Comparing Accident Pattern & Characteristics on National Highways in India

Presented by

Hasan Mehdi Naqvi

Chief General Manager (T) &
Regional Officer-Tamil Nadu,
National Highways Authority of India

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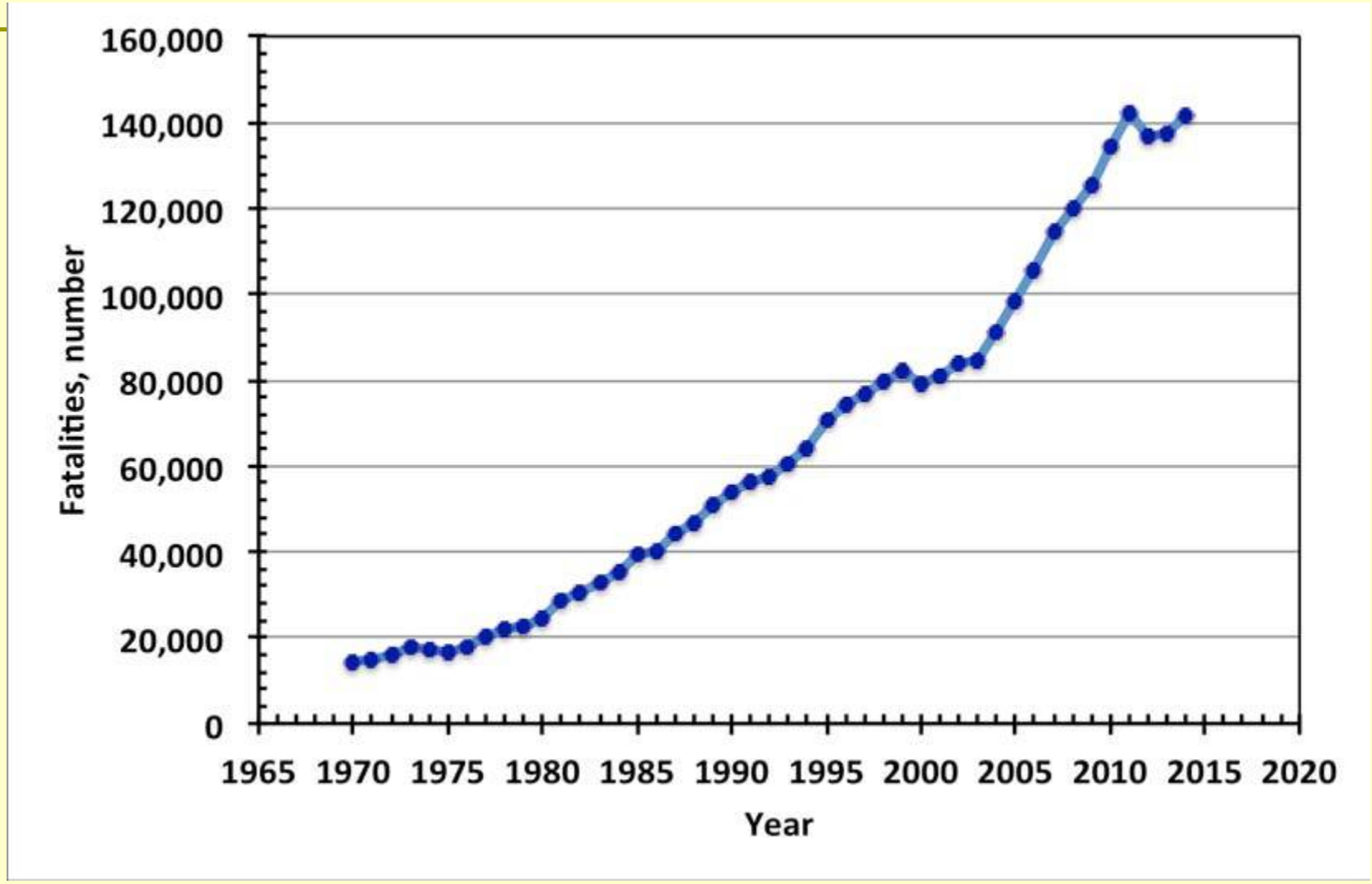
Outline of the Presentation

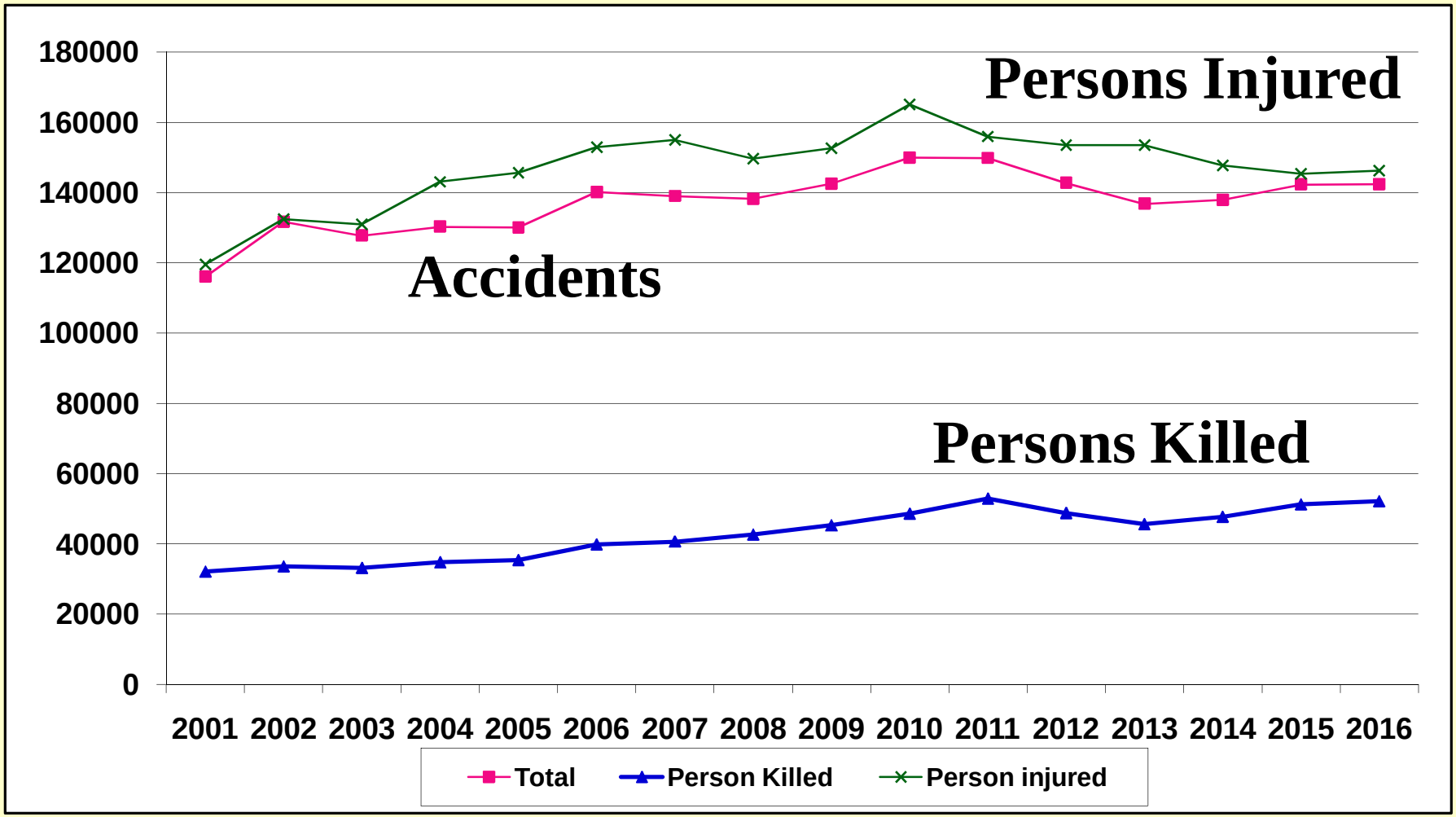
1. Introduction
2. Literature review
3. Data description
4. Fatal crash data analysis
5. Conclusions
6. Recommendations

Road Traffic Deaths in India 1970-2014



Source: Road safety in India Status Report by Mohan, D., et al. (2015)

Trend of Accidents, Person killed & injured on NHs: 2001-2016



Source: Road accidents in India 2002-2016, MoRTH

Literature Review

Salient findings of the research work on accident pattern and characteristics on NHs in India and abroad:

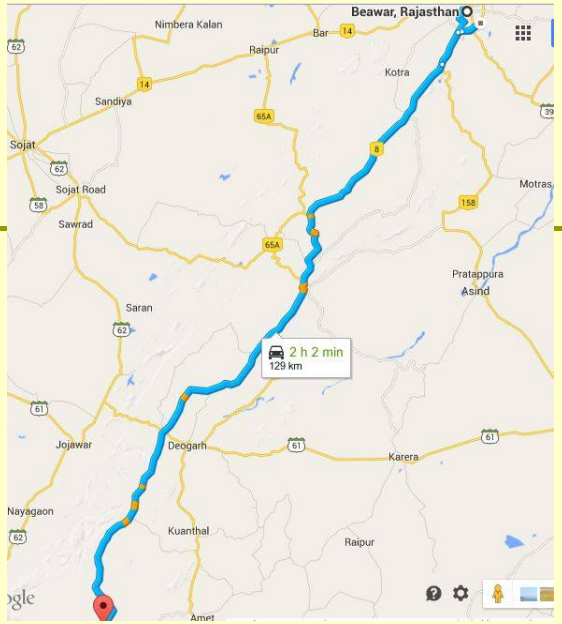
- (Vaishnav et al. 1997) study for two-lane NH-8B in Gujarat showed that head-on collisions were observed highest (26%), trucks involved accidents (19%), pedestrian accidents (~14.4%) and accident density was found 1.10 accidents/km/year
- (Chandra and Bhuyan 2004) study for two-lane roads in UP & Uttarakhand showed heavy vehicles (trucks/bus) were involved in almost 21% and pedestrians in 16% of accidents, followed by two-wheelers (17.8%), cars and pedestrians (16.4% each).

Owing large share of accidents on NHs and absence of comprehensive research on accidents on NHs in India, there is an urgent need to carry out comprehensive accident analysis on NHs.

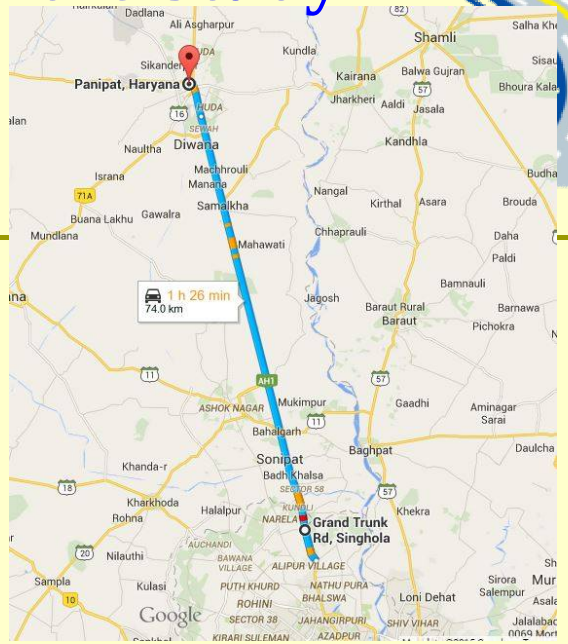
National Highways Sections

- In this study, author has examined and compares **fatal** road accidents pattern and characteristics
  - **two-lane** section of NH-8 namely, from Beawar to Gomti chouraha in Rajasthan for the period 2008-2012,
  - **four-lane** section of NH-24 (Delhi border to Masoori in Uttar Pradesh) during 2010-2013, and,
  - **six-lane** section of NH-1 (from Delhi border to Panipat border in Haryana) for the period 2009-2013.

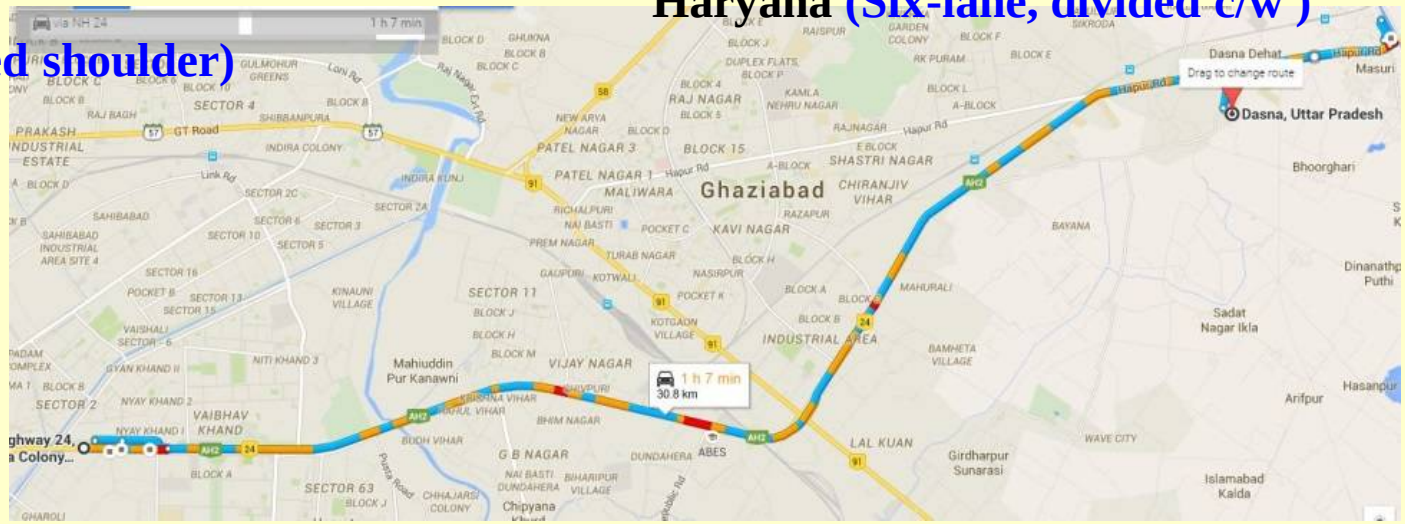
Selected NHs for the Study



NH-8 (Beawar to Gomti chowk) in Rajasthan (Two-lane paved shoulder)



NH-1 (Delhi Border to Panipat) in Haryana (Six-lane, divided c/w)



NH-24 (Delhi Border to Dasna) in Uttar Pradesh (four-lane, divided c/w)

NHs-wise: ADT, Section Length & Fatal FIRs

NH	ADT in Vehicles*	Chainage of NHs Section, (length in km)	Year	Number of Fatal FIRs	No. of Police Stations
NH-8 Two-lane	2,934^	Beawar at km 64 to Gomti Chowk at km 162, (98)	2009-2012	355	5
NH-24 Four-lane	46,836^^	Delhi border at km 7 to Dasna at km 37 (30)	2010-2013	299	4
NH-1 Six-lane	51,085^^^	Delhi border at km 29 to Panipat at km 86 (57)	2009-2013	889	6

^at km 84 in 2013 ^^at km 29.3 in 2014 ^^^km 52.65 in 2012

*Source: 1. MoRTH-for two-lane NH-8 and 2. NHAI.

Other data comprise: Road inventory and Abutting landuse along NHs

Fatal Crash Data Analysis

Fatal Crashes/km/year on NHs

NH	Number of Lanes	Section Length in KM	Fatal crashes /km/year
NH-8	Two-lane (undivided)	96	0.72
NH-24	Four-lane (divided)	27	2.54
NH-1	Six-lane (divided)	57	3.08

Distribution of Fatal Accidents on NHs by Time

Month-wise

- No particular pattern is observed. Hence it can be concluded that fatal accidents on cited NHs have no seasonal effect.

Day-wise

- No significant pattern is noticed on cited NHs.

Hour-wise

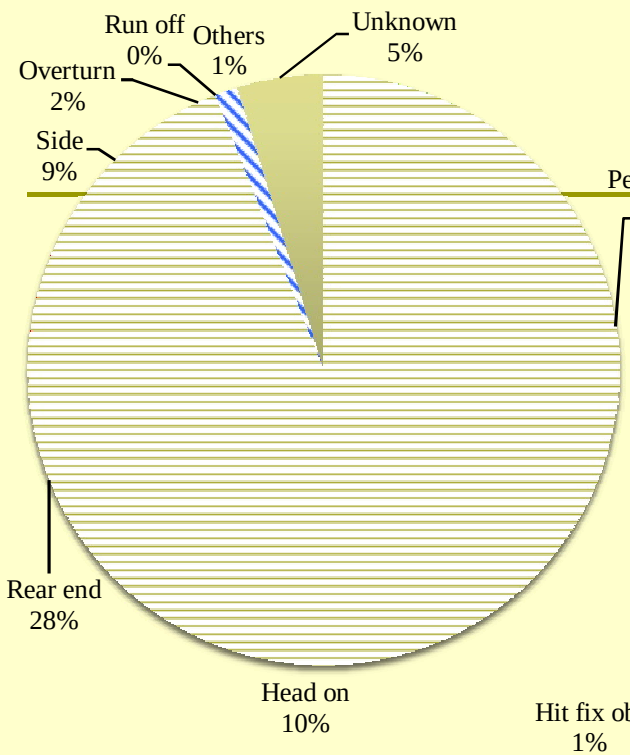
- majority of fatal accidents (~17-18% of total) occurred during evening and night hours (19-21 hrs.) on both two-lane NH-8 and six-lane NH-1 sections.
- In case of two-lane NH-8, sharp increase in fatal crashes are also noticed during 3-4 hrs. in night.

Distribution of Fatal Accidents on NHs by Time

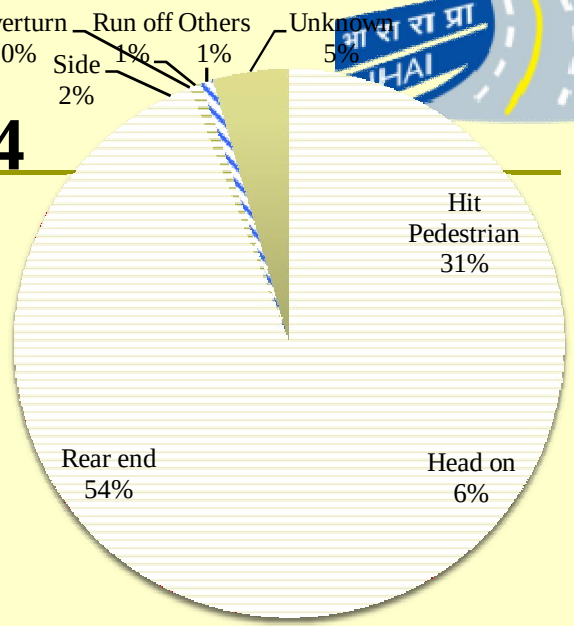
Inferences:

- Poor visibility during evening and night hours on two-lane NH-8 and six-lane NH-1 could be the possible reason for increase in accidents apart from other factors such as driver fatigue and drink-driving in the evening.

Distribution of fatal crashes by collision-type

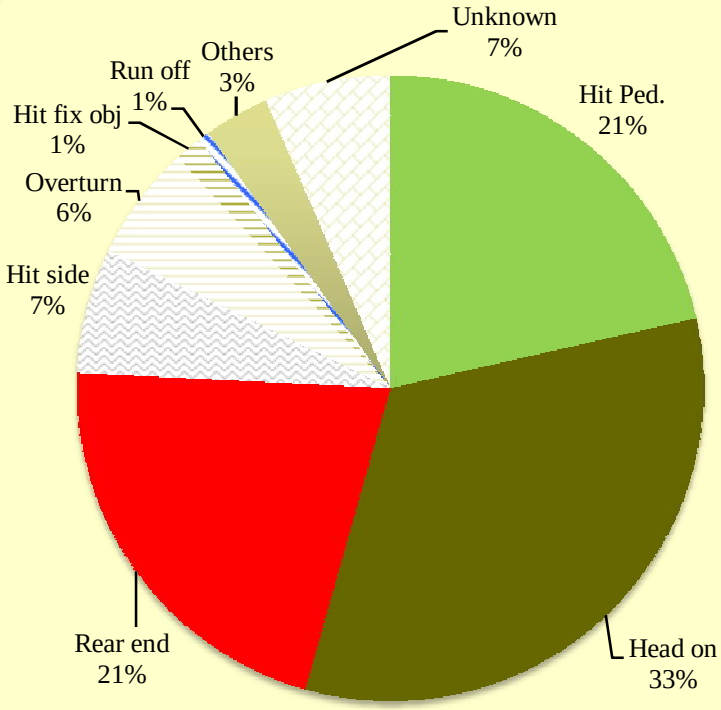


NH-1 **Six-lane**



NH-24 **Four-lane**

NH-8 **Two-lane**



Distribution of Fatal Crashes by Collision-type

Inferences

- Highest share of “head-on” collision on two-lane NH-8 section: in line with the general trend of accidents for two-lane NHs (without median).
- Rear-end collisions are observed on NH-8, NH-24 and NH-1 sections mainly due to parking of vehicles on highway to do minor repair or change of tyres, etc. without using parking indicators or other warning signals.
- On six-lane NH-1, high share of “hit pedestrians” were mainly due to adjoining residential/commercial development along NH.

Distribution of fatal accidents: Vehicle Occupant versus striking vehicle (Two-lane NH-8)

Victims' Vehicle	Striking Vehicle								
	Truck	Bus	Car	Three-wheeler	Motor cycle	Tractor	Other vehicle	Unkno-wn	Total
Truck	19.0 (72.7)	6.3 (2.3)	1.6 (2.3)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	27.0 (22.7)	0.0 (0.0)	12.5 (100)
Bus	4.2 (50.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	4.6 (7.1)	16.2 (42.8)	0.0 (0.0)	4.0 (100)
Car	17.9 (62.5)	12.5 (4.2)	8.2 (10.4)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	18.9 (14.6)	13.8 (8.3)	13.6 (100)
Three-wheeler	4.2 (38.9)	12.5 (11.1)	3.3 (11.1)	0.0 (0.0)	0.0 (0.0)	9.1 (11.1)	13.5 (27.8)	0.0 (0.0)	5.1 (100)
Motorcycle	38.7 (43.9)	43.8 (4.7)	50.8 (20.9)	33.3 (0.7)	58.8 (6.8)	40.9 (6.1)	24.3 (6.1)	55.2 (10.8)	41.9 (100)
Tractor	0.6 (100.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.3 (100)
Bicycle	1.8 (37.5)	0.0 (0.0)	3.3 (25.0)	0.0 (0.0)	5.9 (12.5)	4.5 (12.5)	0.0 (0.0)	3.5 (12.5)	2.3 (100)
Pedestrian	13.7 (32.4)	25 (5.6)	31.2 (26.8)	66.7 (2.8)	35.3 (8.4)	40.9 (12.7)	0.0 (0.0)	27.6 (11.3)	20.1 (100)
Other vehicle	0.0 (0.0)	0.0 (0.0)	1.6 (100.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.3 (100)
Total	100 (47.6)	100 (4.5)	100 (17.3)	100 (0.8)	100 (4.8)	100 (6.2)	100 (10.5)	100 (8.2)	100.0 (100)

Figures in parenthesis depict row-wise %. Figures without parenthesis depict column-wise %. Total number of observations = 355. Other includes modes not listed in Table and hit by tree/pole, roll over and driver or rider lost control

Distribution of fatal accidents: Vehicle Occupant versus striking vehicle (Four-lane NH-24)

Victims' Vehicle	Striking Vehicle								
	Truck	Bus	Car	Three-wheeler	Motor-cycle	Tractor	Other vehicle	Unknown	Total
Truck	6.8 (83.3)	6.1 (11.1)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1.4 (5.6)	4.4 (100)
Bus	1.4 (33.3)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	21.4 (33.3)	100 (33.3)	0.0 (0.0)	2.2 (100)
Car	11.3 (75.8)	6.1 (6.1)	7.7 (9.1)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	4.1 (9.1)	8.0 (100)
Three-wheeler	6.8 (71.4)	0.0 (0.0)	7.7 (14.3)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	4.1 (14.3)	5.1 (100)
Motorcycle	42.5 (52.2)	54.5 (10.0)	41.0 (8.9)	40.0 (3.3)	50.0 (3.3)	57.1 (4.4)	0.0 (0.0)	43.2 (17.8)	43.8 (100)
Tractor	0.0 (0.0)	9.1 (100.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.7 (100)
Bicycle	6.3 (63.6)	6.1 (9.1)	0.0 (0.0)	6.7 (4.5)	8.3 (4.5)	7.1 (4.5)	0.0 (0.0)	4.1 (13.6)	5.4 (100)
Pedestrian	19.9 (39.3)	18.2 (5.4)	43.6 (15.2)	53.3 (7.1)	41.7 (4.5)	14.3 (1.8)	0.0 (0.0)	40.5 (26.8)	27.3 (100)
Other vehicle	4.5 (100.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	2.4 (100)
Unknown	0.5 (33.3)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	2.7 (66.7)	0.7 (100)
Total	100 (53.8)	100 (8.0)	100 (9.5)	100 (3.6)	100 (2.9)	100 (3.4)	100 (0.7)	100 (18.0)	100 (100)

Figures in parenthesis depict row-wise %. Figures without parenthesis depict column-wise %. Total number of observations = 411.
Other includes modes not listed in Table and hit by tree/pole, roll over and driver or rider lost control

Distribution of fatal accidents: Vehicle Occupant versus striking vehicle (Six-lane NH-1)

Victim's Vehicle	Striking Vehicle								
	Truck	Bus	Car	Three-wheeler	Motor cycle	Tractor	Other	Unknown	Total
Truck	55.8 (98.1)	6.1 (0.4)	0.0 (0.0)	0.0 (0.0)	16.7 (0.8)	4.0 (0.2)	14.3 (0.2)	1.2 (0.2)	41.2 (100)
Bus	0.5 (100.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.3 (100)
Car	5.0 (60.9)	12.1 (5.8)	5.6 (11.6)	50.0 (4.3)	0.0 (0.0)	24.0 (8.7)	0.0 (0.0)	7.1 (8.7)	5.9 (100)
Three-wheeler	3.5 (57.7)	9.1 (5.8)	7.0 (19.2)	0.0 (0.0)	4.2 (1.9)	8.0 (3.8)	42.9 (5.8)	3.6 (5.8)	4.4 (100)
Motorcycle	5.1 (37.1)	18.2 (5.2)	30.1 (37.1)	16.7 (0.9)	25.0 (5.2)	28.0 (6.0)	42.9 (2.6)	8.3 (6.0)	9.9 (100)
Tractor	0.6 (55.6)	0.0 (0.0)	2.1 (33.3)	0.0 (0.0)	4.2 (11.1)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.8 (100)
Bicycle	1.5 (38.2)	6.1 (5.9)	8.4 (35.3)	0.0 (0.0)	12.5 (8.8)	12.0 (8.8)	0.0 (0.0)	1.2 (2.9)	2.9 (100)
Pedestrian	27.9 (59.4)	48.5 (4.0)	45.5 (16.3)	33.3 (0.5)	37.5 (2.3)	24.0 (1.5)	0.0 (0.0)	76.2 (16.0)	34.1 (100)
Other vehicle	0.1 (20.0)	0.0 (0.0)	1.4 (40.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	2.4 (40.0)	0.3 (100)
Total	100 (72.5)	100 (2.8)	100 (12.2)	100 (0.5)	100 (2.1)	100 (2.1)	100 (0.6)	100 (7.2)	100 (100)

Figures in parenthesis depict row-wise %. Figures without parenthesis depict column-wise %. Total number of observations = 1,170. Other includes modes not listed in Table and hit by tree/pole, roll over and driver or rider lost control

Conclusions

Two-lane NH-8

- Trucks (Multi Axle Vehicle and standard truck) constitute highest share (46%) of total traffic, followed by car (30%) and LCV (7%).
- "Head-on" collisions (33%) were observed to be highest, followed by "rear-end" i.e. 21% and "hit pedestrian" i.e. 21% of total fatal accidents.
- In 47% of total fatal accidents on two-lane NH-8 section, trucks (both multi-axle and 2-axle) struck victims of other modes including pedestrians, and followed by car (17%).

Four-lane NH-24

- "Rear-end" collisions (54%) were observed to be highest, followed by "Hit pedestrian" i.e. 31% and "head on" i.e. 6% of total fatal accidents.
- On four-lane NH-24, % share of striking vehicle as truck in fatal crash against the respective victims' vehicle namely, motorcycle is observed to be highest (43%), followed by pedestrian (20%) and car (11%).

Conclusions – contd.

Six-lane NH-1

- Highest share of cars (57%) and multi-axle vehicles (15%) were observed.
- Highest number of collisions were observed as “hit pedestrian” i.e. 45%, followed by “rear-end” i.e. 21% and “head on” i.e. 10%.
- 72% of total fatal accidents trucks (both multi-axle and 2-axle) struck victims of other modes including pedestrians, followed by car (12%) and unknown (7%) and tractor/motorcycle (2.1%).

Recommendations

- Owing to heterogeneous traffic (heavy versus light modes and fast versus slow moving modes) movement on cited NHs and number of abutting access roads (cross roads) catering to local traffic,
  - **suitable traffic calming measures** are recommended at junctions or NHs sections having heaving abutting land use.
  - to **designate lanes for light and heavy vehicles** through gantry/overhead signs boards
- Highway police should **discourage on-street parking of vehicles** on highways near dhabhas, vehicle garage(s), etc. to reduce rear-end collisions.
- short/medium-term remedial measures for **vulnerable modes of transport** including **pedestrians** moving along and across
- long-term remedial measures such as **vehicular underpass, service roads, flyover,** etc. based on the accident study

Thank you !

naqvihm@gmail.com