

A Study on Bicycle Flow in Mixed Traffic – Indian Study

SESSION: PLANNING BASED ON STUDIES

THEME: URBAN PLANNING

PRESENTED BY: RAJAT RASTOGI, IIT ROORKEE, INDIA

Orientation of Presentation

Present Scenario

Guidelines

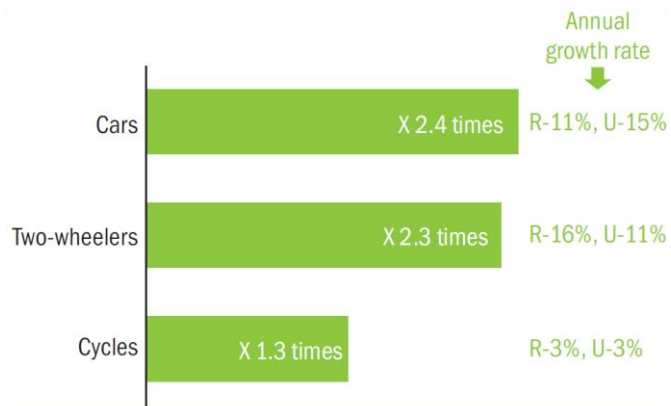
Government Initiatives

Bicycle flow analysis

Innovative practices

Present Scenario

Statistics show that the share of bicycle trips out of the total trips in Delhi has declined from 17% in 1981 to 7% in 1994. The longer trip lengths have made cycling more difficult.



Growth in number of households owning cars, two-wheelers and cycles between 2001 and 2011

Notes: R-Rural; U-Urban

Nearly 45% households, i.e., about 111 million households in India owned bicycles in 2011 (GoI 2011)

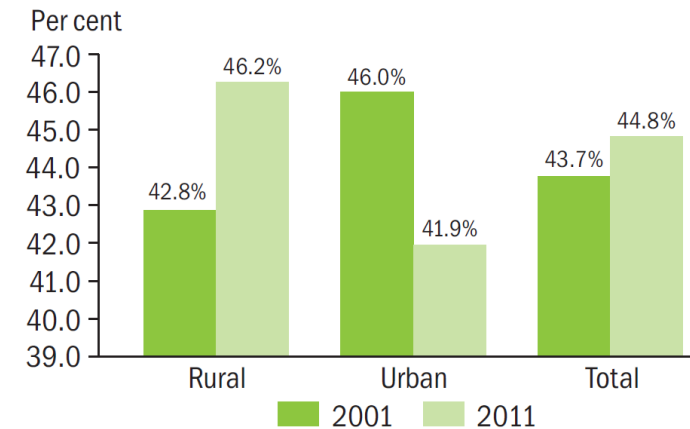


Figure 1.1: Percentage share of households owning cycles (2001-2011)

Source: GoI (2001) and GoI (2011).

Present Scenario



Sri Lanka May 2017

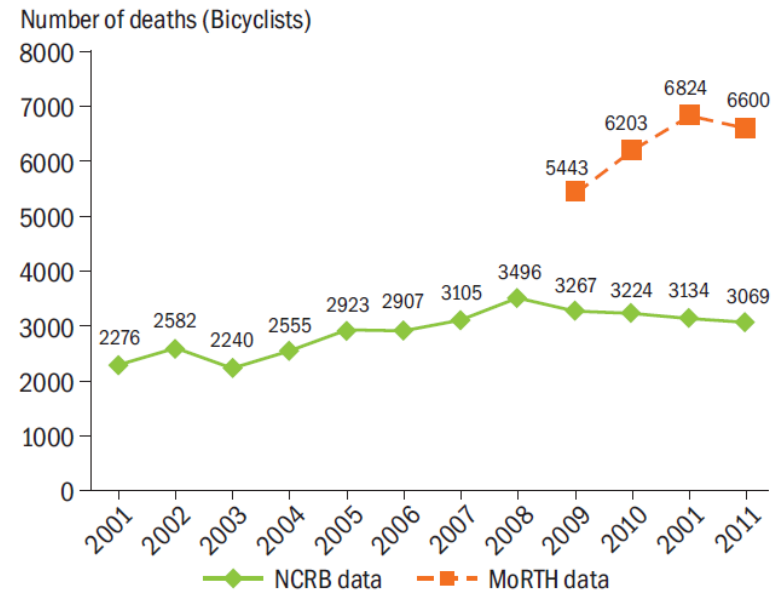


Figure 2.3: Number of cyclists' deaths in road accidents

Source: MoRTH (Various years), NCRB (Various years)
Note: MoRTH data on cyclists' deaths in road accidents was not available before 2009.

Issues Identified

Safety

- Equipment
- Personal
- Along route/path

Encroachments

Continuity and connectivity

Adequacy of facility size

Istanbul Feb 2015



Pune, India May 2017



Sri Lanka May 2017



Modal shares - MOUD 2008

1 Lakh = 0.10 million

City Category	Population	Walk	Cycle	Two wheeler	Public Transport	Car	IPT
Category 1a	<5 lakhs with plain terrain	34	3	26	5	27	5
Category 1b	<5 lakhs with hilly terrain	57	1	6	8	28	0
Category 2	5-10 lakhs	32	20	24	9	12	3
Category 3	10-20 lakhs	24	19	24	13	12	8
Category 4	20-40 lakhs	25	18	29	10	12	6
Category 5	40-80 lakhs	25	11	26	21	10	7
Category 6	>80 lakhs	22	8	9	44	10	7
National		28	11	16	27	13	6

Guidelines Available

Indian Roads Congress code IRC:11-1962 “Recommended Practice for The Design and Layout of Cycle Tracks”

Def.: A way or a part of a roadway designed and constructed for the use of pedal bicycles, and over which a right-of-way exists.

Warrant for separate cycle track:

- Peak hour cycle traffic ≥ 400 and motor vehicles 100 – 200/hr
- OR motor vehicles > 200 /hr and cycles 100/hr

Capacity values for 2, 3 and 4-lane with one-way and two-way traffic

Tracks – Parallel (adjoining/raised/free) or Independent

Geometrics – Lane width 1 m and track width 2 m (minimum)

Government Initiative(s)

National Urban Transport Policy - Vision

“Encourage greater use of public transport and nonmotorized modes by offering Central financial assistance for this purpose”

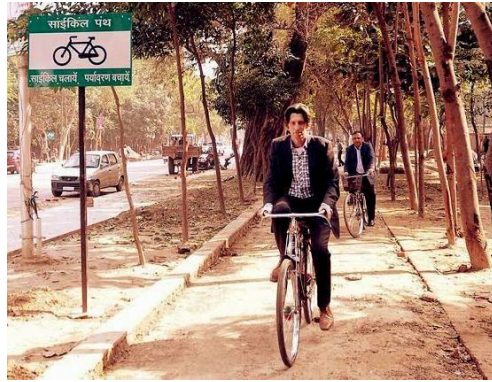
“Bringing about a more equitable allocation of road space with people, rather than vehicles, as its main focus”

Implementation -

The Central Government would also take up pilot projects, in a sample set of cities, to demonstrate the improvements that are possible through the enhanced use of cycling, for possible replication in other cities.

Government Initiative(s)

Cycle path network proposed in Lucknow, Uttar Pradesh State in India for a length of 270 km.



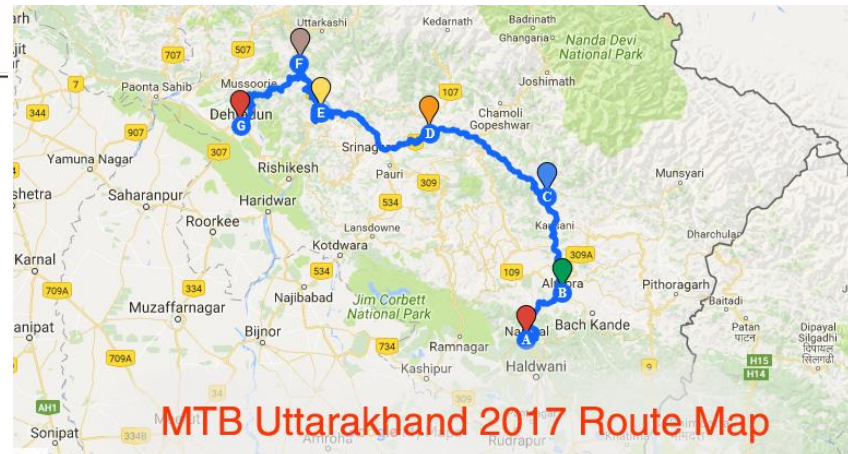
Noida and Greater Noida, Uttar Pradesh State having 65 km of bicycle network, increasing to 100 km, but very few users

207 km long cycle highway along Lucknow – Agra expressway



Government Initiative(s)

Department of Tourism, Govt. of Uttarakhand in association with Cycling Federation of India organized the 3rd edition of The Ultimate Uttarakhand Himalayan MTB Challenge, a premier mountain biking cycling event, from 8th to 16th April 2017 (884 km)



Case Study – Roorkee City, Uttarakhand, India

BICYCLE FLOW IN MIXED TRAFFIC CONDITION

Roorkee City



Roorkee City



NH section – Least Friction

New Urban section – Moderate Friction

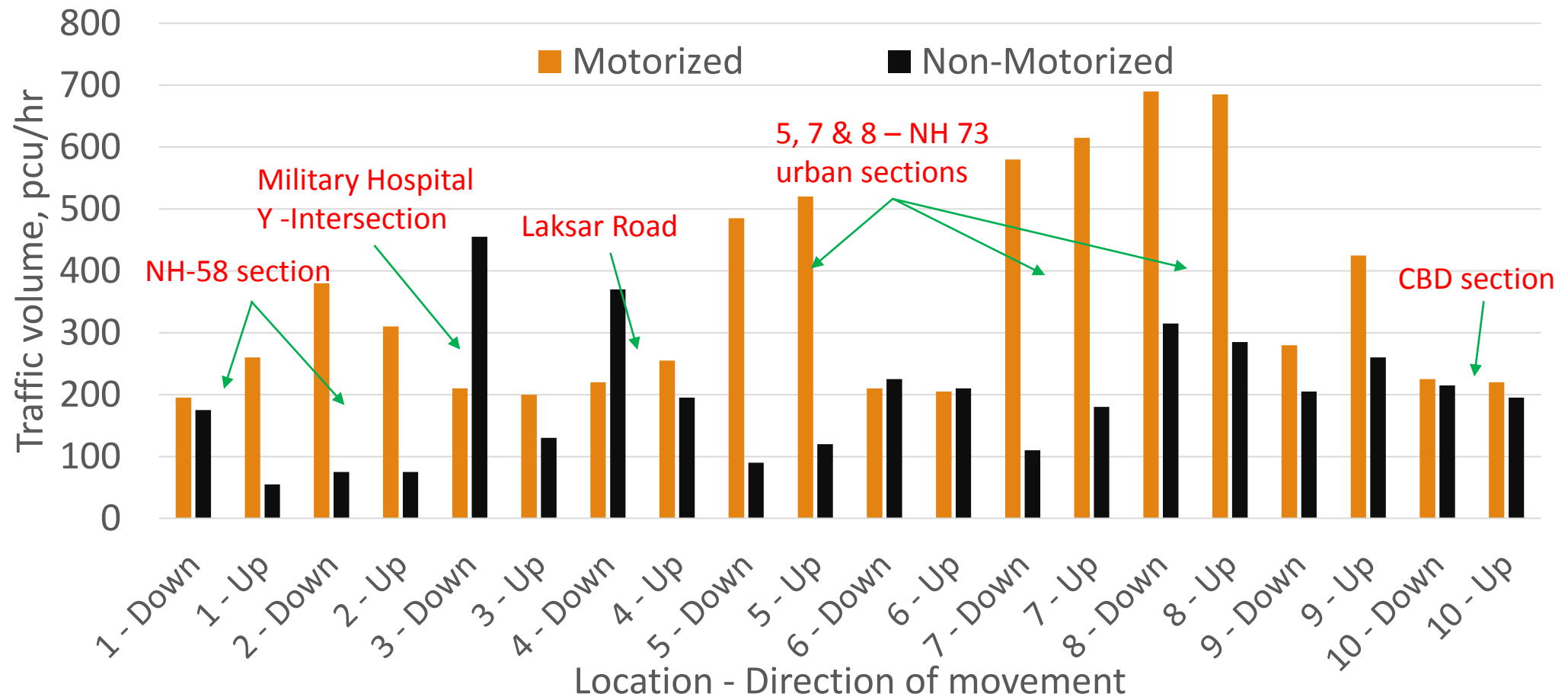


Old City section – Highest Friction



10 Locations

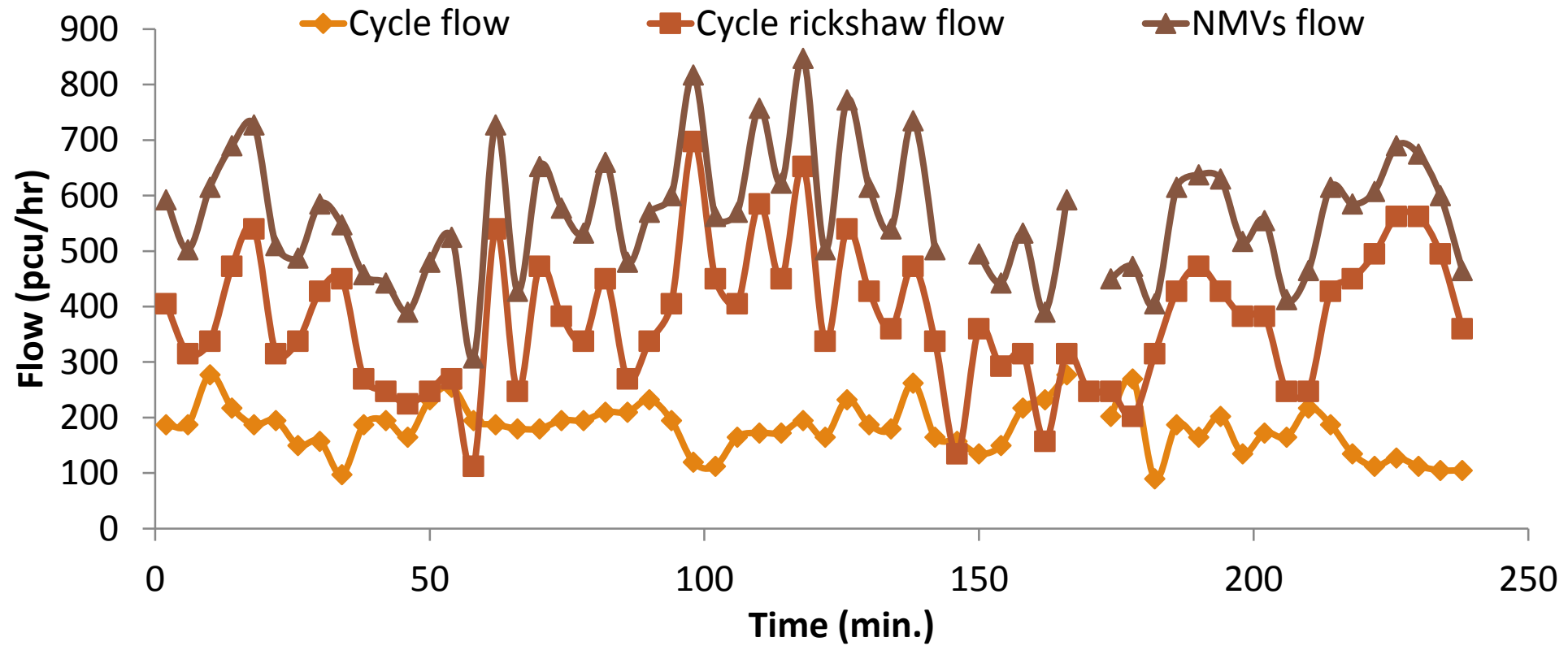
Down – Towards City
Up – From City



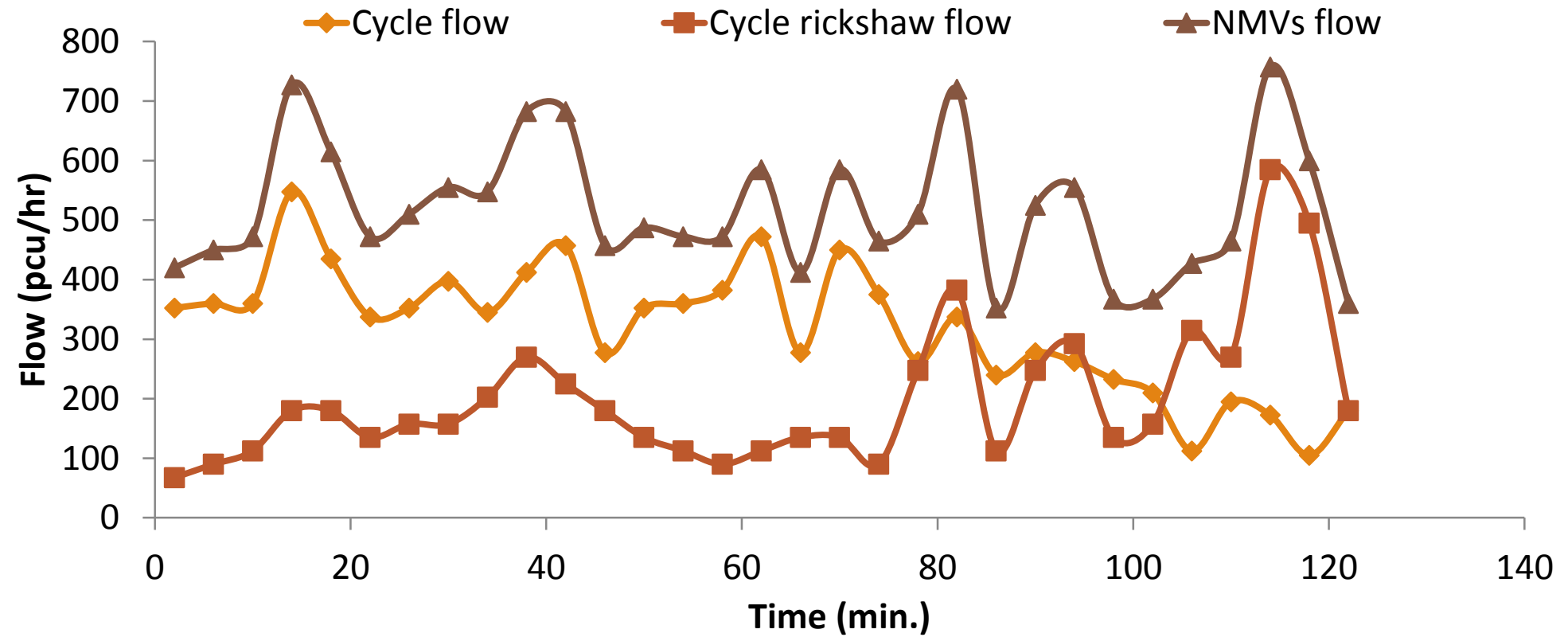
NMT Flows – Bicycle and Total

Location – Direction of traffic	Proportion of		Location – Direction of traffic	Proportion of	
	Bicycles	Non-motorized traffic		Bicycles	Non-motorized traffic
1 – Down	43.31	47.12	6 – Up	37.84	51.04
1 – Up	16.15	18.23	7 – Down	12.11	16.49
2 – Down	15.11	16.93	7 – Up	11.92	25.03
2 – Up	17.73	19.58	8 – Down	20.73	33.06
3 – Down	59.14	68.10	8 – Up	21.19	28.31
3 – Up	28.23	40.76	9 – Up	30.31	37.44
4 – Down	53.31	72.45	9 – Down	32.13	42.82
4 – Up	33.63	43.65	10 – Up	36.82	45.93
5 – Down	12.89	15.37	10 – Down	38.41	48.39
5 – Up	10.56	27.90			

Temporal Variations in Flow



Temporal Variations in Flow



Speed Variations across Locations (km/h)

Speed Data	Location S1	Location S2	Location S3
Sample Size	31	92	60
Maximum	19.87	14.71	10.2
Minimum	14.07	9.6	5.24
Range	5.79	5.11	4.96
Mean	16.79	12.59	8.88
Variance	1.77	.99	1.26
Std. Deviation	1.33	.99	1.12

Speed Prediction Models

Mean speed v/s proportion of traffic

$$S_{AVE} = 1837.42 - 18.239PNMT - 18.232PMT$$

Where, S_{AVE} = Mean Speed of bicycle (kmph)

PNMT = Proportion of Non-motorized traffic (%)

PMT = Proportion of Motorized traffic (%)

Speed Prediction Models

Mean speed v/s volume of motorized traffic

$$S_{AVE} = 15.18 - 0.0030VMT$$

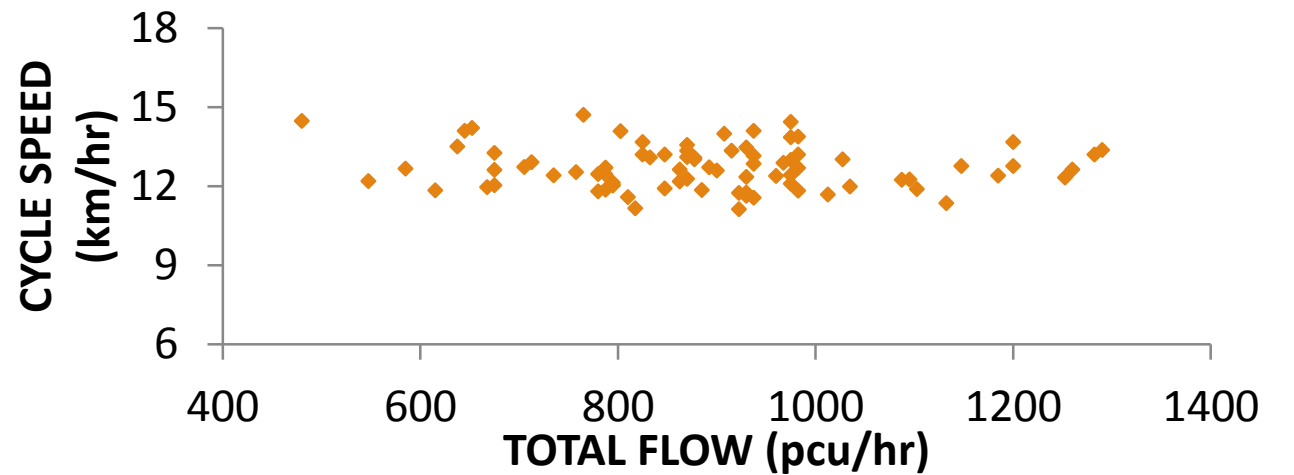
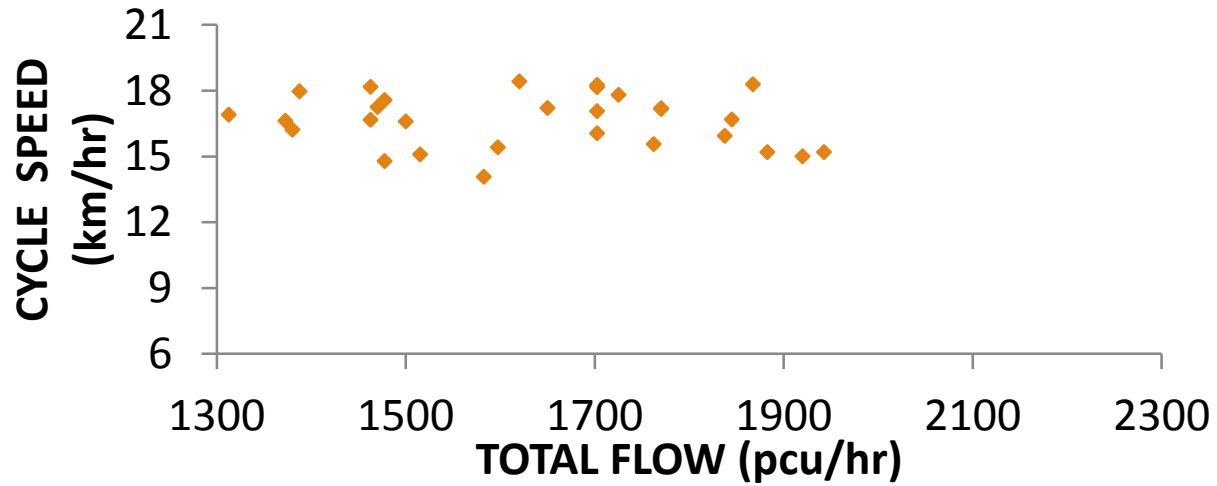
Where, VMT = Volume of Motorized vehicles (pcu/h)

Mean speed v/s categorised traffic volume

$$S_{AVE} = 16.61 - 0.0033VMT - 0.0066VNMT$$

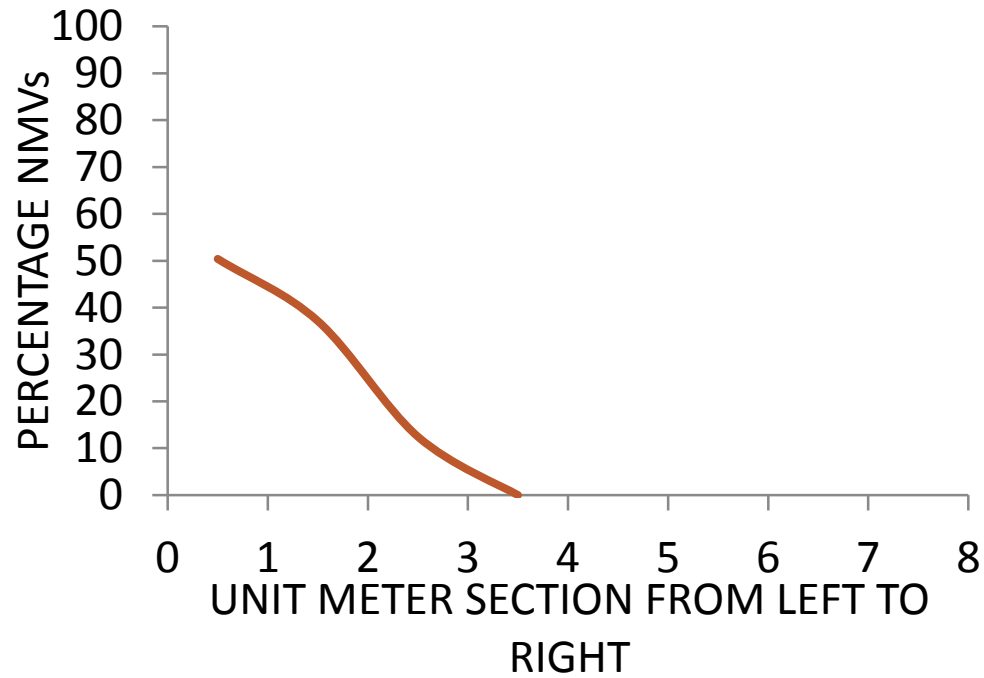
Where, VNMT = Volume of Non-motorized vehicles (pcu/h)

Speed v/s Flow Variations



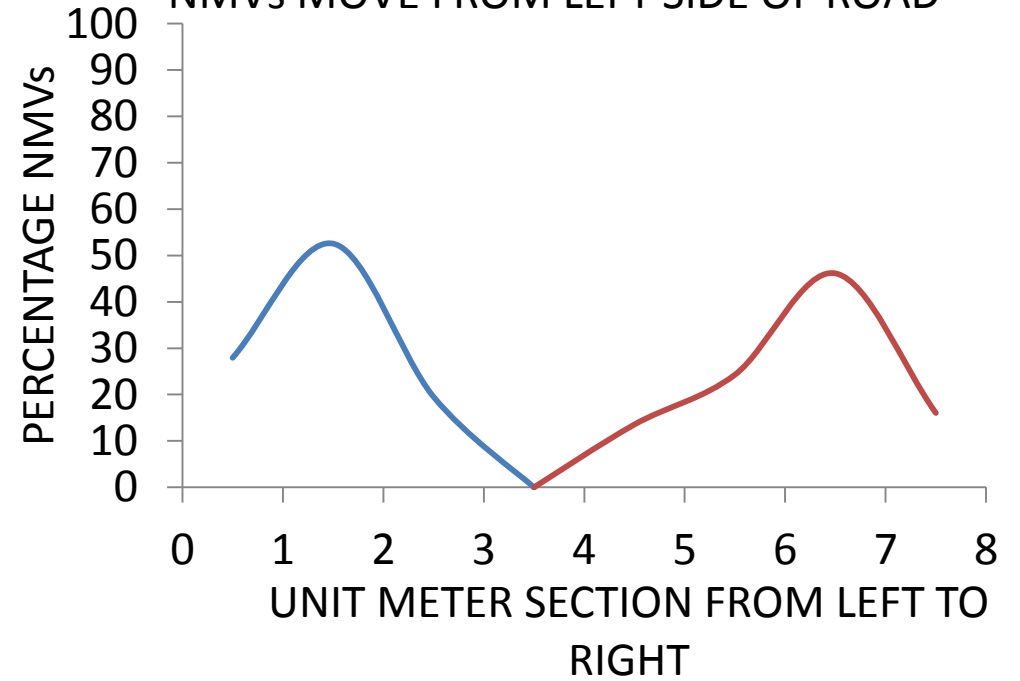
Lateral Placements

— NMVs MOVE FROM LEFT SIDE OF ROAD

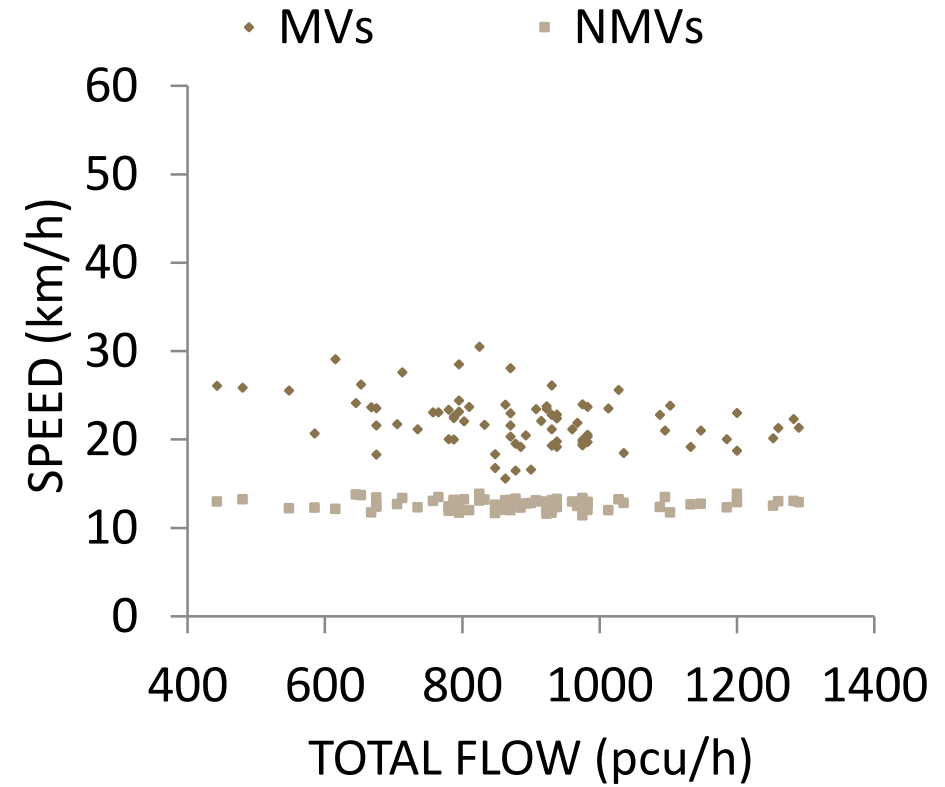
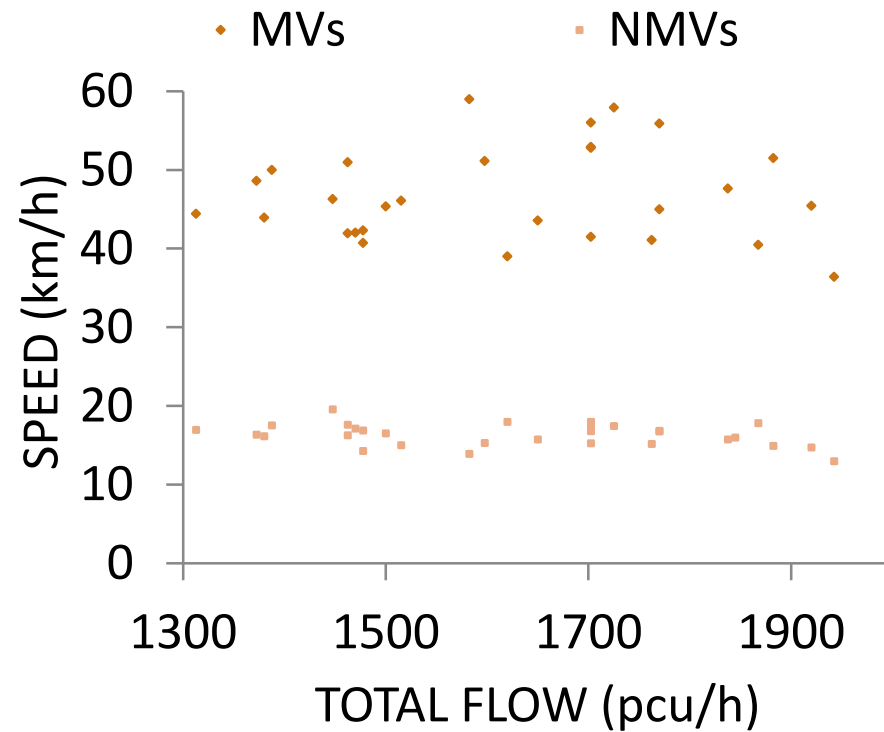


— NMVs MOVE FROM RIGHT SIDE OF ROAD

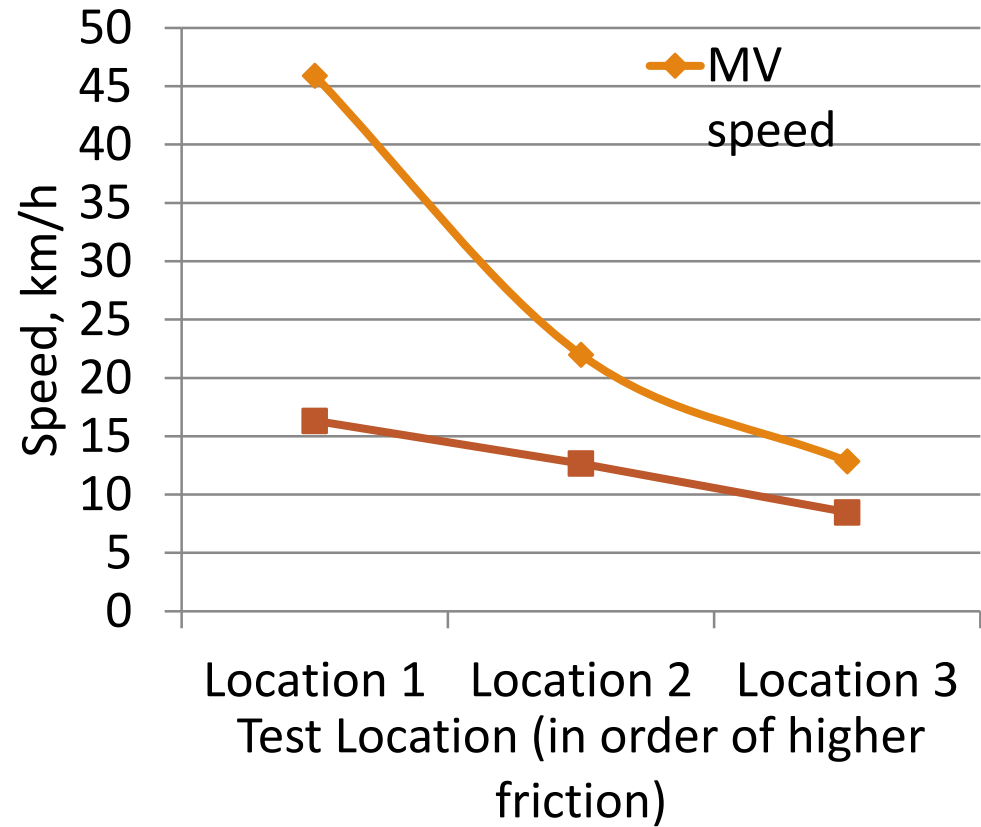
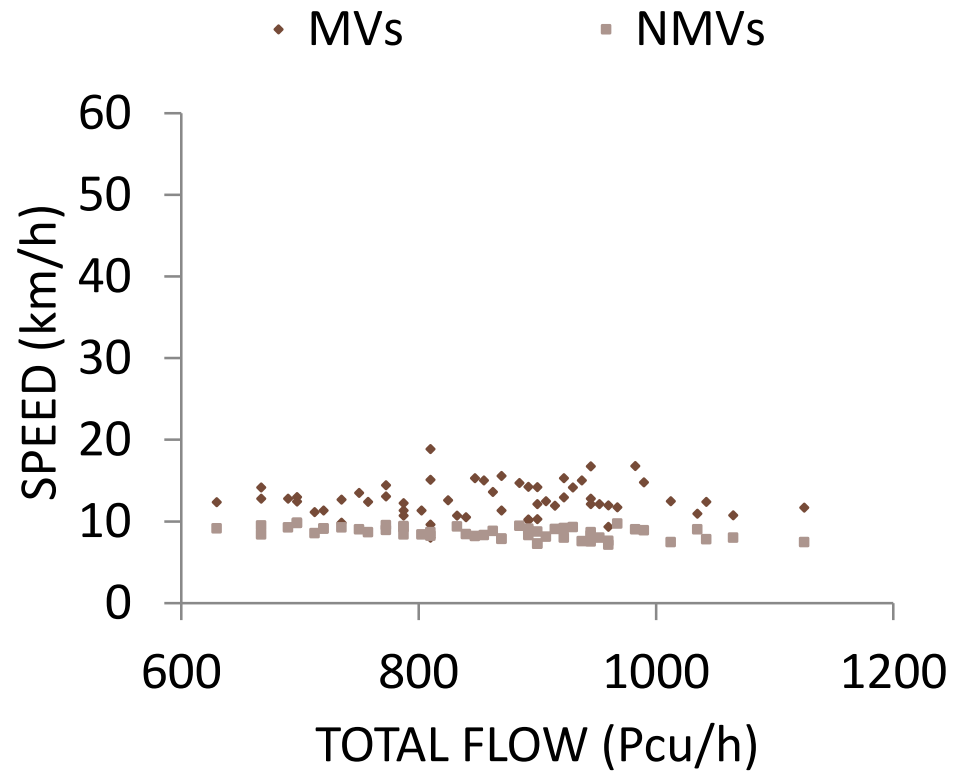
— NMVs MOVE FROM LEFT SIDE OF ROAD



Speed Impacted due to Mix



Speed Impacted due to Mix



Innovative Practices



“Cycle Chalao!” was a private initiative for a cycle sharing scheme started in Pune in 2010

“Green Bike” was another initiative planned by the Delhi Integrated Multi-Modal Transit System (DIMTS) Limited

MyBike – Bike share programme in Ahmedabad

Raahgiri Day, India's first sustained car-free event, launched about two years ago in the city of Gurgaon



Questions Remained Un-answered

How to arrive at **Design Flow Value**, when flow characteristic relationships are non-conclusive?

Are **warrants specified** in guidelines not influenced by temporal and spatial variations?

What shall be the **hierarchy for bicycle facilities** and how to plan/decide for the same?

Does one attach **Level-of-Service** to facilities designed and constructed?