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Principles for development of safer rural highway systems for conditions prevailing in low and middle-income countries

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**.....focus on legislation and educational
measures for improving road traffic safety
problems in LMICs**

implies that standards used for designing and constructing roads will ensure safety, therefore, only appropriate legislation regarding seat belt use, speed limits and alcohol control are required to improve traffic safety in LMICs.

Conditions prevailing in LMICs: *are they different?*

Mixing of local traffic with high speed through traffic

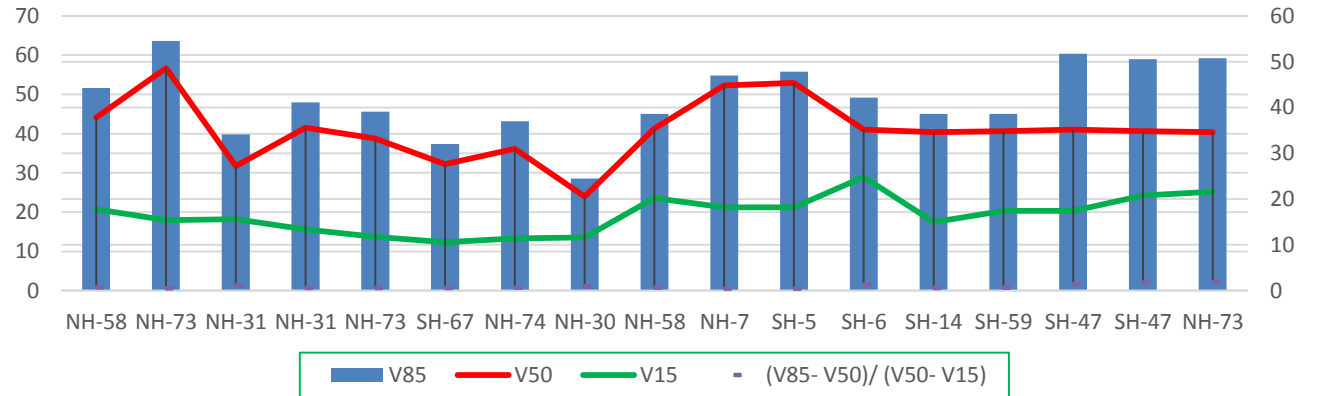


Highway passing through towns/village
~1.5 km highways through the village

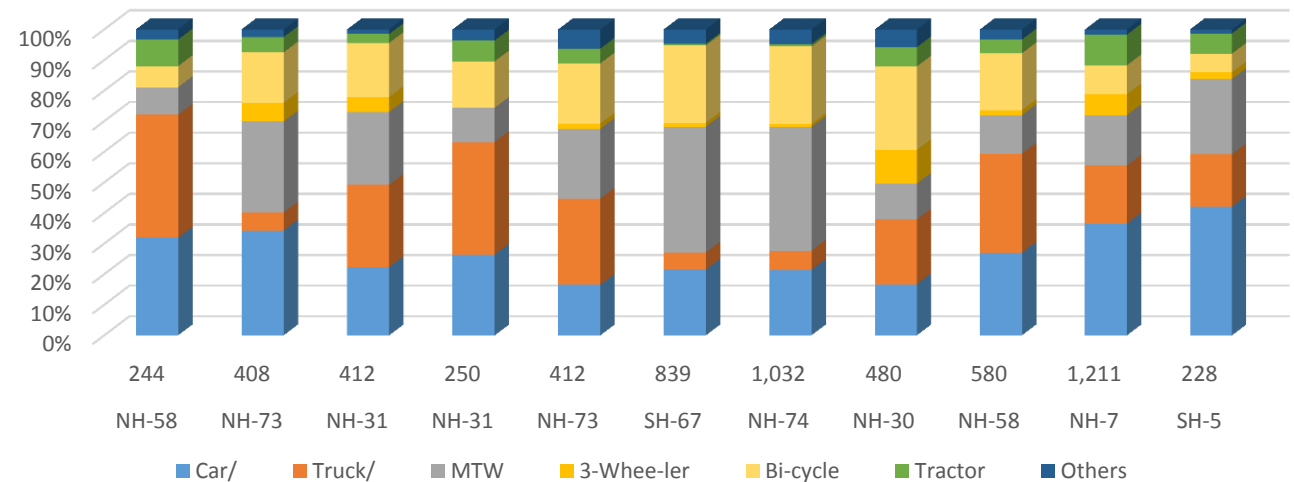
Conditions prevailing in LMICs: *are they different?*

- High speed variations due to presence of NMT, small vehicles on highways.
- Presence of Motorized two wheelers and non motorized vehicles.

Speed variation on Highways in India

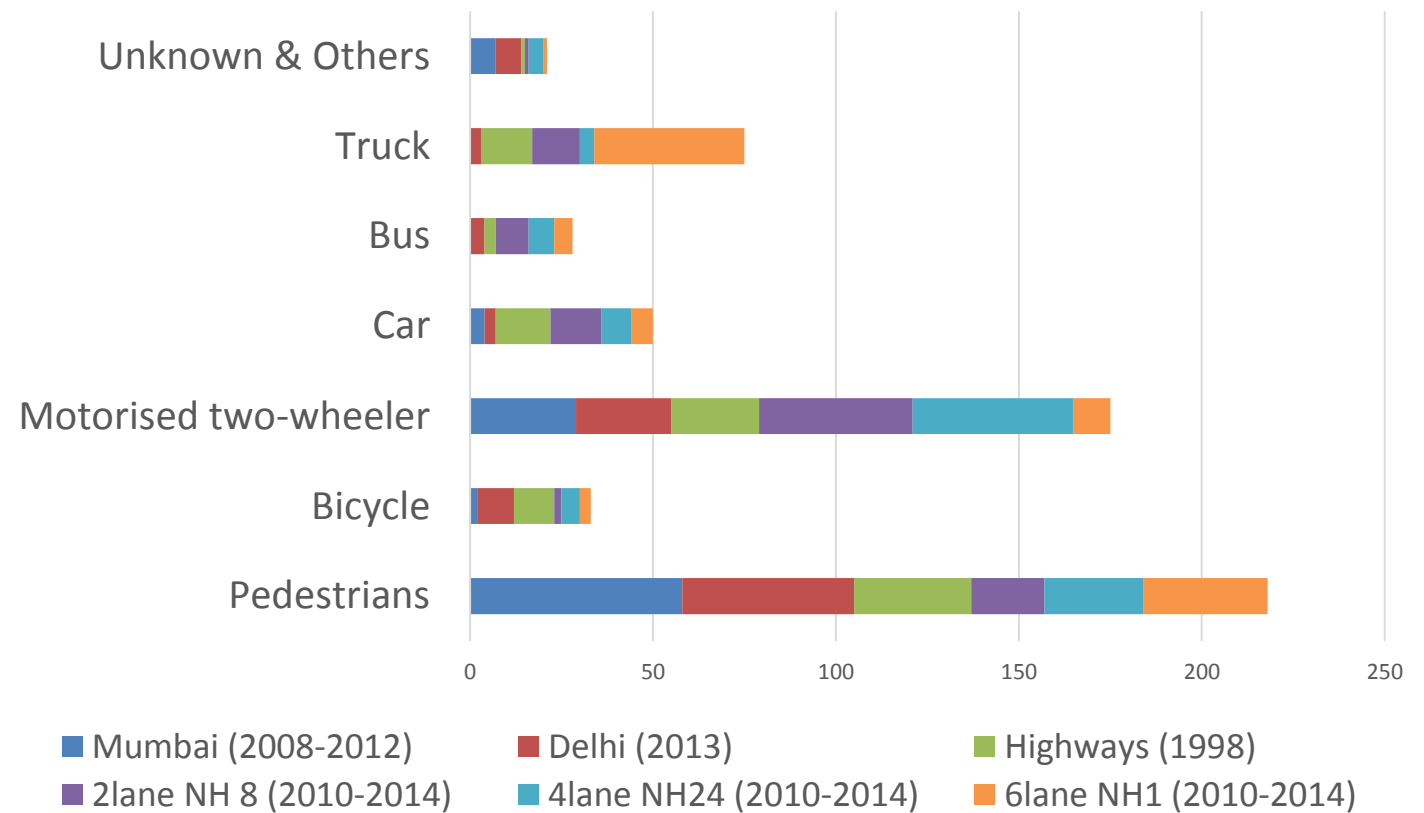


Share of different Travel modes present on highways



Traffic movement and crash patterns

- Proportion of pedestrians and MTW in fatalities 20-40%
- Highway shoulders used by parked vehicles, slow moving vehicles(tractors, bicycles, animal carts)
- Right most lane used by heavy vehicles
- Overtaking maneuver from passenger side



Scientific method/ evidence based interventions ?

- Fundamental vision or theory -drives what data should be collected and what should be evaluated.

if the theoretical understanding is that driver error causes traffic crashes & driver training can reduce traffic crashes; the data collection process focusses on driver related data and modelling impact of driver characteristics and knowledge about driving rules.

If the theoretical understanding is that driving behaviour is influenced by the road and traffic characteristics, then road geometry and traffic characteristics (operating speeds, traffic volume, type of vehicles) are modelled for controlling traffic crashes.

Safety Science and Traffic safety:

interdisciplinarity, problem-solving orientation and systems approach

Interdisciplinarity -a first necessary condition to deal with complex phenomena that exist in reality: such phenomena cannot be reduced to paradigmatic notions within one scientific domain. a decomposition of their complexity is a prerequisite for unravelling their control laws, properties, relations, variables and performance indicators.

Problem Orientation- achieving consensus on a common problem definition is considered a second prerequisite for a scientific approach of safety. Interdisciplinary discourses may result in controversies and rivalries, It also may lead to individual antagonism, defining minorities as dissenting voices in a homogeneous scientific community.

Systems Approach-facilitates in structuring a complex reality. A decomposition in elements, components, aspects and relations provides oversight and coherence across levels and entities that interact with each other; similar to a patient and the health system or a convict and the judicial system.

Traffic safety principles / the corner stones for developing safe highways in LMICs.

- Principle 1 Recognition of human frailty
- Principle 2 Acceptance of human error
- Principle 3 Creation of a forgiving environment and appropriate crash energy management.

Principle 1 and 2 must recognize that highways in LMICs will have presence of NMVs and pedestrians along with motorized traffic.

Principle 3 becomes the operational principle for setting appropriate speed limits for ensuring a forgiving environment for all road users.

Pedestrians will make mistakes in judging the possible risk in the system whereas, drivers can make mistakes in adopting an appropriate speed.

Safe Highway designs in LMICs / priorities

The design speed must be in line with the requirement of principle 3 “Creation of a forgiving environment and appropriate crash energy management”. This implies that for setting appropriate design speed, presence of NMVs, presence of activities along the highway, and density of built up area along the highway, frequency of towns and villages through which the highway passes must be taken into consideration.

Design speed may vary from 30 km/h to 90km/h with a road cross section designed for appropriate crash energy management depending on the surrounding landuse present along the highway.

Safe Highway designs in LMICs/priorities2

LMICs have weak institutional capacity, weak enforcement of legislations, therefore speed control by texture change, audible markers, rumble strips, change in geometric standards, median designs, lowering speeds at intersections by introducing roundabouts, raised stop lines and speed humps on minor roads are expected to be more successful in speed compliance by all road users-good drivers, bad drivers, young drivers, knowledgeable drivers, drivers with poor driving education etc. ensuring compliance with the principle 2.

most effective measure for speed compliance is by design: active speed control measures.



Conclusion/way forward

.....realization of vision zero also requires generation of new knowledge and establishing a process which enables generation of new knowledge to ensure safe highways in LMICs.

Given the complexity of traffic safety science and its implementation in field, ***continuous experimentation is required in LMICs to develop safe highways based on the principles of safe systems approach.***