Crash Investigation and Black Spot Assessment

By

Ravishankar Rajaraman
Technical Director, JP Research India Pvt. Ltd.
Chairman, RASSI Technical Committee

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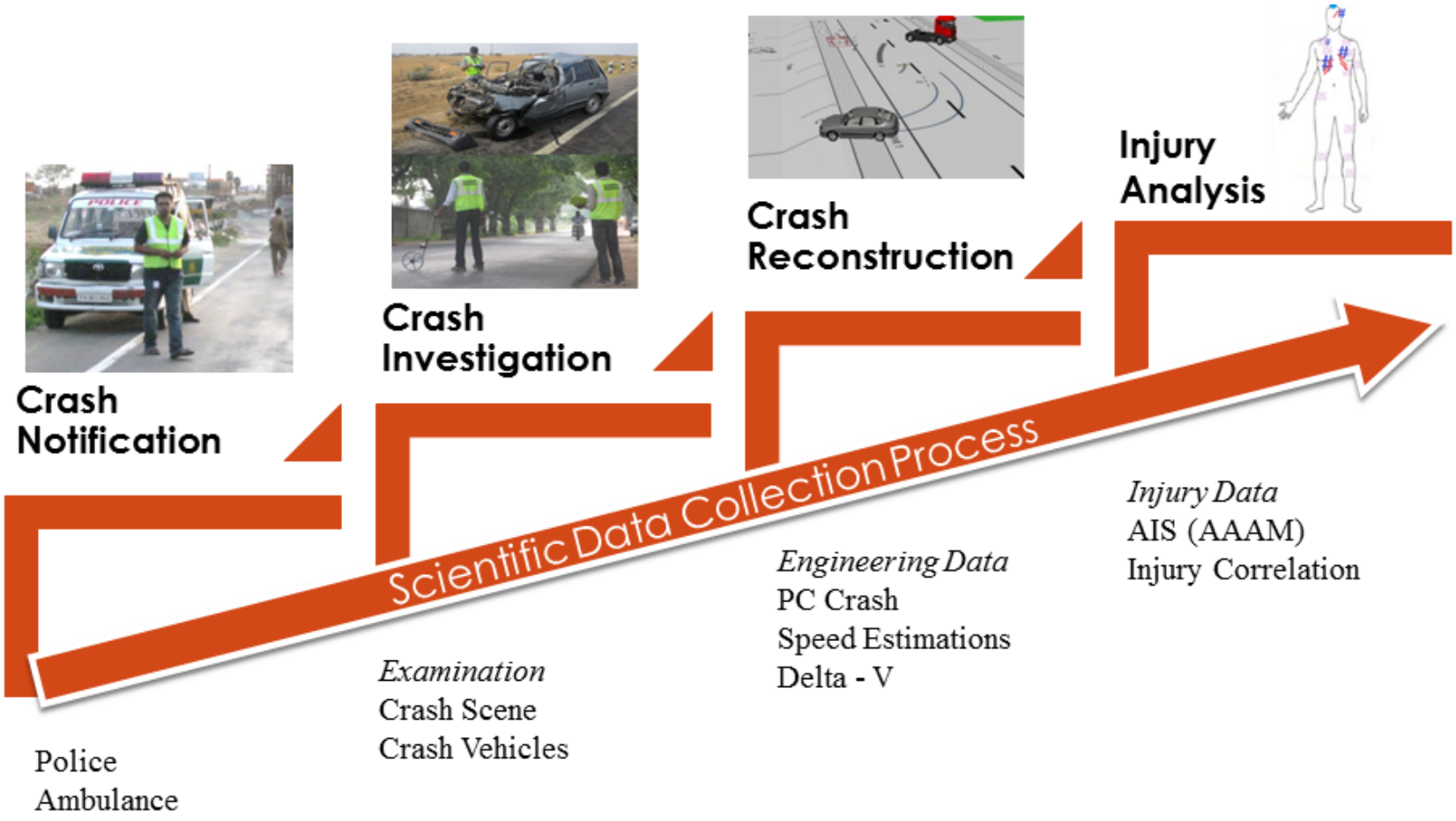
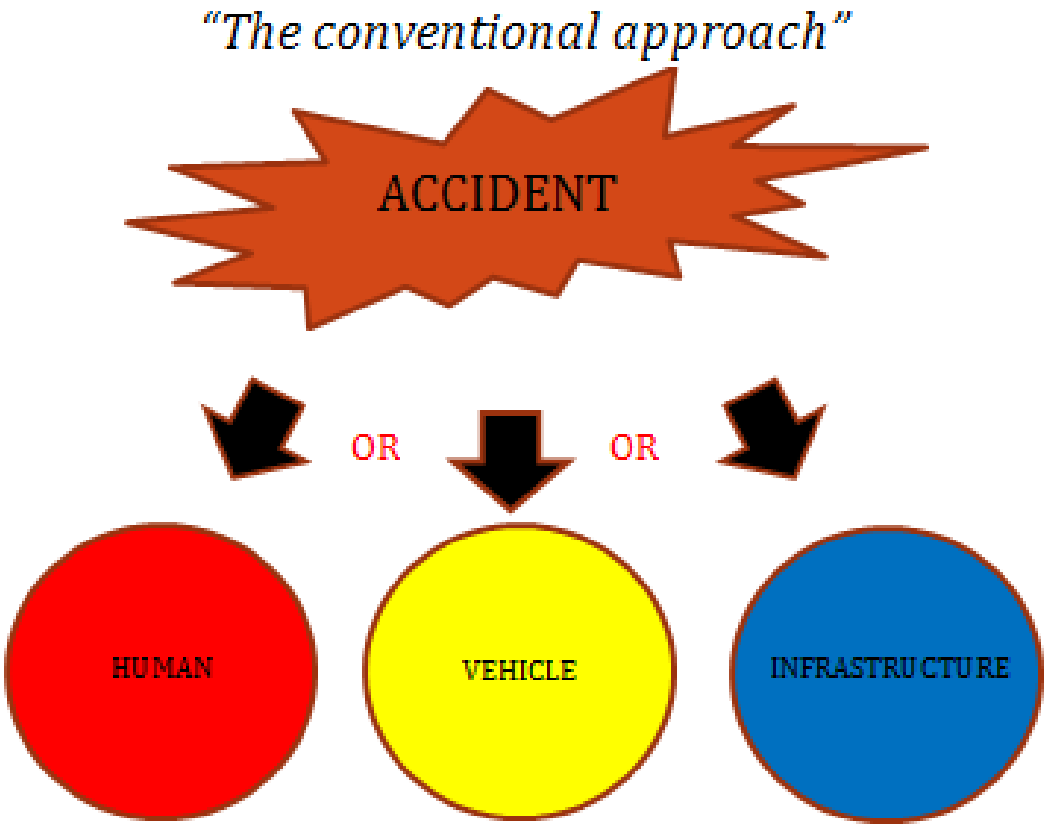
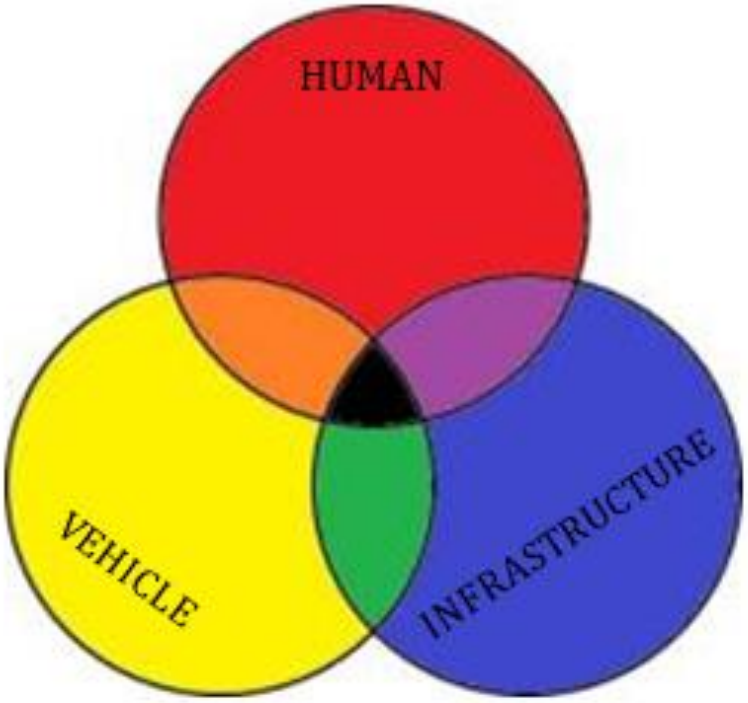
JPRI Crash Investigation Methodology



Lack of reliable crash data



Changing the way India looks at crashes

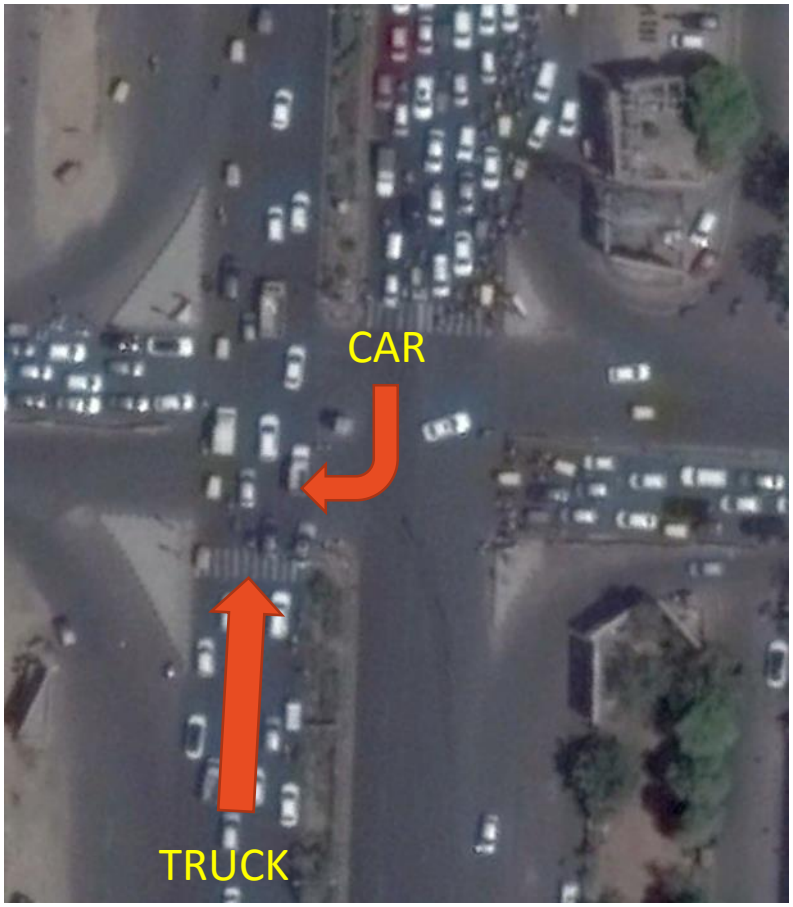


Venn diagram analysis

- Scientific basis required.
- Purpose should not be limited to which driver is responsible for the crash.
- Determination of all possible contributing factors leading to the crash and the consequential injuries.

Example case

- Crash location: Intersection
- Crash time: 01:15 hrs
- One occupant of car fatal.
- The occupant was entrapped and evacuation took hours.



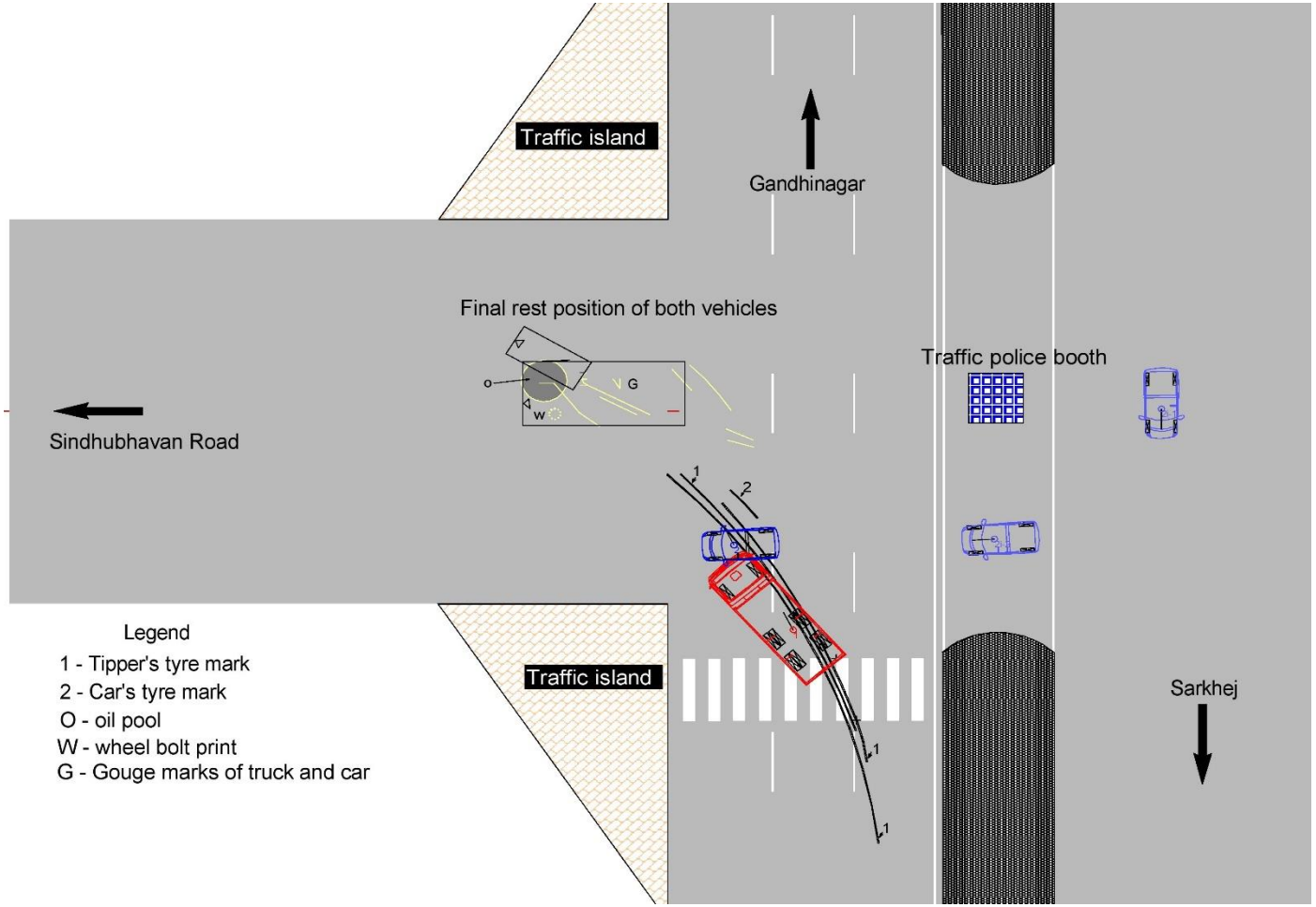
Courtesy: Google Earth

Crash Scene Examination

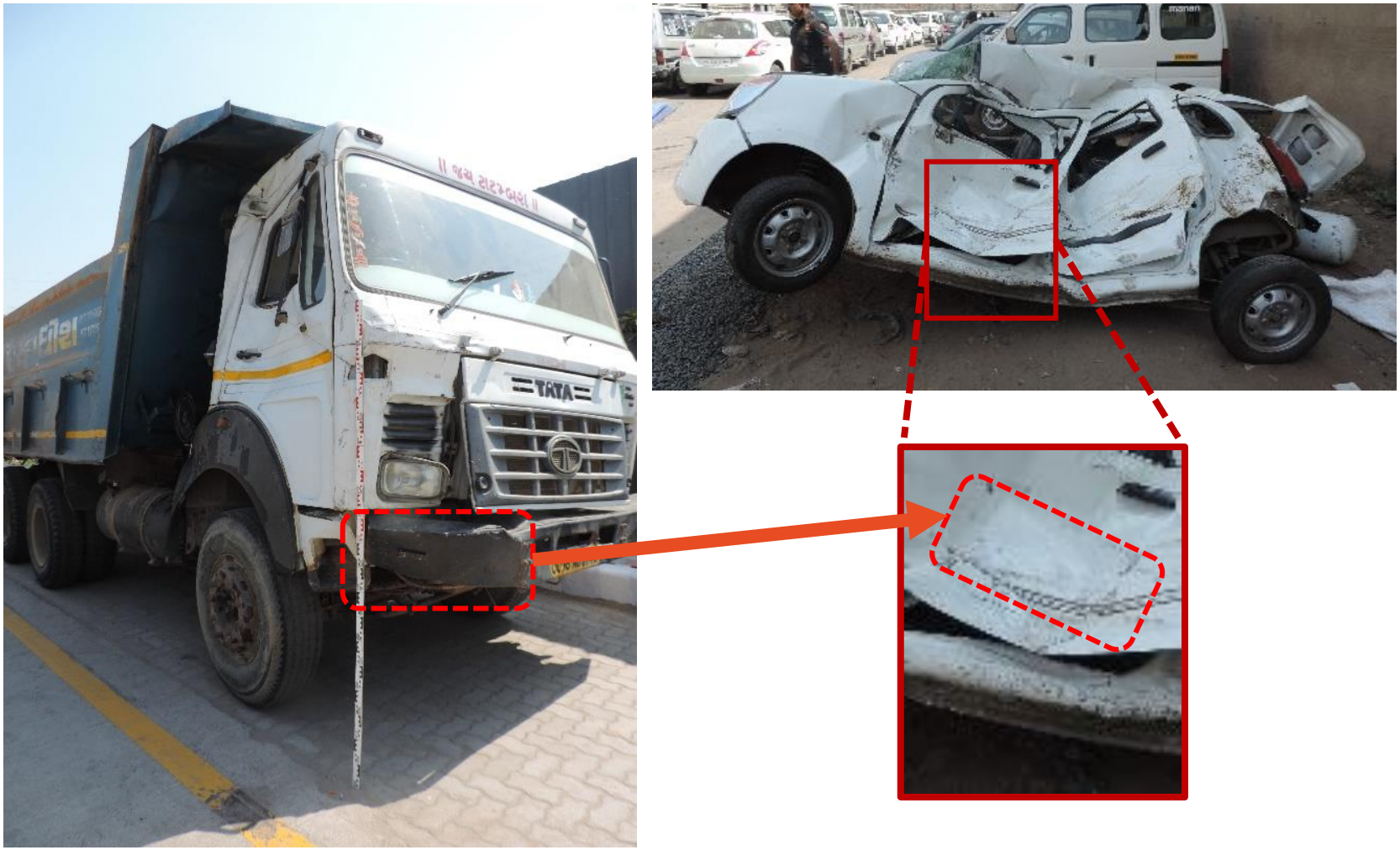
Travel direction of tipper

- Identification and marking of vehicle trajectories (skid/brake marks), point of impact and final resting positions.
- Taking pictures and measurements.

Crash Scene Diagram (to scale)



Crash Vehicle Examination



CCTV Footage

Courtesy: Ahmedabad City Police

Speed Estimation – Tipper

Time - 1:45:705 (m:ss:ms)

Time - 1:47:278 (m:ss:ms)

Distance : 17.4m for tipper

Speed Estimation – Car

Time - 1:45:685 (m:ss:ms)

Time - 1:47:269 (m:ss:ms)

Distance : 9m for car

Speed Calculations

Velocities to be found	Values			Results (kmph)
Tipper average speed (kmph) **V = distance / time (m/s) x 3.6**	d t	= =	17.4 m 1.573 s	40
Car average speed (kmph) **V = distance / time (m/s) x 3.6**	d t	= =	9 m 1.825 s	18

Reconstruction: PC Crash Simulation

Accident View

Tipper driver view

Driver vision obstruction due to median plantation and structures.

Low sight distance resulted in late reaction by tipper driver.

Contributing factors for this crash

- Overloaded tipper
- Car driver did not wait to check before crossing
- Car occupant entrapment
- Car occupant evacuation time
- Vision obstruction because of median plantation

Is there a more systematic way to identify these factors?

Haddon Matrix.

Haddon Matrix

- Created by Dr. William Haddon Jr.
- A physician and doctor.
- Widely considered to be the father of modern injury epidemiology.
- Haddon Matrix was developed in the late 1950s.

Dr. William Haddon Jr.
Source: www.icadts.org

The Haddon Matrix: 3 Factors

- Specifying and examining the <u>3 factors</u>

HUMAN

VEHICLE

INFRASTRUCTURE/
ENVIRONMENT

The Haddon Matrix: 3 Phases

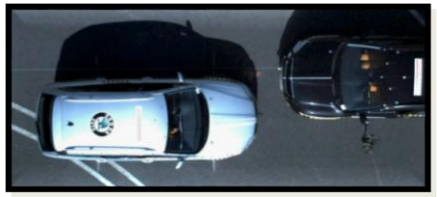
In a timeline of 3 phases of a traffic accident:

- Pre-crash: Prevention of crash
- Crash: Prevention/reduction of injury
- Post-crash: Life-sustaining

The Haddon Matrix: 3 x 3

FACTORS

PHASES



The Haddon Matrix

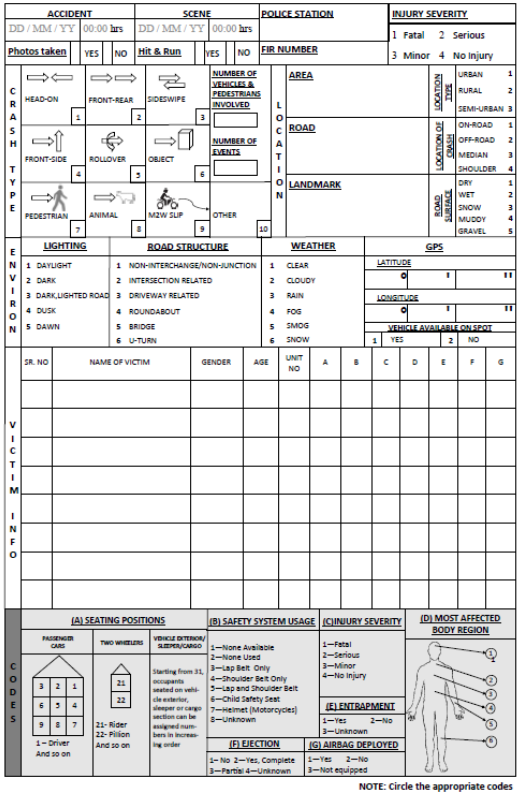
		FACTORS		
PHASE		**HUMAN**	**VEHICLE**	**INFRASTRUCTURE**
PRE-CRASH	Crash Prevention	1 • *Information* • *Attitudes* • *Impairment* • *Police enforcement*	2 • *Roadworthiness* • *Working lights* • *Good brakes* • *Handling* • *Speed control*	3 • *Road design and layout* • *Speed limits* • *Pedestrian Facilities*
CRASH	Injury prevention during the crash	4 • *Use of safety systems*	5 • *Occupant restraints* • *Other Safety devices* • *Crash protective design*	6 • *Crash protective roadside objects*
POST-CRASH	Life Sustaining	7 • *First-aid skill* • *Access to medics*	8 • *Ease of access* • *Fire risk*	9 • *Rescue facilities* • *Congestion*

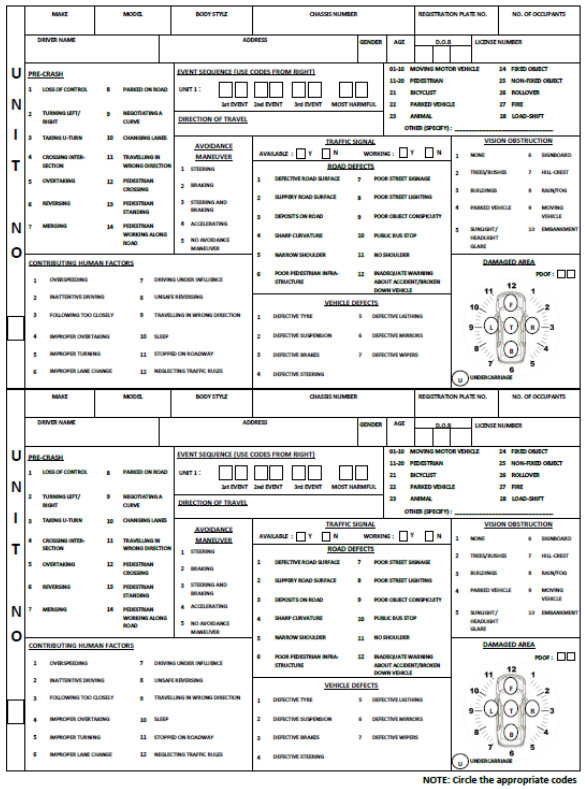
Apply Haddon Matrix to tipper-car crash

		FACTORS		
PHASE		**HUMAN**	**VEHICLE**	**INFRASTRUCTURE**
PRE-CRASH	Crash Prevention	*Car - Violation of right of way* *Truck - Overloading*	• *Roadworthiness* • *Working lights* • *Good brakes* • *Handling* • *Speed control*	***Vision obstruction due to median plantation***
CRASH	Injury prevention during the crash	• *Use of safety systems*	*Car - Passenger compartment intrusion*	• *Crash protective roadside objects*
POST-CRASH	Life Sustaining	• *First-aid skill* • *Access to medics*	*Car – Occupant Entrapment*	*Car – Occupant Evacuation*

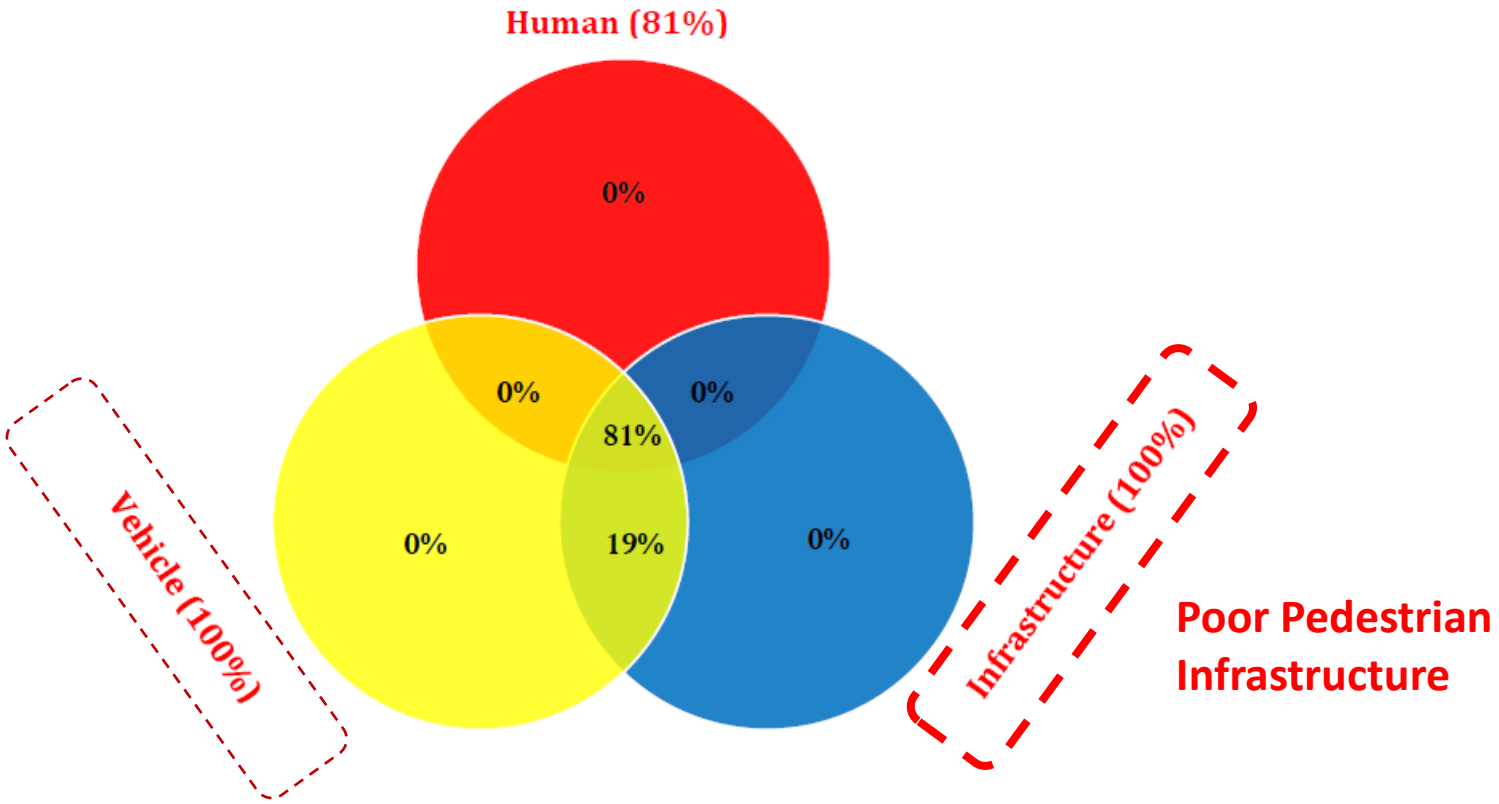
JPRI - WRI-India Crash Data Collection Forms

- 3-4 page form and coding manual for in-depth data collection





Analysis: Fatal Pedestrian Accidents in Kolkata City



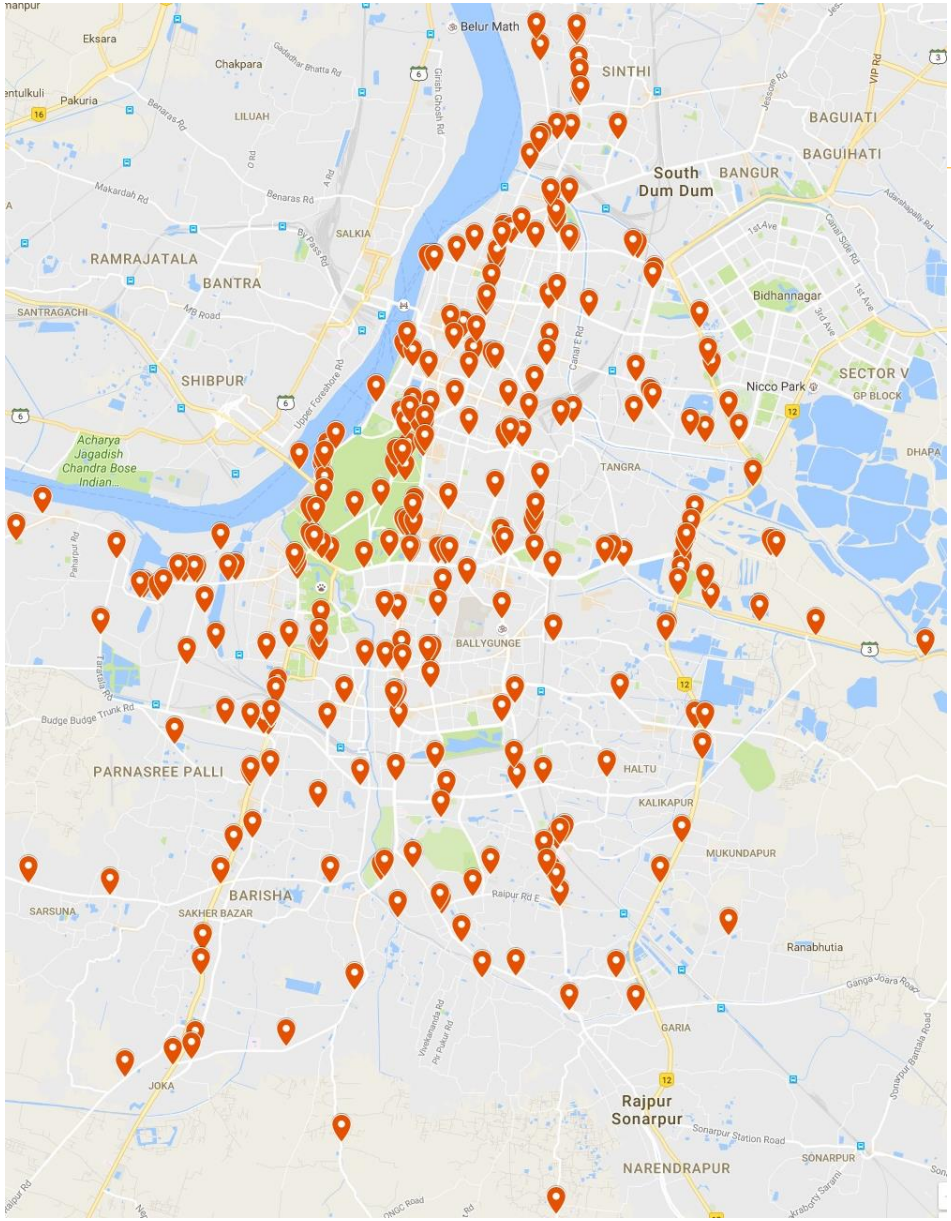
Infrastructure has 100% influence on the occurrence of fatal pedestrian accidents

Source: Kolkata city fatal accident study report 2014 - 2015

Contributing factors for fatal pedestrian accidents

Human (81%)	Vehicle (100%)	Infrastructure (100%)
Speeding more than 30Kmph (77%)	Pedestrian knocked down to the ground (66%)	Poor pedestrian infrastructure – crossing (72%)
Driver inattention / Distraction (8%)	Pedestrian run over (34%)	Poor pedestrian infrastructure – walking alongside (28%)
None	Vision obstruction due to vehicle interiors (8%)	None

Source: Kolkata city fatal accident study report 2014 - 2015

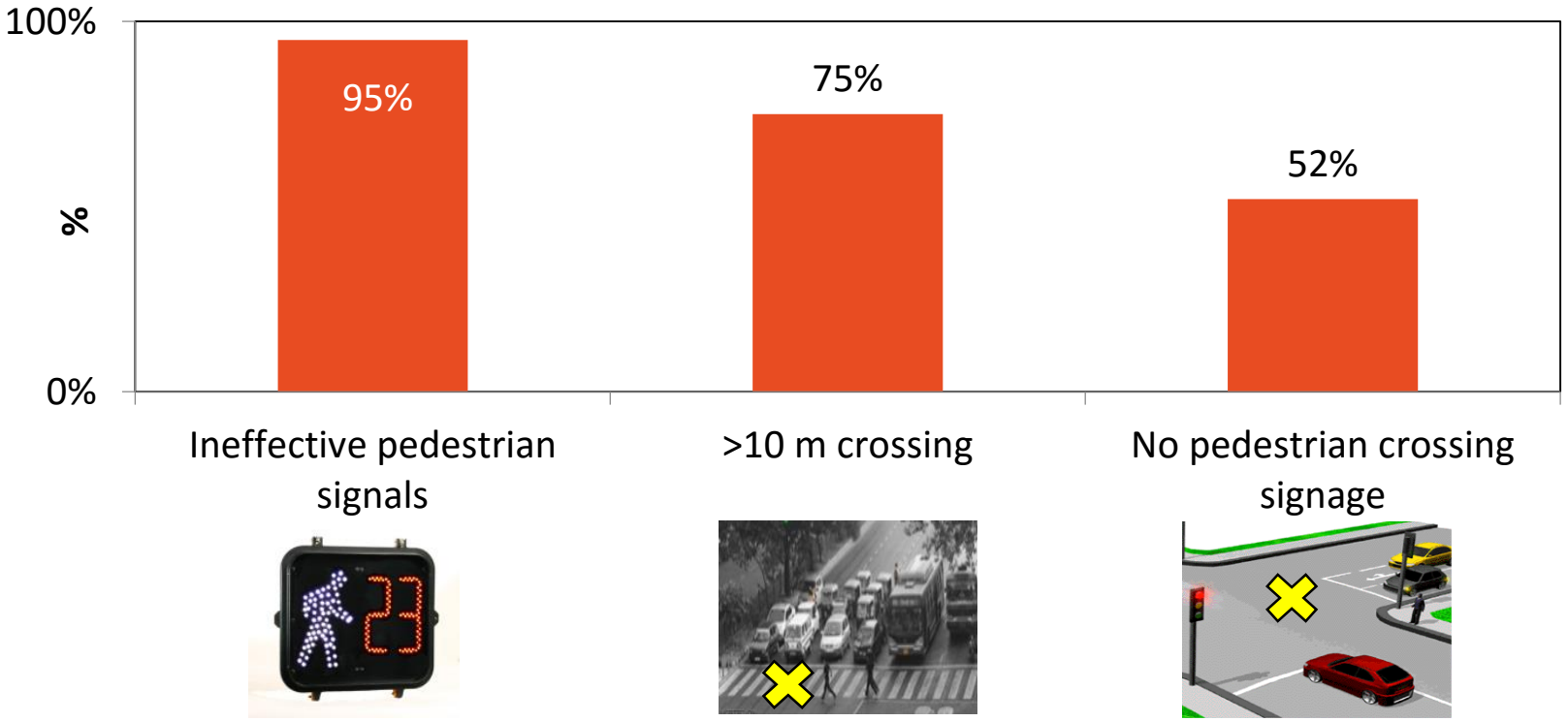


Black spots

- *GPS Coordinates of 316 fatal accidents from Nov 2014 to Nov 2015.*
- *No 2 fatal accidents occurred at the same location.*
- *Fatal accidents are widely spread around Kolkata city.*

Infrastructure factors leading to fatal pedestrian crossing accidents

- 72% of fatal pedestrian accident occurs when pedestrians are trying to cross the road.
- 76% of fatal pedestrian crossing accident occurs at or near junctions.



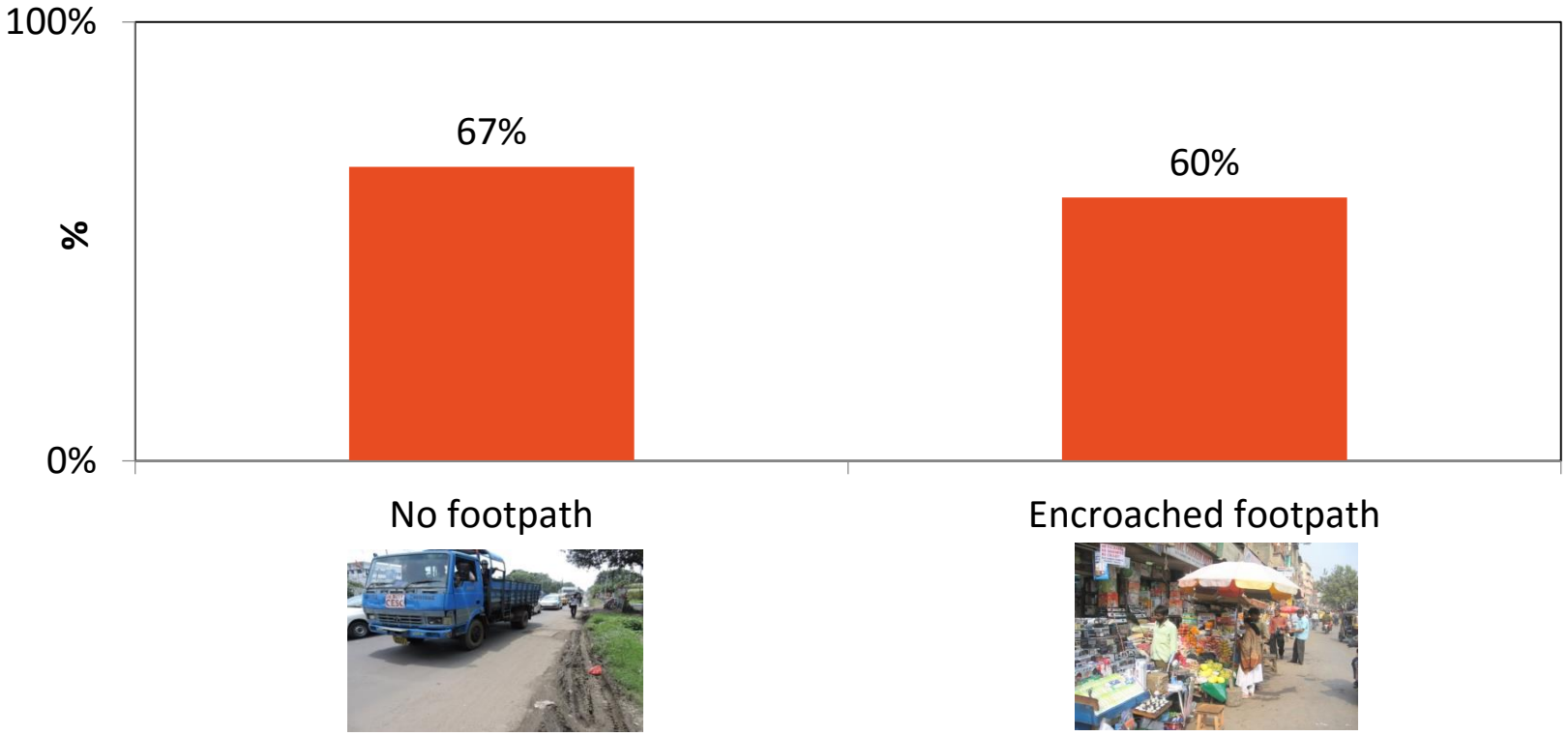
Source: *Kolkata city fatal accident study report 2014 - 2015*

Example fatal pedestrian crossing accident
Crossing distance *>10 m*

Source: Kolkata Traffic Police

Infrastructure factors leading to fatal pedestrian walking alongside accidents

- 28% of fatal pedestrian accidents occur when pedestrians are walking alongside the road.



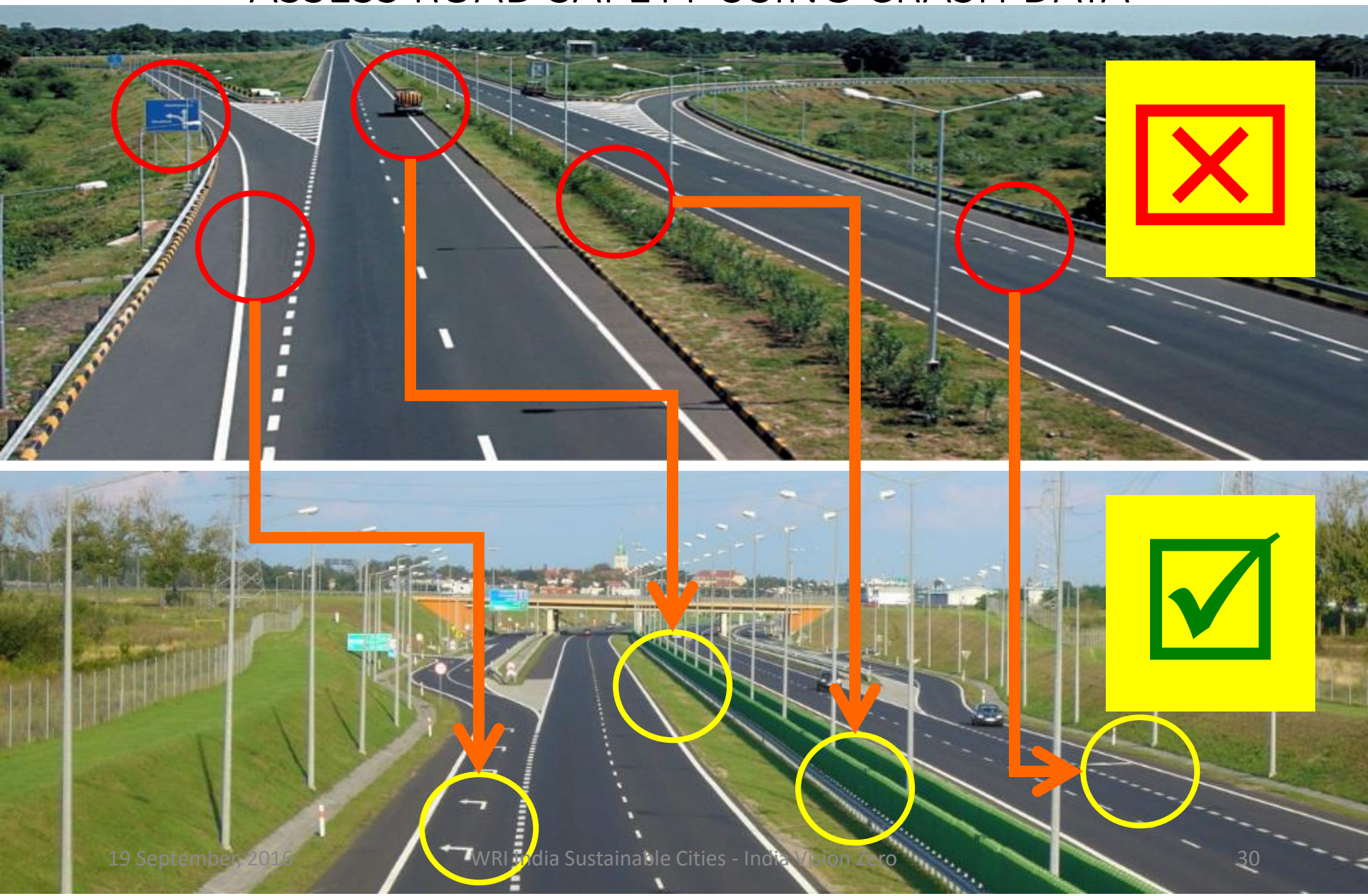
Source: Kolkata city fatal accident study report 2014 - 2015

Black spot assessment on Mum – Pune E'way "Zero Fatality Corridor" Project

S. No	Contributing factor	Frequency	Frequency Type	No. of Fatal Victims (Average per year)	No. of Injured Victims (Average per year)
1	Narrow/No shoulder	218.09	Distance (km)	19	66
2	Roadside/Median concrete structure	275.00	Count	9	24
3	Roadside steep slope/drop-off	79.14	Distance (km)	5	24
4	Poor/ineffective road signage	20.00	Count	6	17
5	Sharp road curvatures	162.00	Count	5	18
6	Gaps-in-median	88.00	Count	2	16
7	Unguarded overhead bridge pillars	122.00	Count	4	2
8	Unguarded Bridge/Jersey wall	166.00	Count	3	5
9	Unguarded Underpasses	96.00	Count	2	5
10	Entry/Exit road	76.00	Count	2	1
11	Driver vision obstruction	37.00	Count	1	4
12	Roadside trees	21.37	Distance (km)	1	2
13	Curb stones	67.44	Distance (km)	0	6
14	Guardrail end taper	169.00	Count	0	2
15	Flower pots in the median	14.24	Distance (km)	0	1

Making Overhead Bridge Pillars Forgiving

ASSESS ROAD SAFETY USING CRASH DATA



Summary

- On-site crash investigations required for reliable crash data.
- Haddon Matrix needs to be applied for systematic determination of all contributing factors in a crash.
- Contributing Infrastructure Factors identified can then be analysed for assessing black spot issues and providing suitable interventions.
- Infrastructure design has a significant influence on road accidents.

Thank You

COIMBATORE

PUNE

www.rassi.org.in

reachus@jpresearchindia.com

AHMEDABAD

KOLKATA