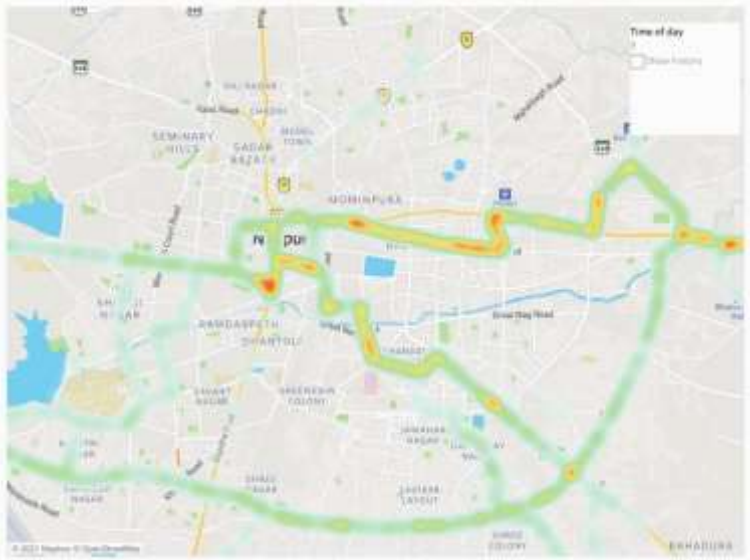


Infrastructure Safety

Blackspots fixes

Mobility Analysis

GreySpot Map



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Vehicle Safety

Improve safety of large vehicle fleets through safe driving behaviors

How CAS devices improve vehicle safety

The Need
Timely warning to drivers for ***distraction*** and ***indiscipline*** can prevent accidents

*Research has shown that driver alerts provided up to **2 seconds prior** to a risky situation can be life-saving*

CAS* Safety Alerts to Driver

Forward Collision Warning (FCW)
Improves driver alertness to **rear-end collision events**

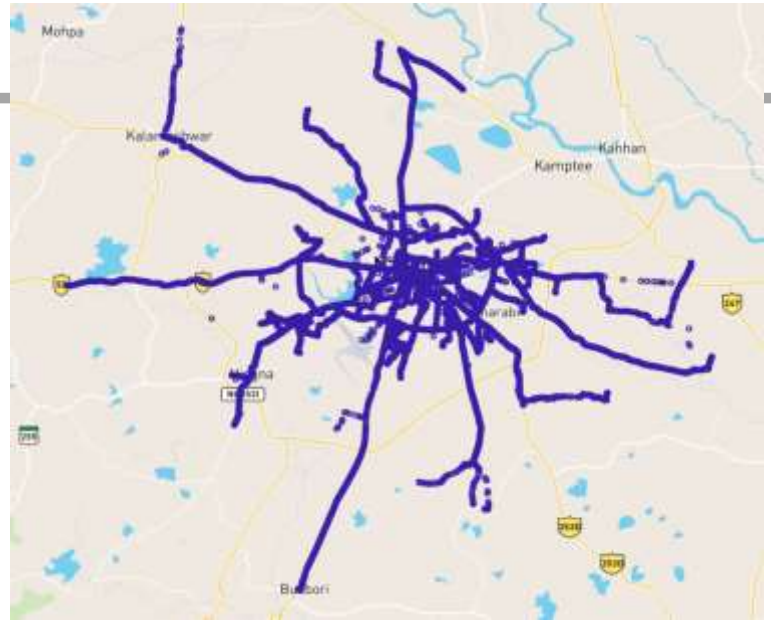
Pedestrian Collision Warning (PCW)
Improves driver alertness to **vulnerable road users**

Headway Monitoring & Warning (HMW)
Helps driver **maintain safe distance** from the vehicle ahead

Lane Departure Warning (LDW)
Promotes lane discipline *(use **turn indicator before changing lanes**)*

*CAS – Collision Avoidance Systems

Overview of CAS-fitted fleet in Nagpur



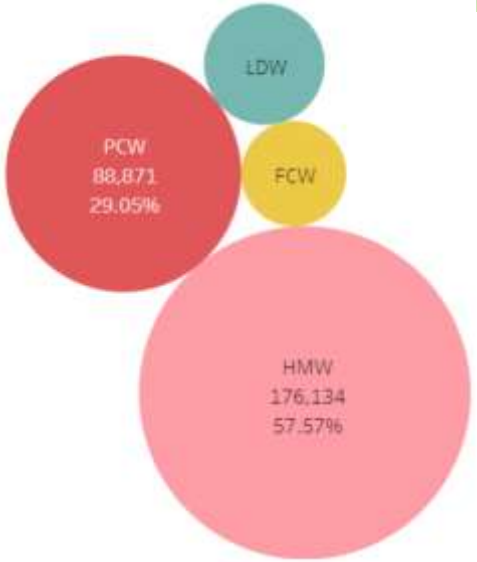
Fleet overview

- 250 vehicles
- 75 routes
- 80 KMs/driver/day

- Typical fleet operation: 5 AM to 11 PM

- Data analysis - 1 month observation to allow for **sufficient randomness**

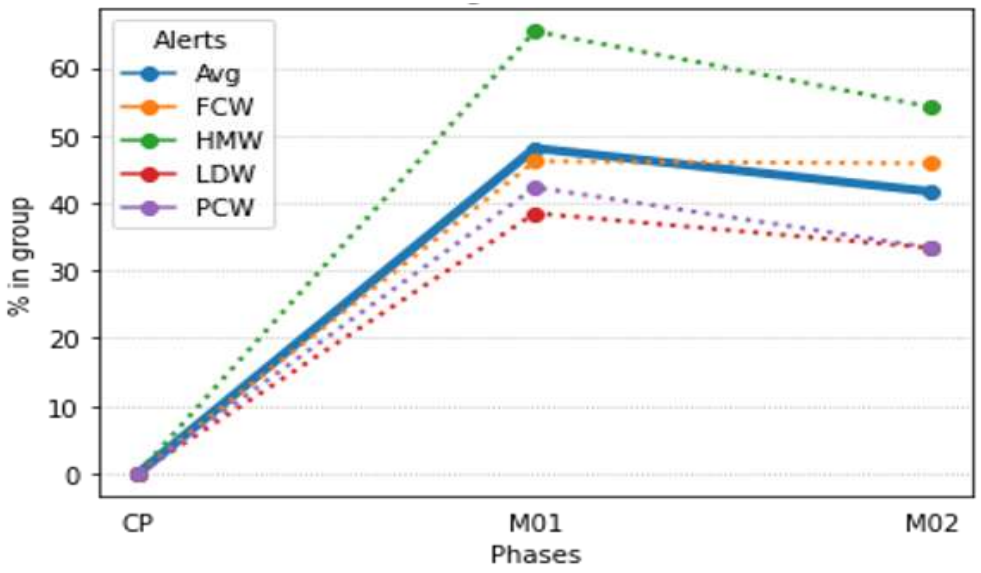
Alerts overview



FCW - Forward Collision Warning
PCW - Pedestrian Collision Warning
HMW - Headway Monitoring & Warning
LDW - Lane Departure Warning

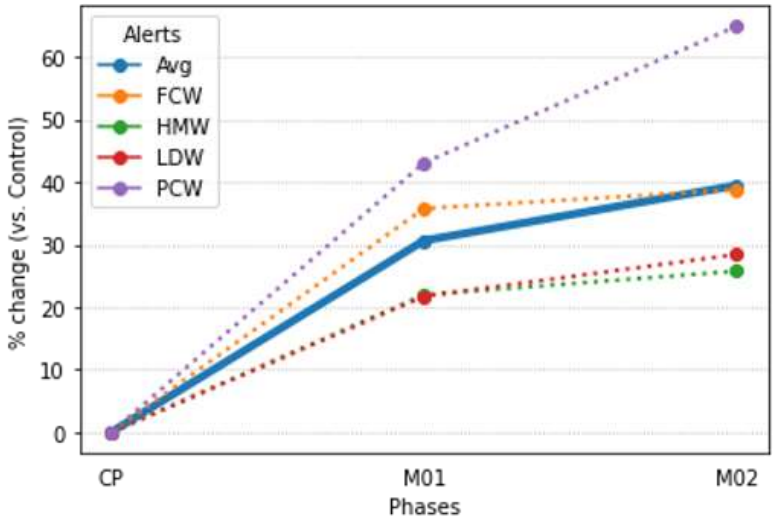
Observations - Safe driving behavior of drivers with CAS

Drivers with improved safe driving behavior



- On average, **48% drivers** demonstrated improvement in safe driving behavior (~1 in 2 drivers)
  - **Maximum drivers (65%) showed improvement in keeping safe-following distance** - one of the essential driving discipline needed to enhance road safety aimed at reduction of incidence of road crashes / fatalities

Safety alerts reduction in improved drivers



- Among improved drivers, **safety alerts reduced by 31%** on an average and thus lowering collision likelihood
  - **Highest alert reduction was observed for Pedestrian Warning**, which protects vulnerable road users. This warning saw 43 % reduction among improved drivers

FCW - Forward Collision Warning *HMW - Headway Monitoring & Warning* *LDW - Lane Departure Warning* *PCW - Pedestrian Collision Warning*

Infrastructure Safety

Improvement at Black Spots

Infrastructure Safety: Identification of Black Spots and Improvement Measures

Objective: Black Spot Improvement Measures
Impact: Finalization of Black Spot locations based on Crash Data *(2018, 2019 and 2020)* & Evolving safety Measures to reduce the road crashes and eliminate the black spot.

Discussions about the Project: iRASTE launch with Shri B. Radhakrishnan, Commissioner, NMC along with other stakeholders

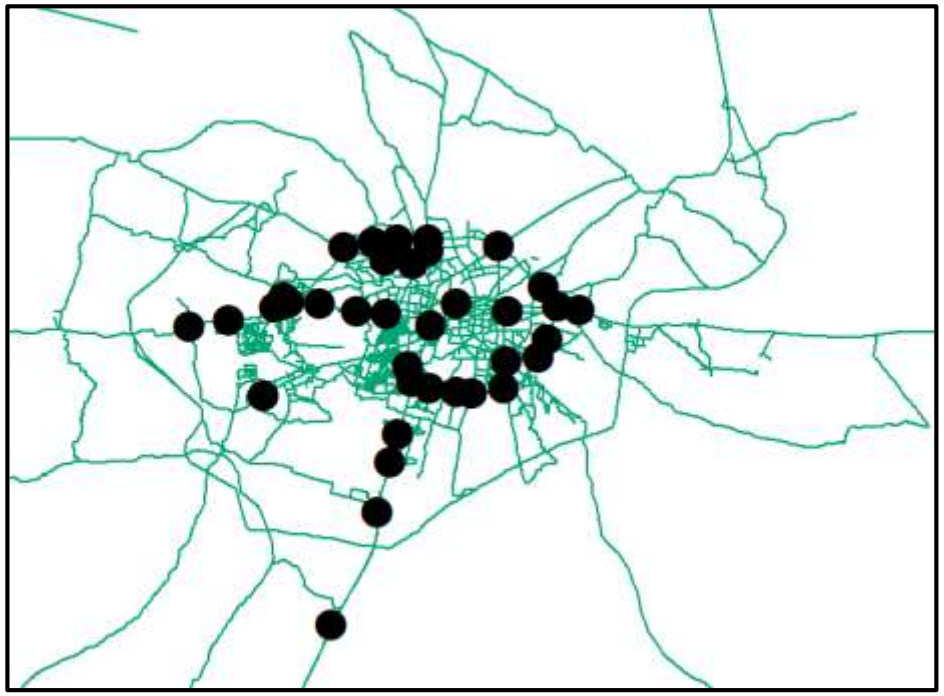
Discussion on the Black Spot locations with Honorable MP, Rajya Sabha, Dr. Vikas Mahatme and Shri Chandra Shekhar Mohite, Member, Road Safety Council Nagpur City

Reconnaissance visit to the blackspots

Blackspots

Out of the 117 listed ~~Black~~spots *(by all sources),*

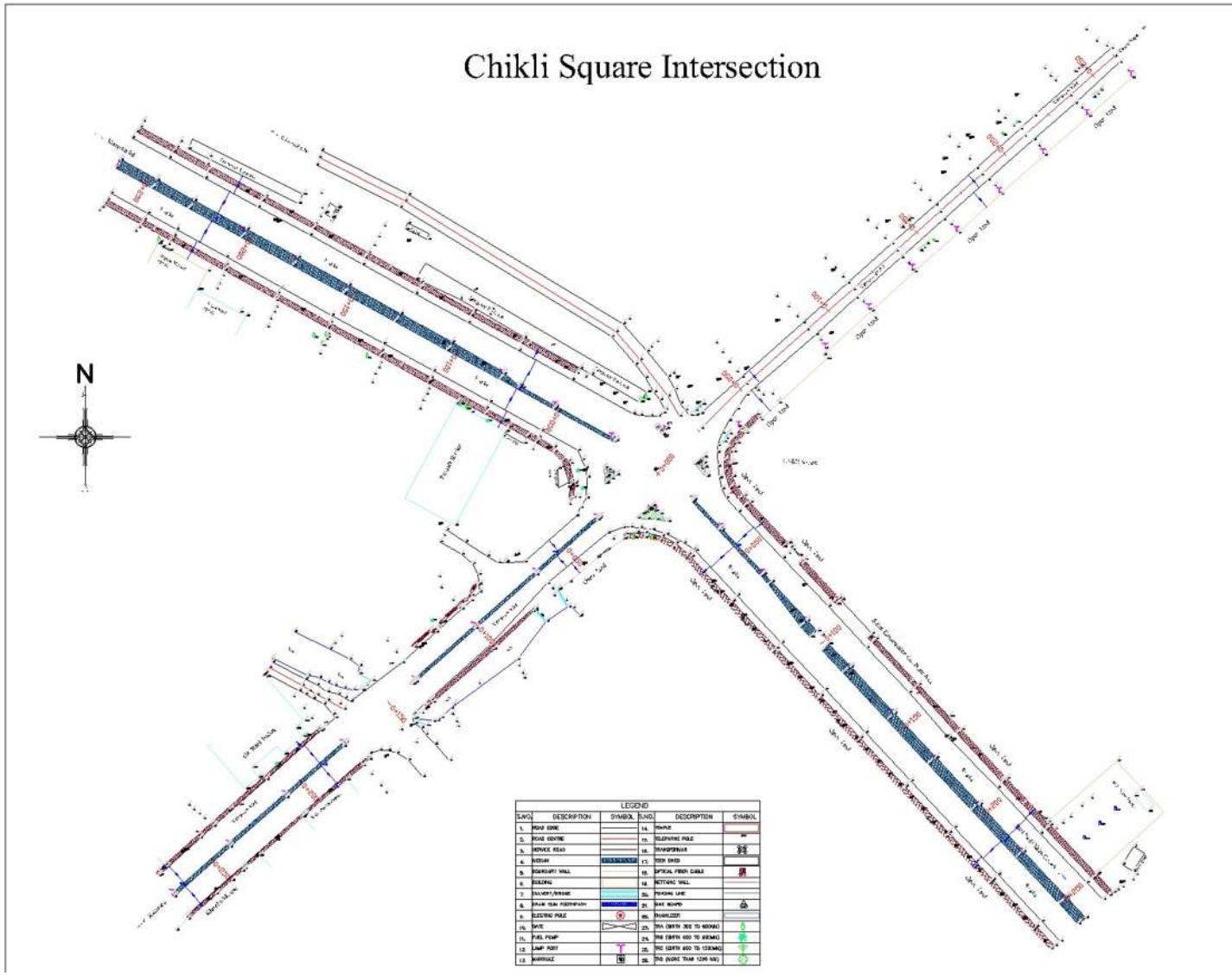
37 Blackspots (MoRTH protocol)
9 midblock locations
28 intersections



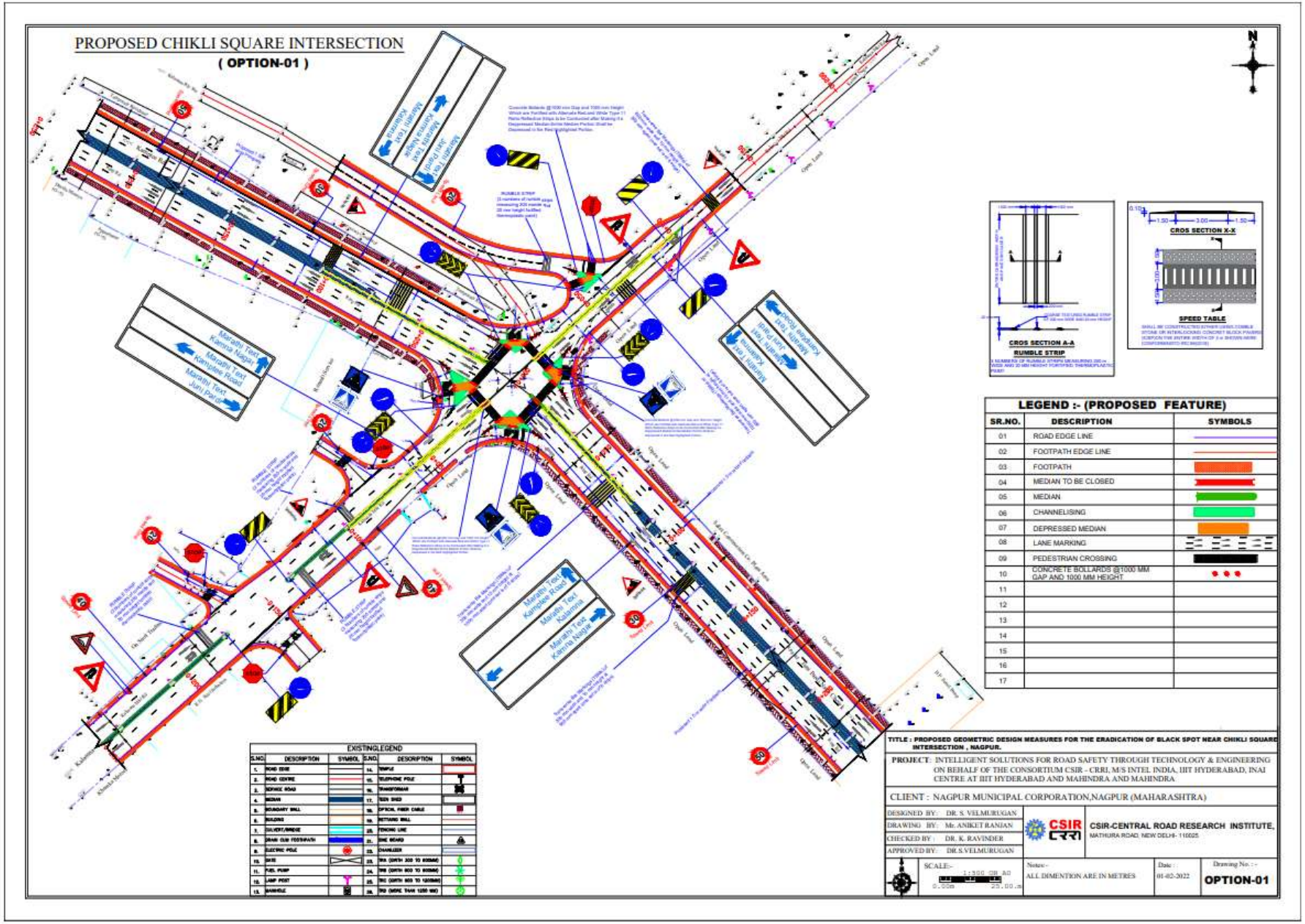
No.	Blackspot location
1	Telephone Exchange to C.A road
2	Maruti Seva Square, Kamptee Road
3	Prakash High School
4	Juni Pardi Naka Chowk
5	Jhansi Rani Square (1) (variety chowk)
6	Chhatrapati Square
7	Dongargaon
8	Rajiv Nagar intersection (Electric zone square)
9	8th mile
10	Wadhamna
11	Wadi T point (Dhamna)
12	Dattawadi Square
13	Khandgaon Turning
14	Shivangaon Fata
15	NEERI Point
16	Campus Intersection (Futala chowk)
17	Ravi Nagar
18	Jinga Bai takli to Zhanda Chowk
19	Pagalkhana Square to Mankapur Square
20	Ayappa Mandir to Gorewada Square
21	Police Talawe T point
22	Auto HUB to Toll Naka
23	Gittikhadan to Dinshaw
24	New Toll Naka to Toll Naka
25	Gorewada to Toll Naka
26	Mayo Square
27	Veerghav Square (Omkar Nagar)
28	Mhalgi Nagar Square
29	Manewada Square
30	Shrinagar Chowk
31	Mahesh Dhaba
32	Chinchbhawan Square
33	Kharbi Chowk
34	Shitla Mata Square
35	Wathoda Square
36	Chikli Square
37	Maruti Seva Square, Amravati Road

Location: **Chikli Square Intersection before Treatment** - 10 fatalities and 5 Crashes during the last 3 years

- Poor Intersection treatment in terms of channelizers, and absence of depressed Median and Pedestrian marking, diverging merging treatments etc.
- Absence of Continuous footpath
- Absence of Soft Traffic Calming Measures on the Free Left Turning Approaches
- Absence of Edge Line zig-zag markings using
- Absence of essential Road signs like Speed Limit Sign, Crash Prone Area Sign, etc.

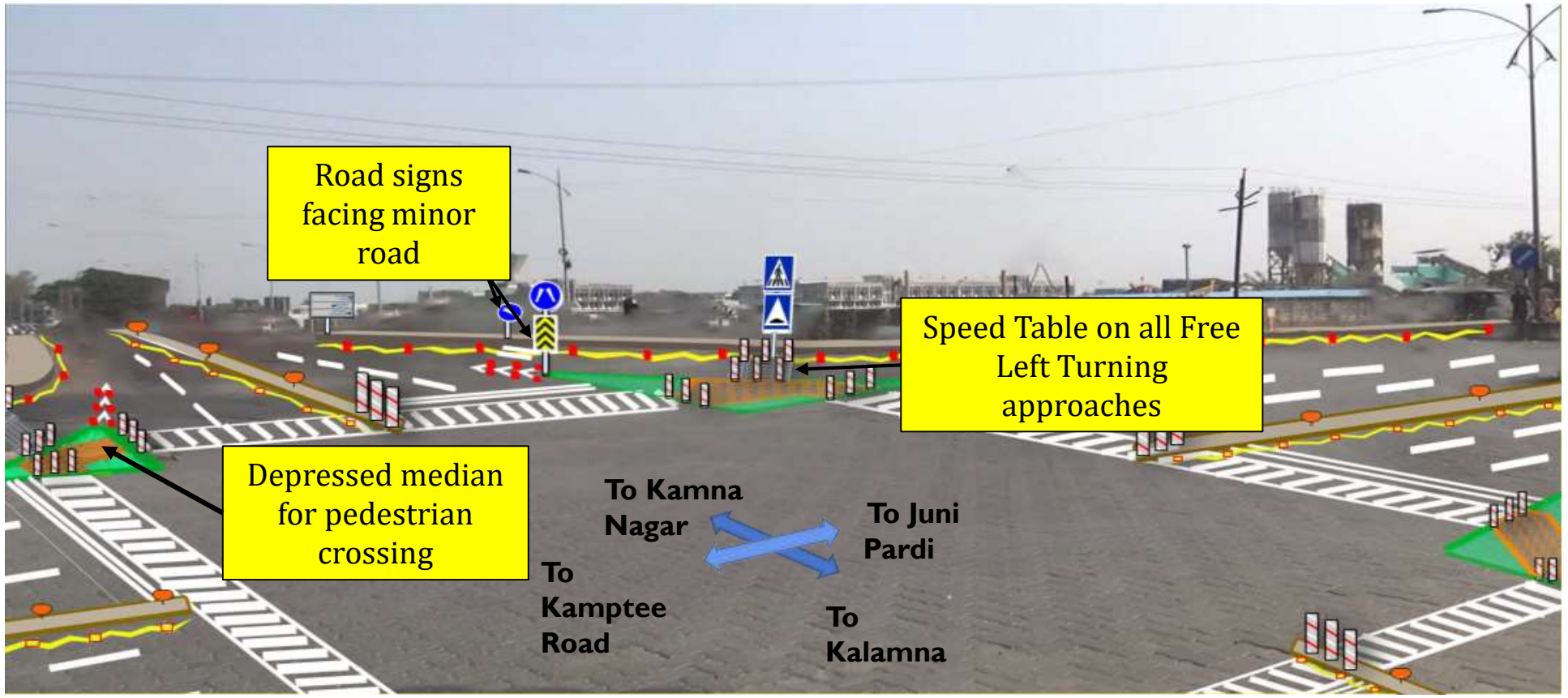


Geometric Design Plan *(GDP)* for **Chikli Intersection** covering up to 250 m length on each of the approach arms: **Option 1**



Estimated Approximate Cost for the implementation – Rs. 36,00,000

After Improvements



- Crash Prone Area Sign and Speed Limit Sign on a Single Sign Post
- Edge Delineation Markings (Zig-Zag Line) along with Red Retro Reflective Studs
- Red and Yellow road studs along the outer and inner edges of the road
- Placement of median marker

- Intersection improvement
- Speed table on all the Free Left Turns.
- Chevron Marking at the diverging and merging locations.
- Erection of Cement Concrete bollards

Mobility Analysis

Pro-active identification of probable road-crash-prone locations - Greyspots

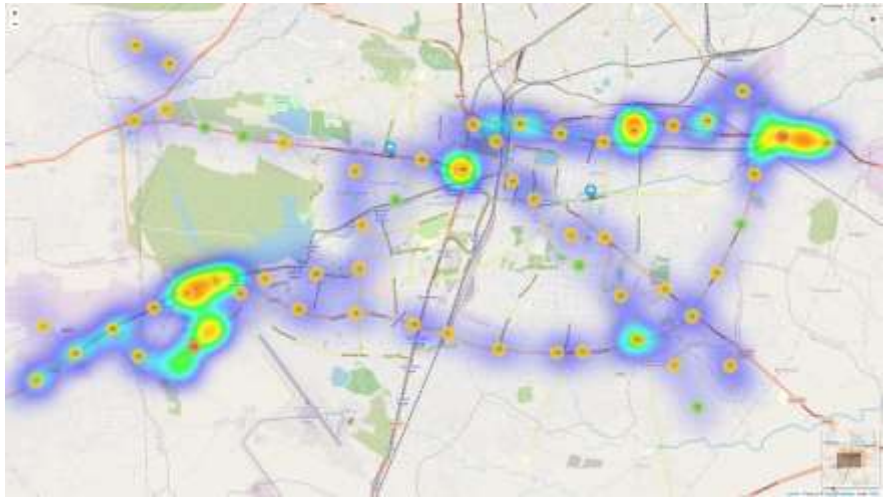
What is a Greyspot ?

Greyspot is a location on road, with high number of near-accident-like events. This location if left unattended can potentially become black spots over time.

Technically, a greyspot is a:

- geographical location (*l*) on a road,
- within a distance of *r* meters
- where a combination of collision-alert data,
  - across all vehicles with sensors
  - driven by multiple drivers
  - over a long period (weeks/months)
  - across times-of-day

  exceed a threshold (τ)



Greyspot

- Severity Index (SI) = 0.553*N3arm + 0.527*N4arm + 0.229*N5arm – 0.157*RL+0.157*PCW - 0.133*FCW

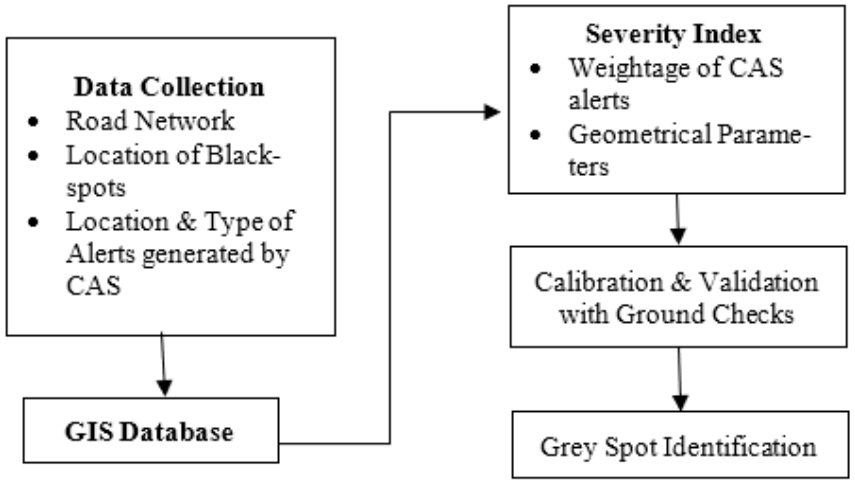


Fig.1. Methodology

Table 2: Number of Conflict Point at 3 and 4 arm intersection

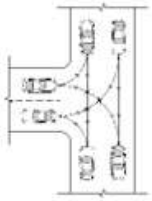
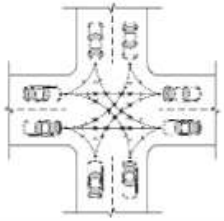
Geometry Type	Diagram	Number of Conflict Points
3 arm unsignal-ised intersection		3 merging 3 diverging 3 crossing Total = 9 points
4 arm unsignal-ised intersection		4 merging 4 diverging 16 crossing Total = 24 points

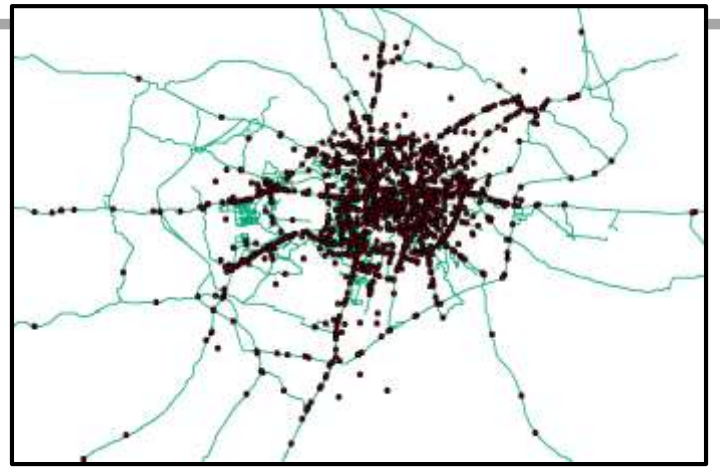
Fig.7. Grey Spot locations on Nagpur Road Network

iRASTE GIS-Database

Road Network

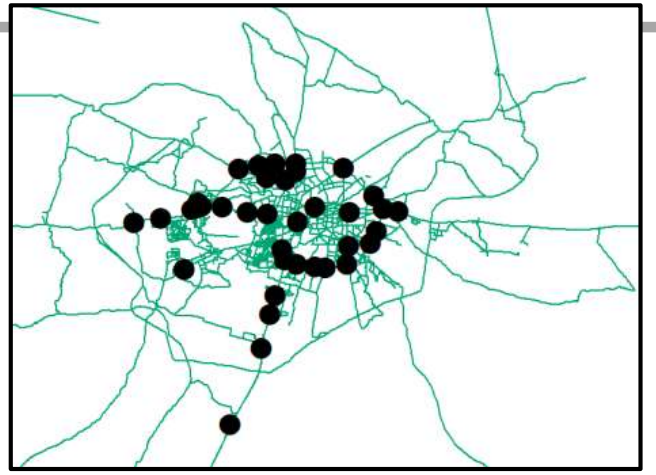
Total road length – 1575.161 km

3 arms–639, 4 arms-147, 5 arms-10



FIR Locations

2225 FIRs (Jan,2019-Nov,21)

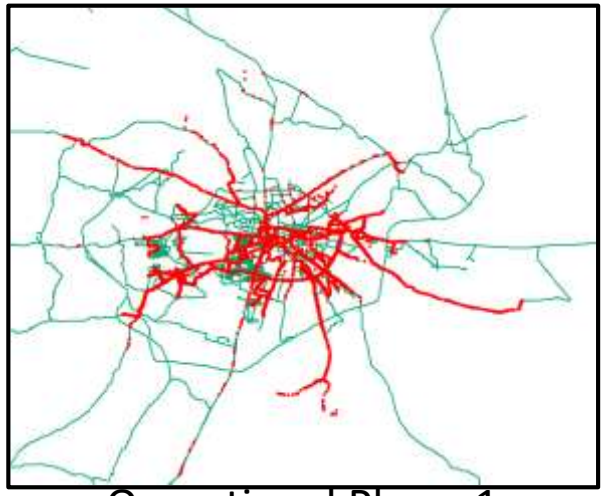


Blackspots

37 Blackspots

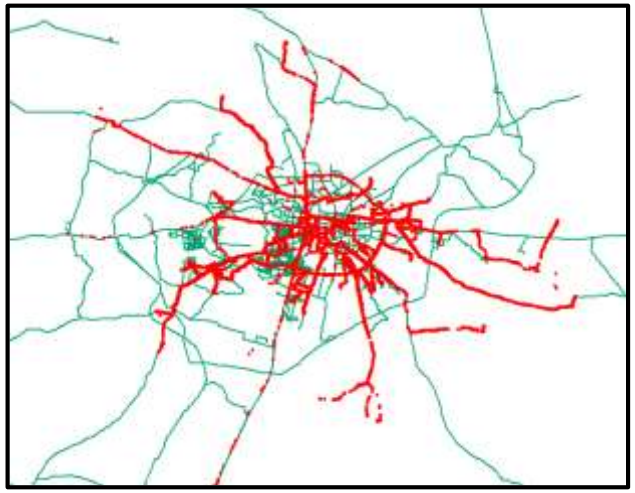
Control Period

8th July – 12th August



Operational Phase 1

16th August – 15th December



Operational Phase 2

16th December - 15th March

Project iRASTE TELANGANA

Intelligent Solutions for Road Safety through Technology & Engineering

September 30 ‘22

S.NO	ROUTE	COUNT
1	HYDERABAD - VIJAYAWADA	60
2	HYDERABAD - BANGALORE	13
3	NIZAMABAD - HYDERABAD	10
4	HYDERABAD - BADRACHALAM	4
5	HYDERABAD - KARIMNAGAR	4
6	NIZAMABAD - GUNTUR	3
7	HYDERABAD - MYSORE	2
8	HYDERABAD - KURNOOL	1
9	HYDERABAD - TIRUPATI	1
10	HYDERABAD - VISHAKAPATNAM	1
11	HYDERABAD - ELURU	1
	TOTAL	100

Driver Monitoring System

Telangana Highway Black Spots