



# How to Keep Balance Between Green and Safety for E-bike

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# E-Bike and Scooter

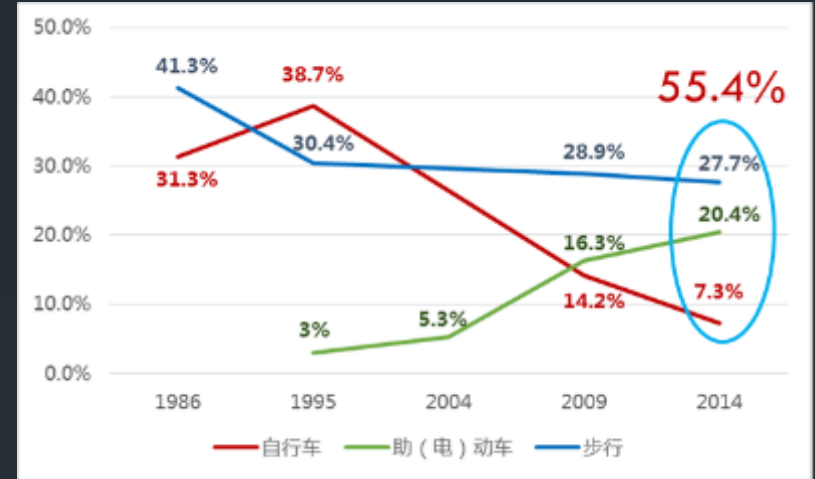
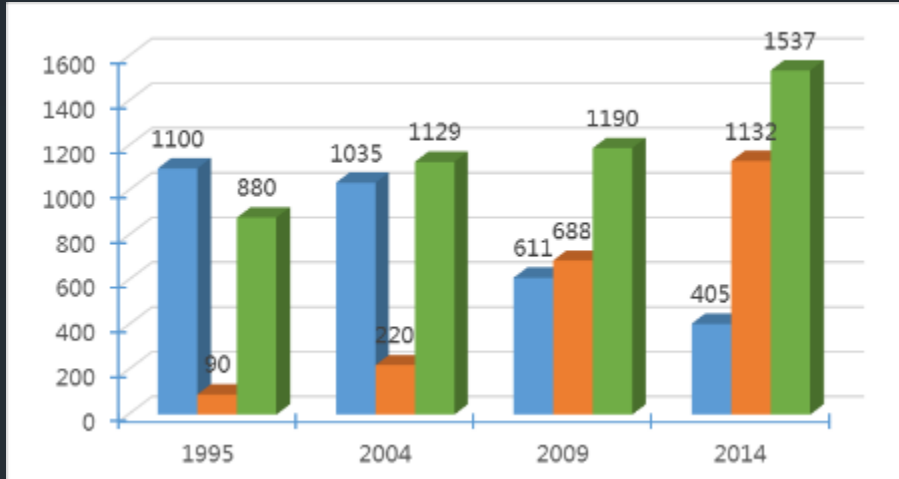
- What is the non-motorized transportation or bicycle?
  - E-bike, Scooter, Traditional bicycle sharing the bicycle lane
  - The maximum speed of E-bike and Scooter driving on the bike line should be below 20km/h and weight is less than 40kg, according to the traffic regulation
- The traveling speed of E-bike and Scooter is 2 times faster than bicycles

# E-Bike and Scooter



Indicator	Bicycle	Bicycle Style Electric Bicycle	Scooter Style Electric Bicycle
Length (cm)	170-190	150-180	160-190
Width (cm)	50-60	40-50	60-70
Height (cm)	70	60	110
<b>Speed (km/h)</b>	<b>10-15</b>	<b>15-25</b>	<b>20-40</b>

# Ownership and usage is booming

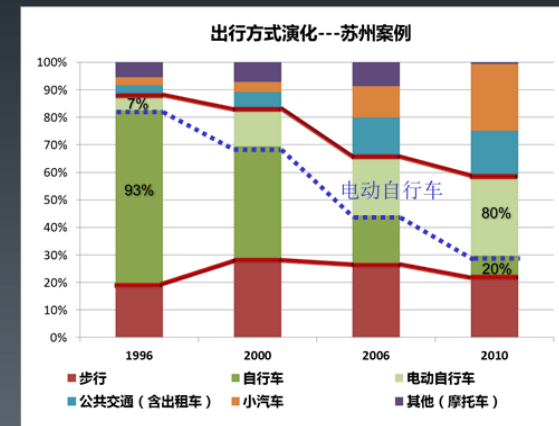
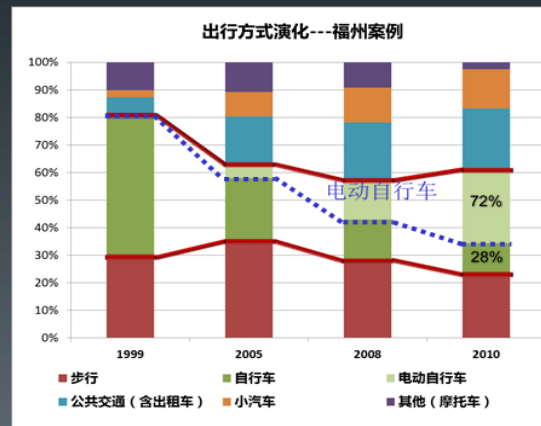
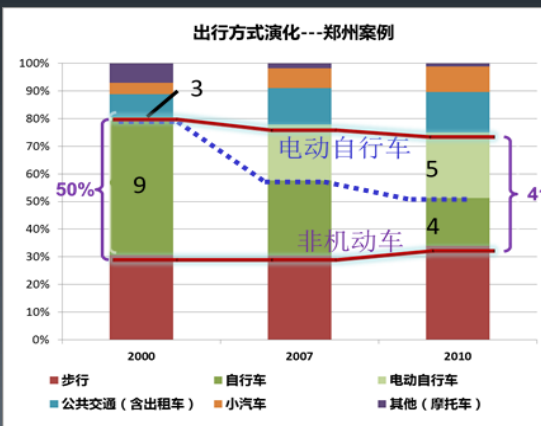
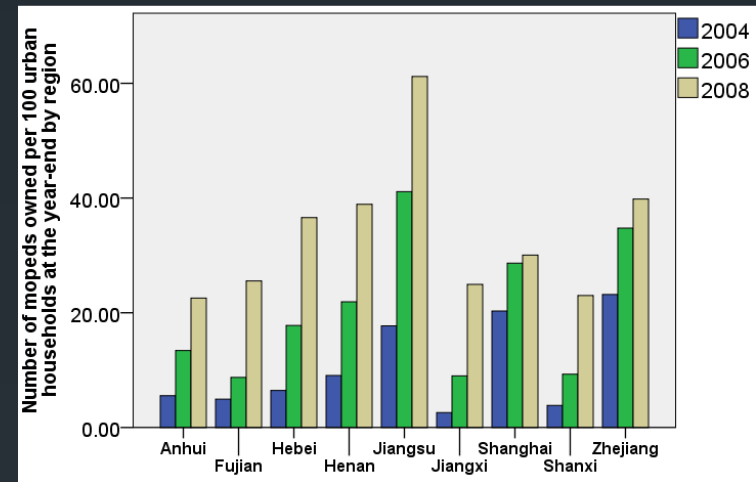
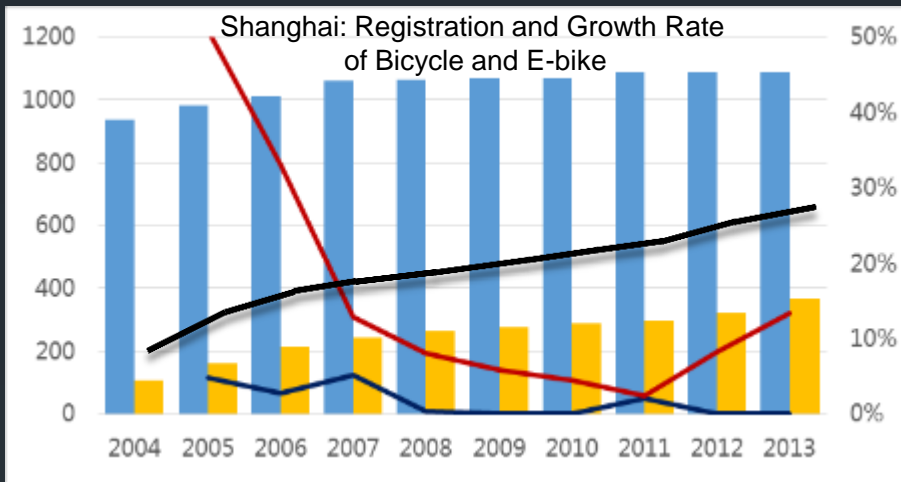


Trips/day (10,000) and mode share in Shanghai  
Blue: Bike Orange: Walking Green: E-bike

- 6-7 millions E-bike and 10 millions bicycle for 25 millions people in Shanghai. Only 40% bicycle is active.
- 1995 -2014, the share rate of bicycle in trip mode declines from 39% to 7.3%, the E-bike rises from 3% to 20.%, located in top 1.

# Ownership and usage is booming

- E-bike shares the bicycle lane with the bicycles, its traveling speed is almost double

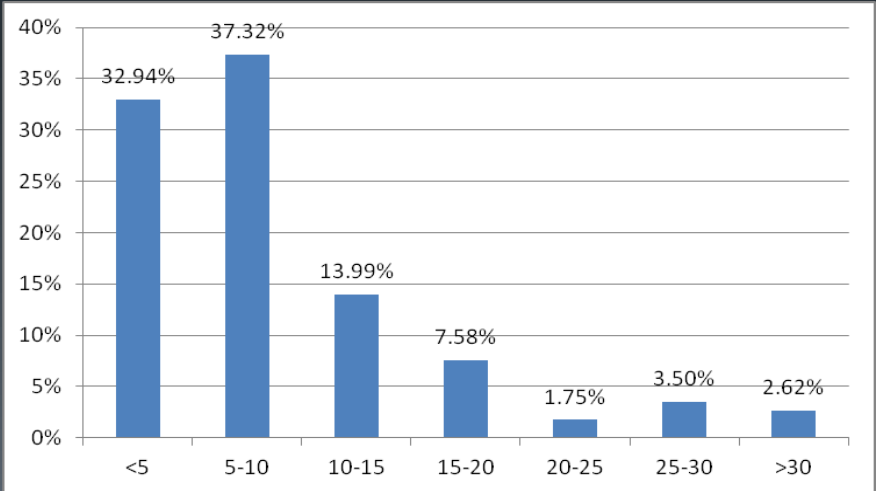


# Distribution of Trip purpose and distance

- Commuting by E-bike is owner's main purpose. There is a higher share rate for commuting than the all purpose travel. In addition, there are often 1-3 other purposes trip a day.
- The average trip distance of E-bike is 4.1km, 24 minutes. The travel speed from door to door is 10.25km/h, higher than the bus's 9.1km/h.

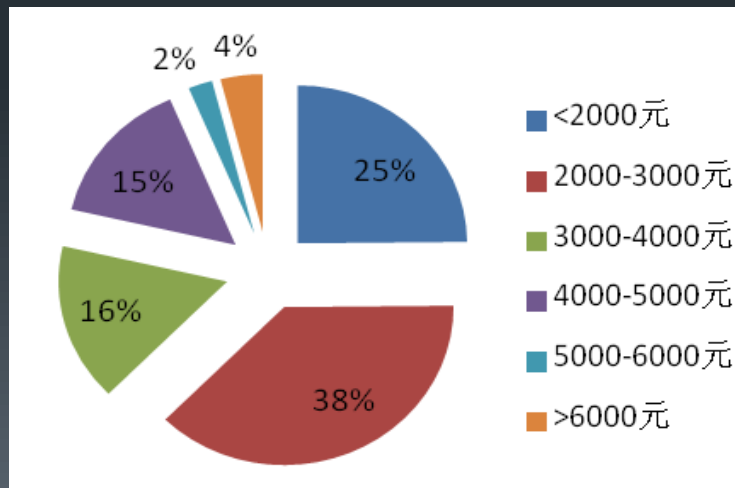
## Trip distribution of E-bike

Trip distance	Range of trips		
	E-bike	Car	Rail
0-8km	1		
8-11km	2	1	
> 11km	3	1	2



# Who is the users?

- Most of the user belongs to middle to lower-income class. When Shanghai average Monthly wage was 4331 RMB in 2011, 79% users' monthly income below 4,000 RMB. There is a higher proportion for newcomer than the permanent residence.
- About 100 thousands employee use E-bike as logistics last-miles every day .



Income of the owner





# Is E-Bike and Scooter green?

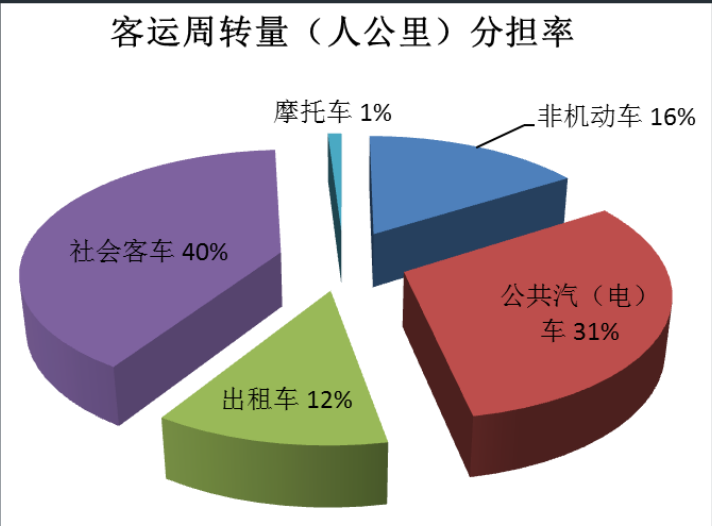
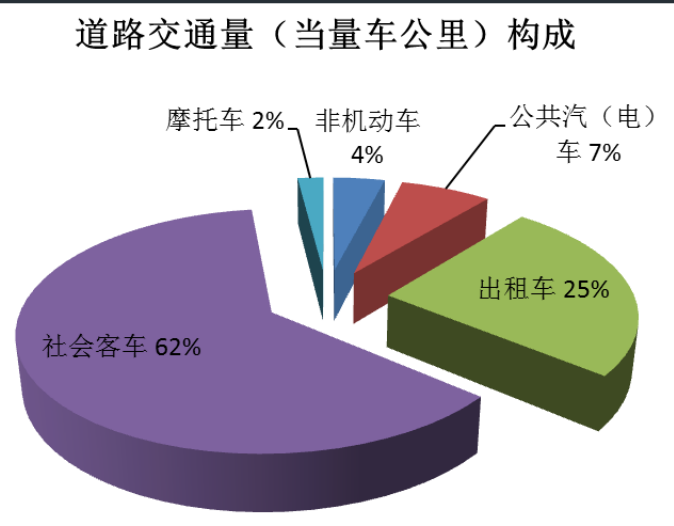
- Green : Environment friendly, Low carbon emission, Ecological, Healthy
- Clean: zero-emission during running and the batteries are retrieved.
- Economic: E-bike is a cheap transport tool that is affordable almost for everyone especially for short-term workers. City's newcomers and lower income people are the main users of E-bike, 80% get income below the average wage. A daily cost equals a bus ticket.
- Efficiency for road occupancy and parking.



# Efficiency of road utilization

- Taking Shanghai as an example, no any road was extended for E-bike and no congestion occurred in bicycle lanes, even though from 1986 to 2014 the total trips by E-bike and bicycle doubled.

Occupancy: Car : Taxi : Motor : E-bike : Bus =  
1 : 0.75 : 0.78 : 6.2 : 6.9



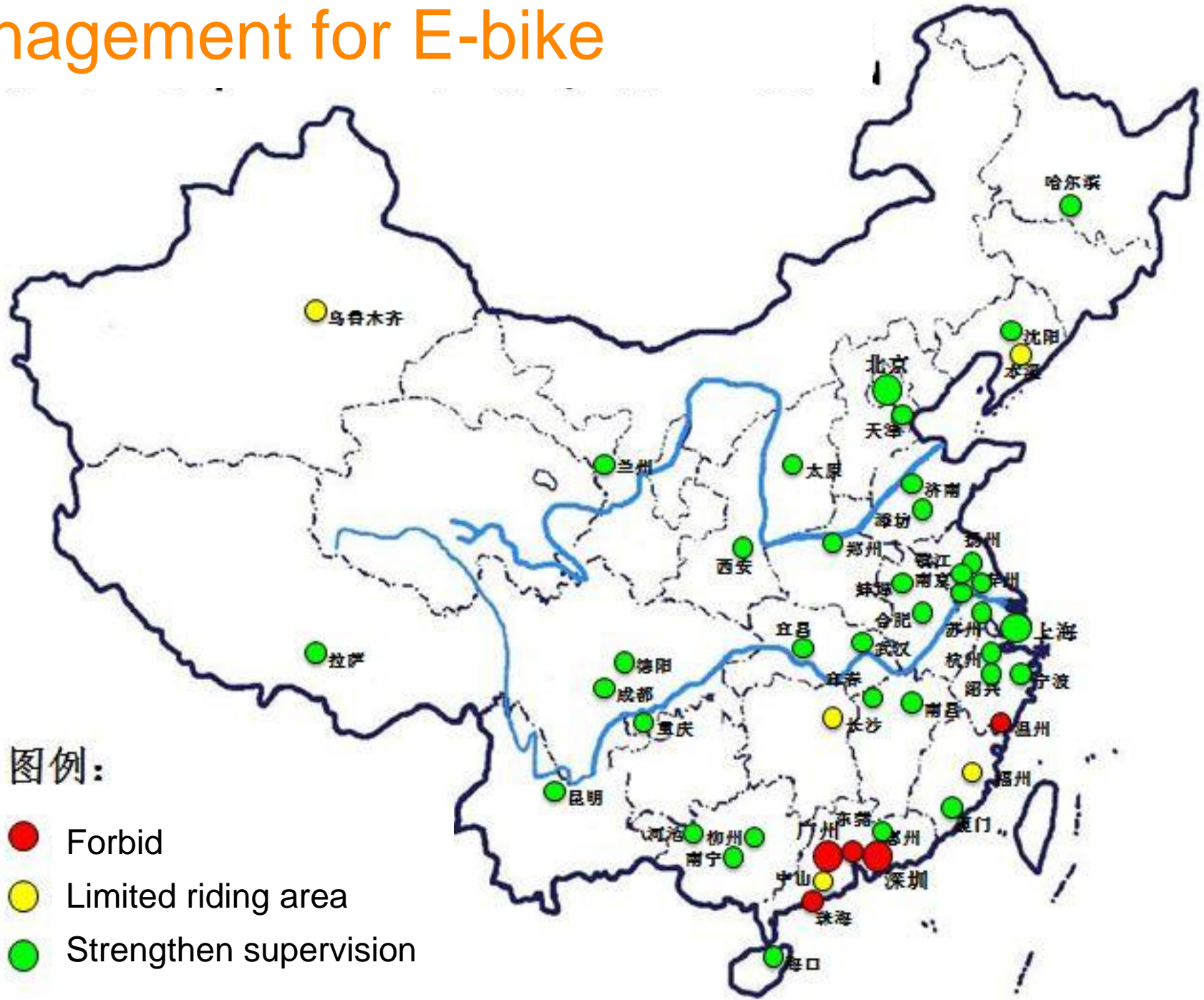
VMT .vs. PKM blue is (E) bicycle



# Is E-Bike and Scooter safe?

- E-bike is a challenge for city planners and environmentalists
- With rapid growth of E-bike, the bike lane is occupied by E-bike and the utilization of bicycles on the road drops sharply. The observation on bike lanes of several arterial roads in Shanghai shows that the proportions of E-bike are 55%~85%.
- Shared lane space and speed difference create more conflicts and risk, and bring unsafe feelings to the bicycle riders. This is why some cities limit or forbid E-bike.

# Management for E-bike

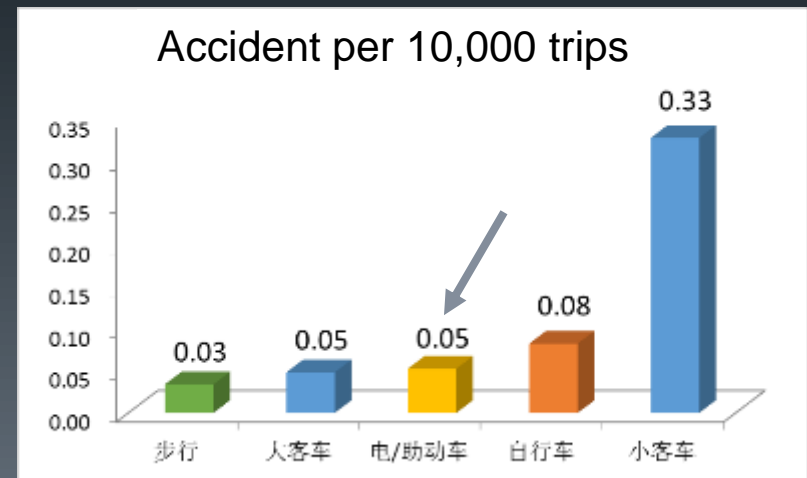
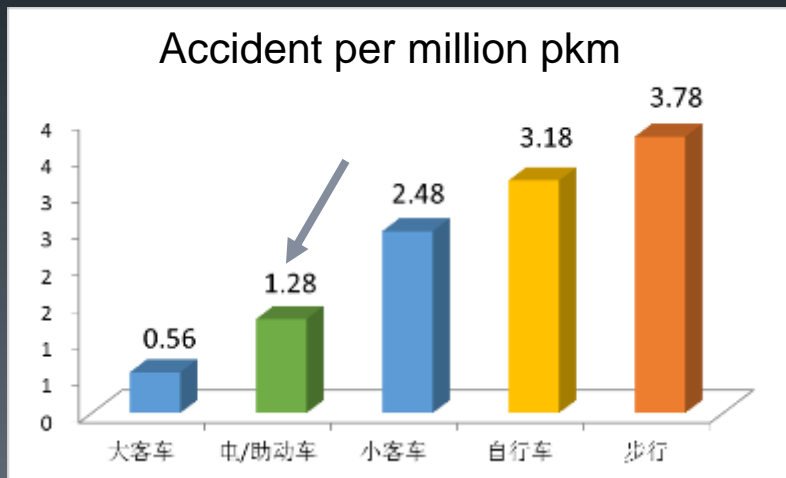


图例:

- Forbid
- Limited riding area
- Strengthen supervision

# Is E-Bike and Scooter safe?

- E-bike involves approximately 20% of the traffic accidents, 2/3 of which could be attributed to E-bike.
- Frequency of the accident
  - Based on PKT : E-bike < Car < Bicycle < Walking
  - Based on trips : Walking < E-bike < Bicycle < Car



# Accident reason of E-bike

- Severity of the accidents: The number of persons injured

**Bicycle < Walking < E-bike**

( 1.06 ) ( 1.07 ) ( 1.19 )

- Most of E-bike runs faster than the speed limit by replacing the battery. The passing events between E-bike and bicycles occur frequently, traffic conflicts and safety risk are increased.

Observation Sites	Vehicle Type	Number of Observations	Mean (km/h)	Minimum (km/h)	Maximum (km/h)	Range (km/h)	Std. Deviation	Level of Sig.
Middle Yanggao Rd.	Bicycle	63	12.70	8.02	21.69	13.67	2.84	0.654
	Moped	62	24.36	16.71	32.09	15.38	3.63	0.638
Wuning Rd.	Bicycle	44	13.58	8.86	19.60	10.74	2.32	0.431
	Moped	69	23.37	14.67	33.68	19.01	4.10	0.645

Observation Site	Volume (vehicle/h)	Moped percentage (%)	Data collection period (h)	Number of passing events				Male rider passing events percentage (%)
				Total	M-B	M-M	B-B	
Middle Yanggao Rd.	677	56	3	150	87	42	21	80.0
Wuning Rd.	2400	82	1.5	294	204	72	18	79.9

# Accident reason of E-bike

- Enforcement: the driver is not required to obtain a license and most of E-bike does not have plates. It is very difficult for the police to put them under effective management, which leads to very common regulation violation.
- Education: more than half rider of E-bike is the newcomer for the city. They didn't enough knowledge about traffic regulation., and no good access to adequate training and education.

## The distribution of E-bike accident 2006-2011

Type of accident	autos	bicycle	pedestrian	others
Number of accident	3141	246	348	417

Accident reason	Number of accident	Proportion
Violation of traffic signal	311	18%r
Violation of giving way	303	18%
Illegal reversed riding	222	13%
Riding on vehicle lane	207	12%



# Conclusion

- E-bike is economic, efficient, clean and convenient, though it indeed brings more traffic conflicts and traffic safety risk.
- A transport system with equality and tolerance needs to improve the existing traffic regulations and road design, to establish an institution that could effectively manage E-bike and its driver
- Build up a wide safety education network to improve the educational level of the E-bike users including better understanding of the traffic rules and regulations.