

AfroSAFE 2024 | 13–14 June 2024, Tanzania

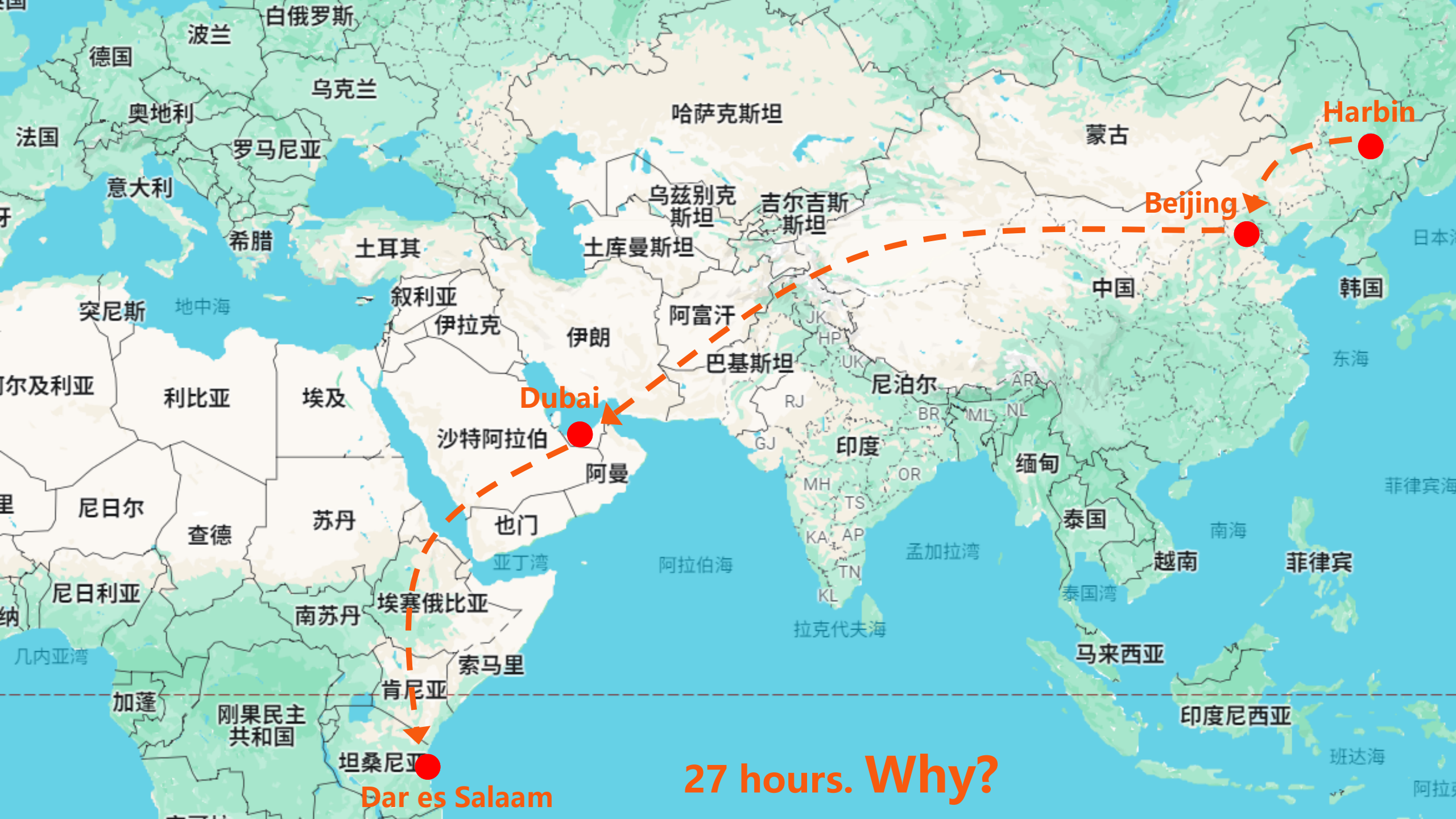
Lessons learned from characteristics of extraordinarily severe traffic crashes in China, 2004-2019

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Harbin

Beijing

Dubai

Dar es Salaam

27 hours. Why?



三人行
必有我师焉。

- 《论语·学而》



When I walk along with two others, they may serve me as my teacher.

1. Introduction

Introduction

□ Remarkable achievements



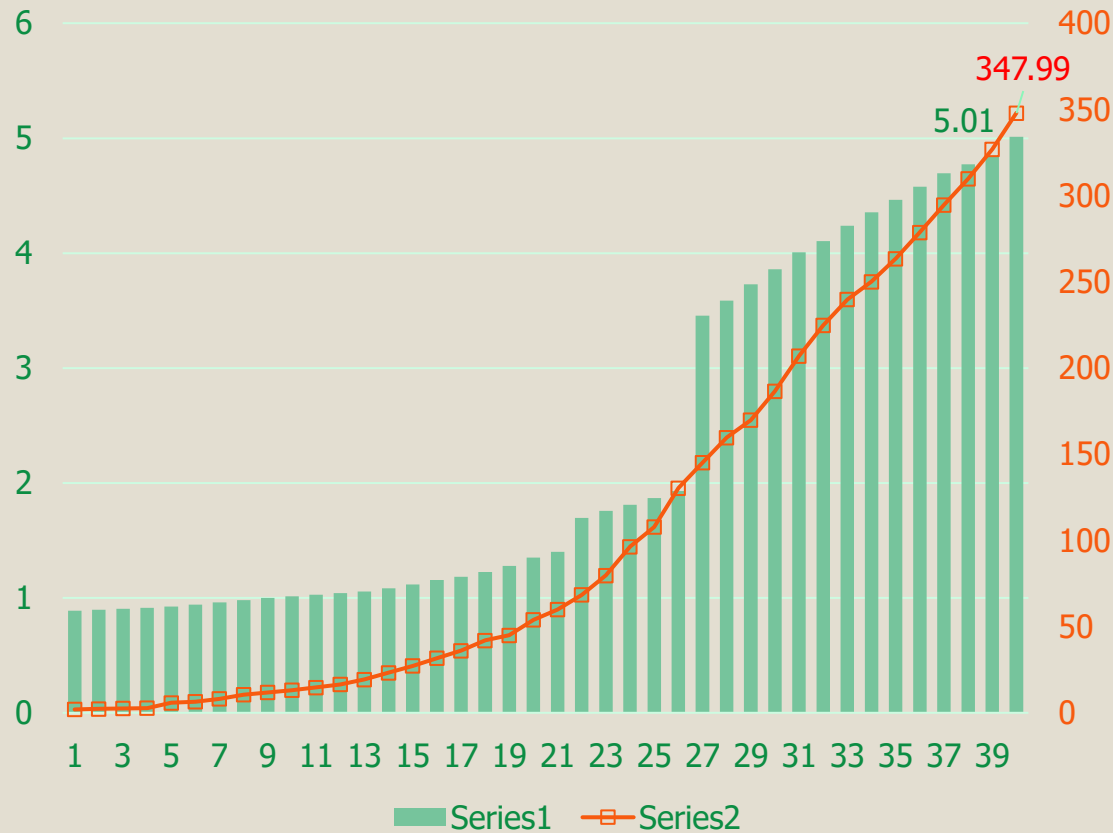
Rural two-lane highway



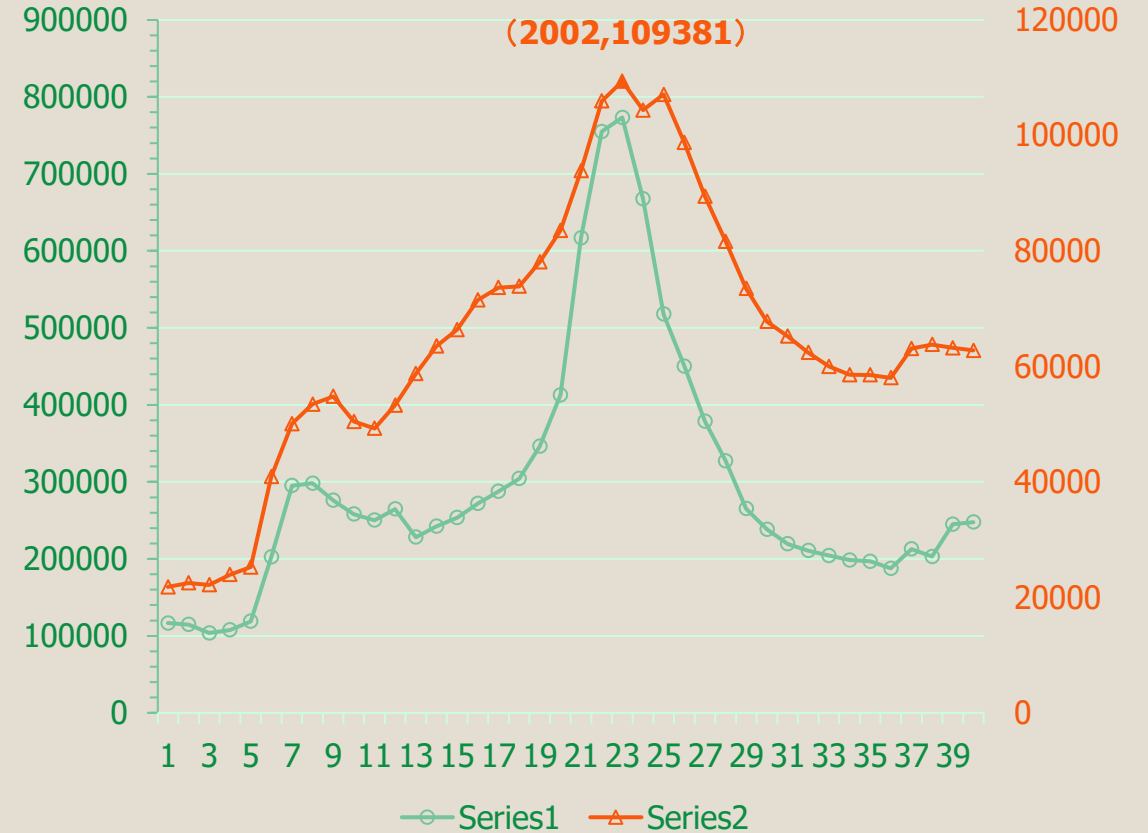
Rural highway in mountainous area

Introduction

Remarkable achievements & great safety concern



Highway mileage and motor vehicle parc(1980-2019)

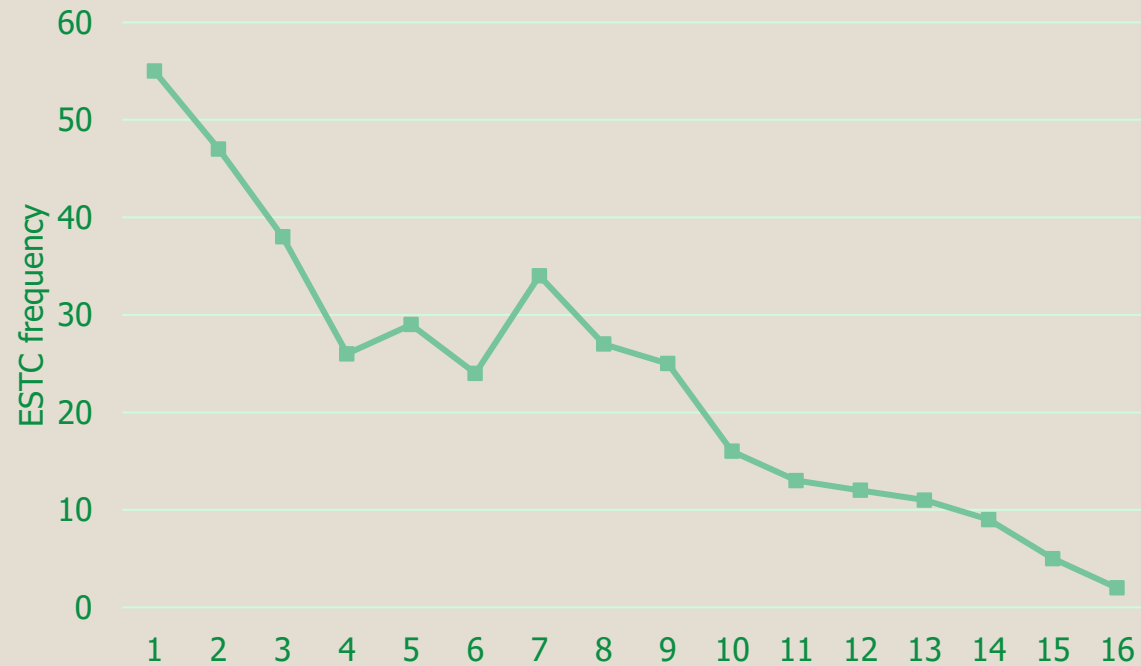


Schematic diagram of road crash(1980-2019)

Introduction

□ Why do we focus on ESTCs ?

Extraordinarily severe traffic crashes (ESTCs) cause **more than 10 deaths** each crash.



Introduction

□ Why do we focus on ESTCs ?

Date	Time	City	Description	Deaths	Injuries
2020-4-15	05:30	Songyuan City, Jilin	A passenger car scratched the other passenger car in the opposite lane at first, and then collided with a small truck that illegally carried 15 passengers . The small truck was on fire after the collision.	12	4
2020-10-4	05:30	Songyuan City, Jilin	A small truck rear ended a farm tractor at first, and then run into the opposite lane and collided with the other small truck that illegally carried 16 passengers .	18	1
2020-11-27	16:48	Putian City, Fujian	A concrete mixer rear ended a three wheeled cargo motorcycle that allows 1 passenger only but carried 16 passengers .	11	5



4·15 ESTC



10·4 ESTC



11·27 ESTC

Horrific traffic accident kills 13, injures 18 more in Tanzania's Mbeya region

Wednesday, June 05, 2024



Scene of vehicles that collided on the Simike slope in the Mbembela area of Mbeya City, causing 13 deaths and 18 injuries. PHOTO / SADDAM SADICK



Introduction

□ Objectives

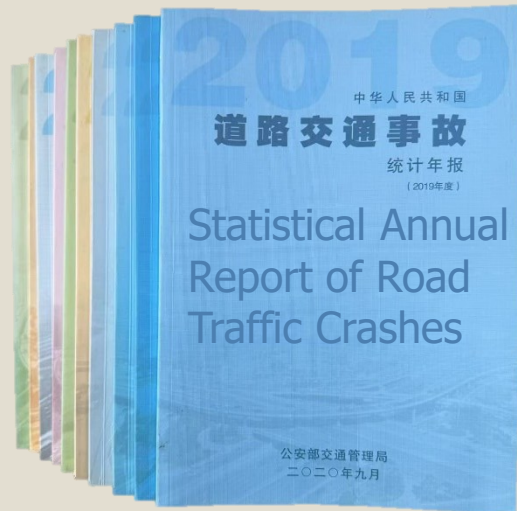
- What are the common characteristics and characteristic patterns of ESTCs in China?
- What have changed in crash characteristics of ESTCs over time?
- What have caused the changes?

2. Data

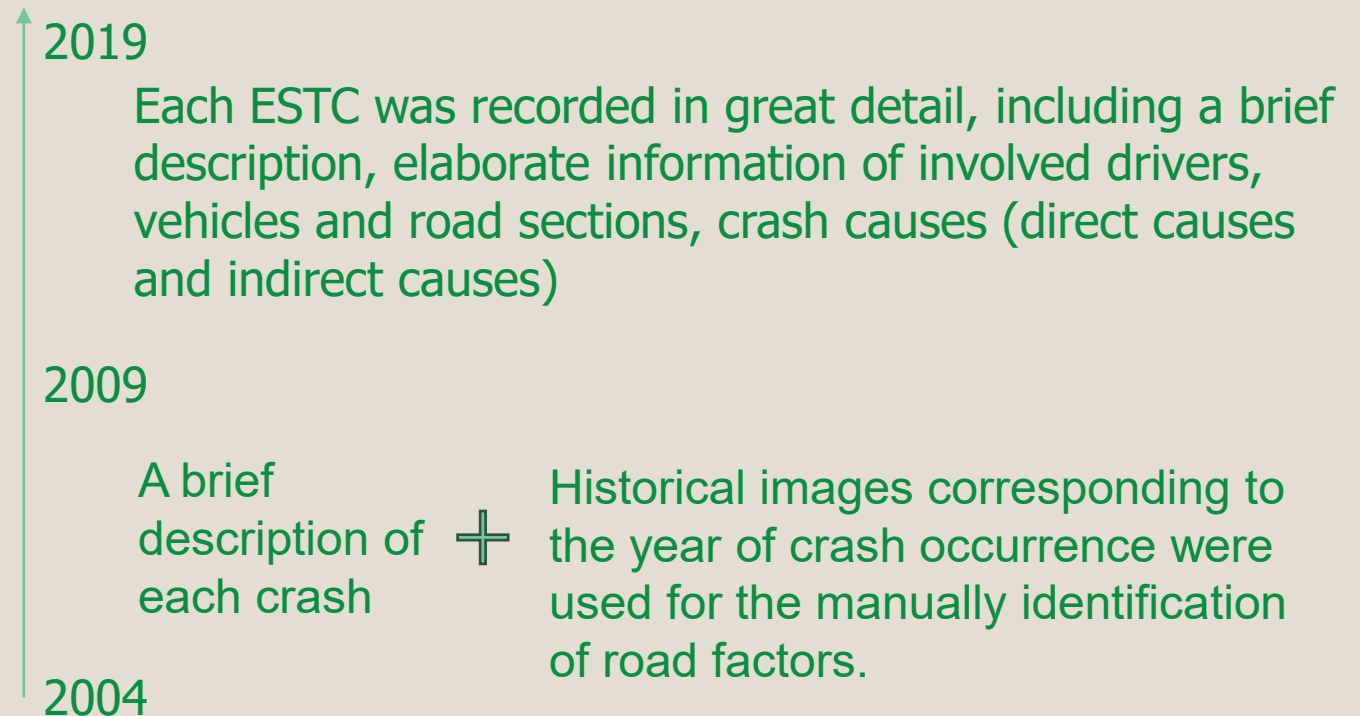
Data

□ Data source

The data were collected from *Statistical Annual Report of Road Traffic Crashes* published by the Bureau of Traffic Management of the Ministry of Public Security of People's Republic of China.



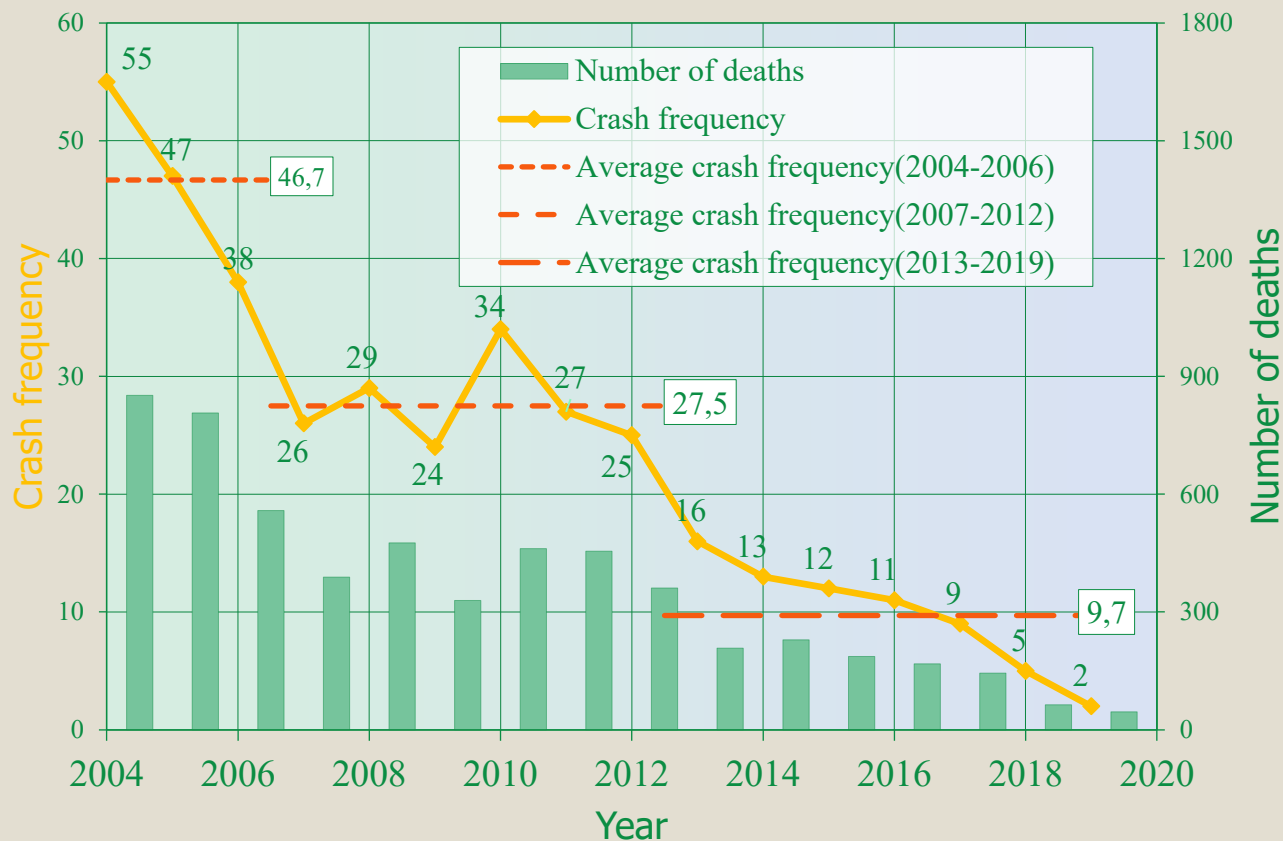
ESTC data from 2004 to 2019 in China



Data

□ Data processing and coding

From 2004 to 2019, a total of 373 ESTCs were recorded in the annual reports, which in total result in 5,734 deaths.



Period I from 2004 to 2006: the crash frequencies were at the high level but declining.

Period II from 2007 to 2012: the crash frequencies were fluctuating at the medium level.

Period III from 2013 to 2019: the crash frequencies were at the relatively low level and declining.

□ Data processing and coding

65 categories were obtained for the 11 characteristics

Factor	Characteristic	Category
Driver factors	Driver status	Normal status(NS), Not qualified(NQ), Fatigue driving(FD), Alcohol driving(AD), Distracted driving(DD), Other status(OS)
	Driver violation	Speeding(SD), Illegal overtaking(IO), Improper driving(ID), Wrong lane driving(WLD), Illegal manned(IM), Other violations(OV), Unknown behavior(UB), Improper driving & Illegal manned(IM), Improper driving & Wrong lane driving(ID&WLD), Speeding & Illegal manned(SD&IM), Speeding & Illegal overtaking(SD&IO), Speeding & Improper driving(SD&ID), Speeding & Wrong lane driving(SD&WLD)
Road factors	Road type	Freeway(FWY), Class I highway(I), Class II highway (II), Class III highway (III), Class IV highway(IV), Substandard highway(V)
	Road alignment	Straight(S), Curve(C), Sloped(SL), Curve & Slope(C&SL)
Vehicle factors	Vehicle type	Passenger car(PC), Medium bus(MB), Large bus(LB), Small truck(ST), Medium truck(MT), Large truck(LT), Other types(OT)
	Vehicle condition	Normal condition(NC), Overload(OL), Nonstandard(NSD), Mechanical failure(MF), Poor braking(PB), Other conditions(OC), Overload & Nonstandard(OL&NSD), Overload & Mechanical failure(OL&MF), Overload & Poor braking(OL&PB)
Environment factors	Time of day	Early morning 00:00-05:00 (EM), Morning 05:00-12:00(MRN), Afternoon 12:00-19:00(ATN), Night 19:00-24:00(NIT)
	Day of week	Weekday(WKD), Weekend(WKND)
	Weather	Clear(CR), Rain(RN), Snow(SW), Fog(FG)
Other factors	Crash type	Head on(HO), Rear end(RE), Right angle(RA), Run off road(RoR), Sideswipe(SS), Turnover(TO), Other crash types(OCT)
	Period	2004-2006(PI), 2007-2012(PII), 2013-2019(PIII)

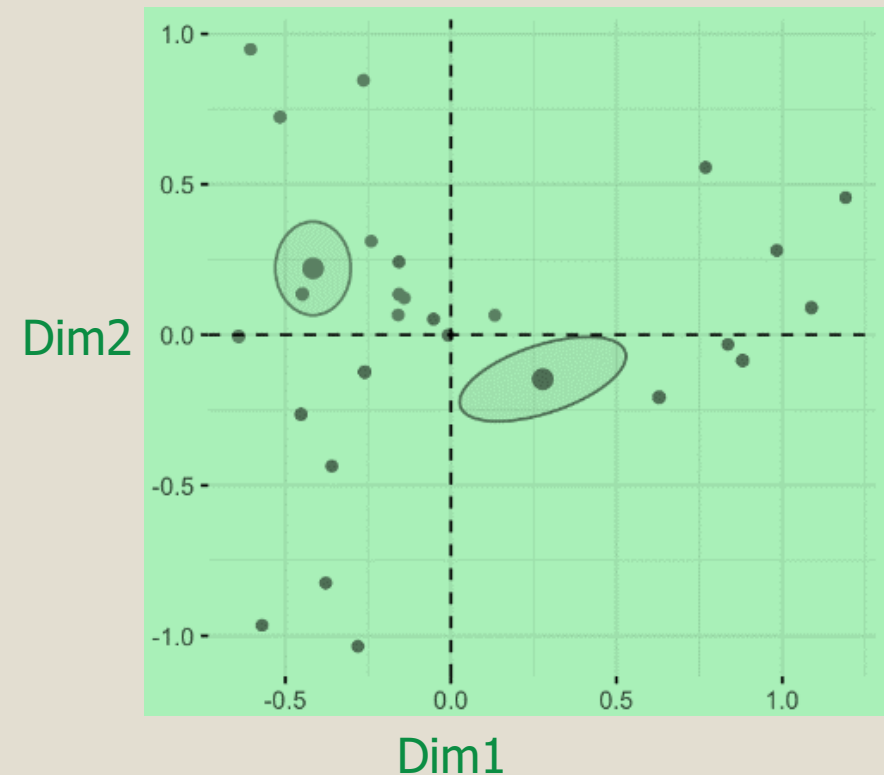
3. Methodology

Methodology

□ Multiple correspondence analysis (MCA)

The MCA is an extension of the simple correspondence analysis for summarizing and visualizing a data table containing more than two categorical variables.

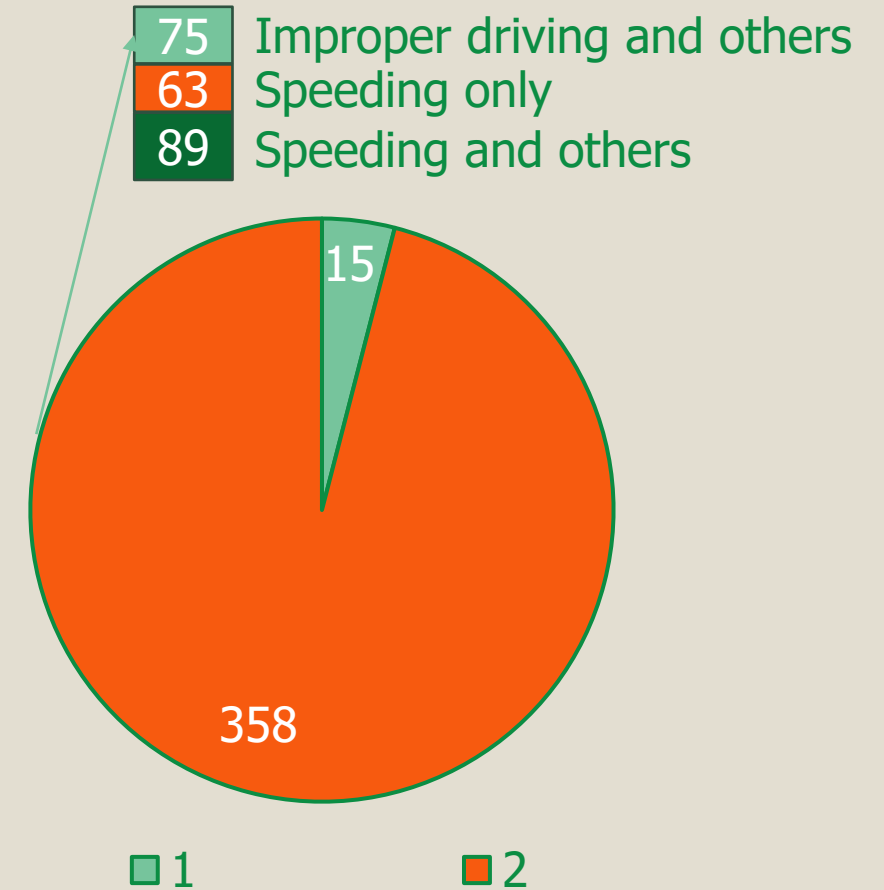
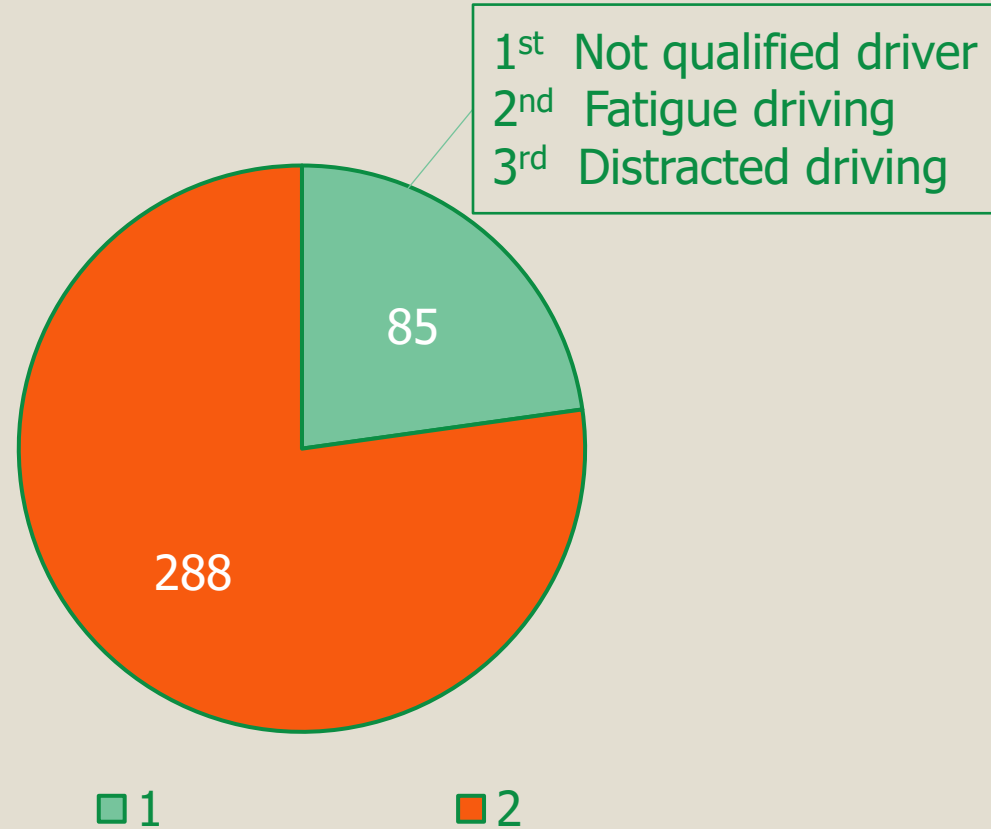
The MCA uses a distance measure and transforms the associations between categories of variables into coordinates in a multidimensional space. Usually, the first two dimensions are considered for visualization and interpretation of association (Greenacre and Blasius, 2006).



4. Results

Preliminary analysis results

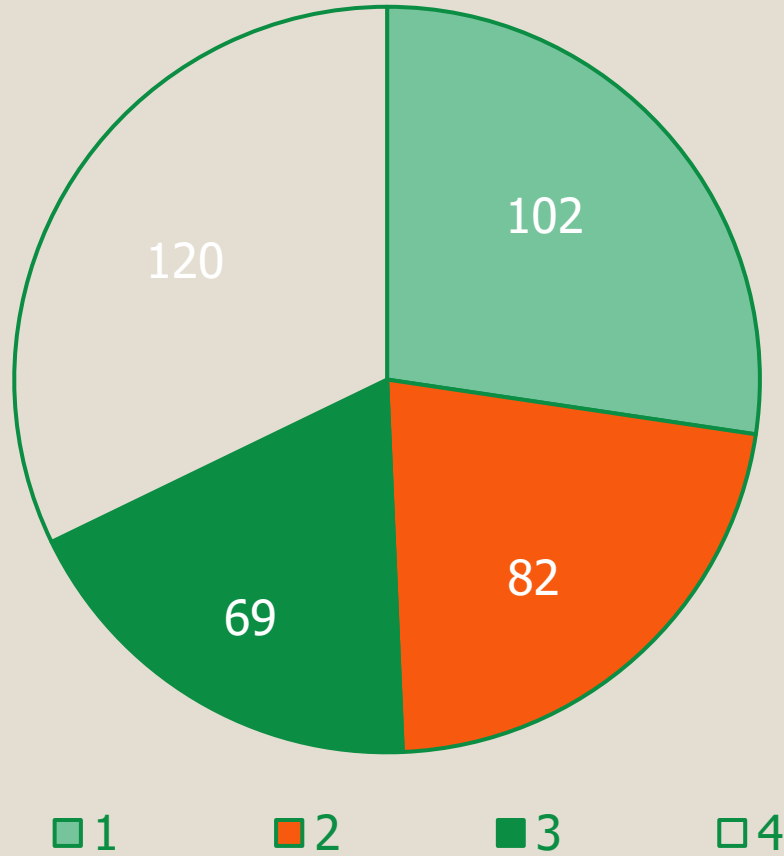
□ Driver factors



- Frequencies of most of categories of driver violations decreased from period I to period III, except for the combinations of speeding & improper driving, speeding & wrong lane driving, improper driving & wrong lane driving.

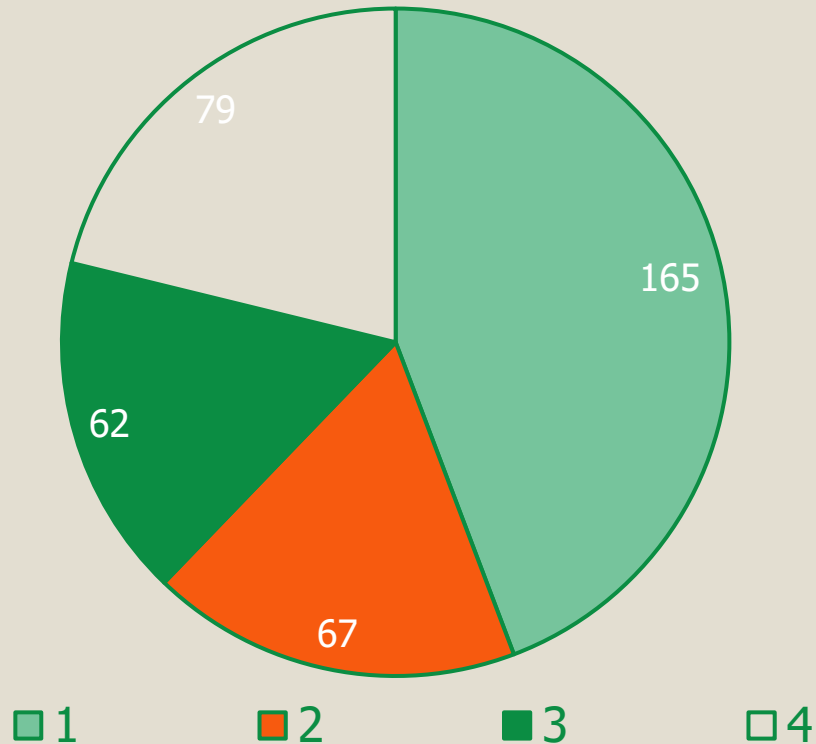
Preliminary analysis results

□ Road factors



Preliminary analysis results

Vehicle factors

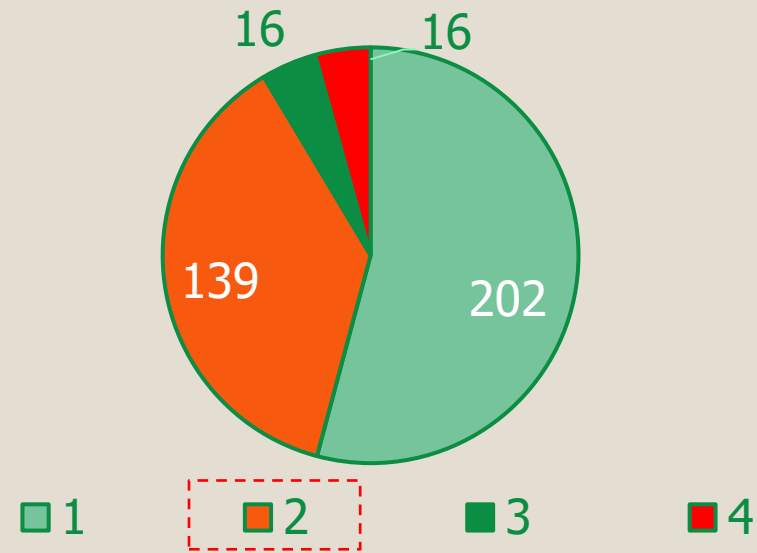


● vehicle condition

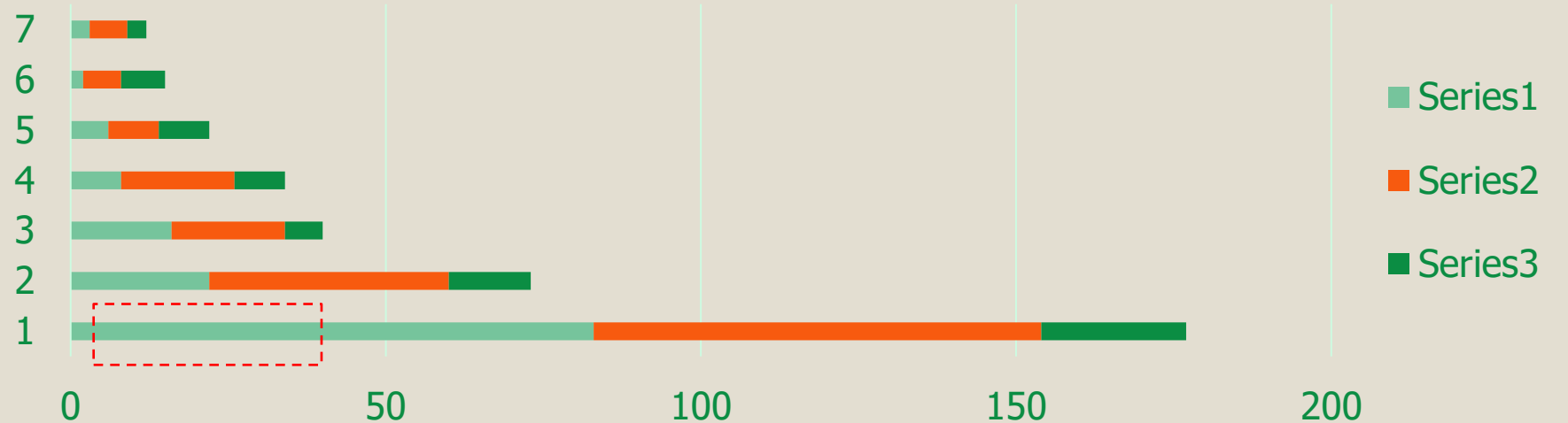
- 92 ESTCs caused by overload only
- 55 ESTCs caused by overload together with other conditions
- 57 ESTCs caused by poor braking or overload & poor braking

Preliminary analysis results

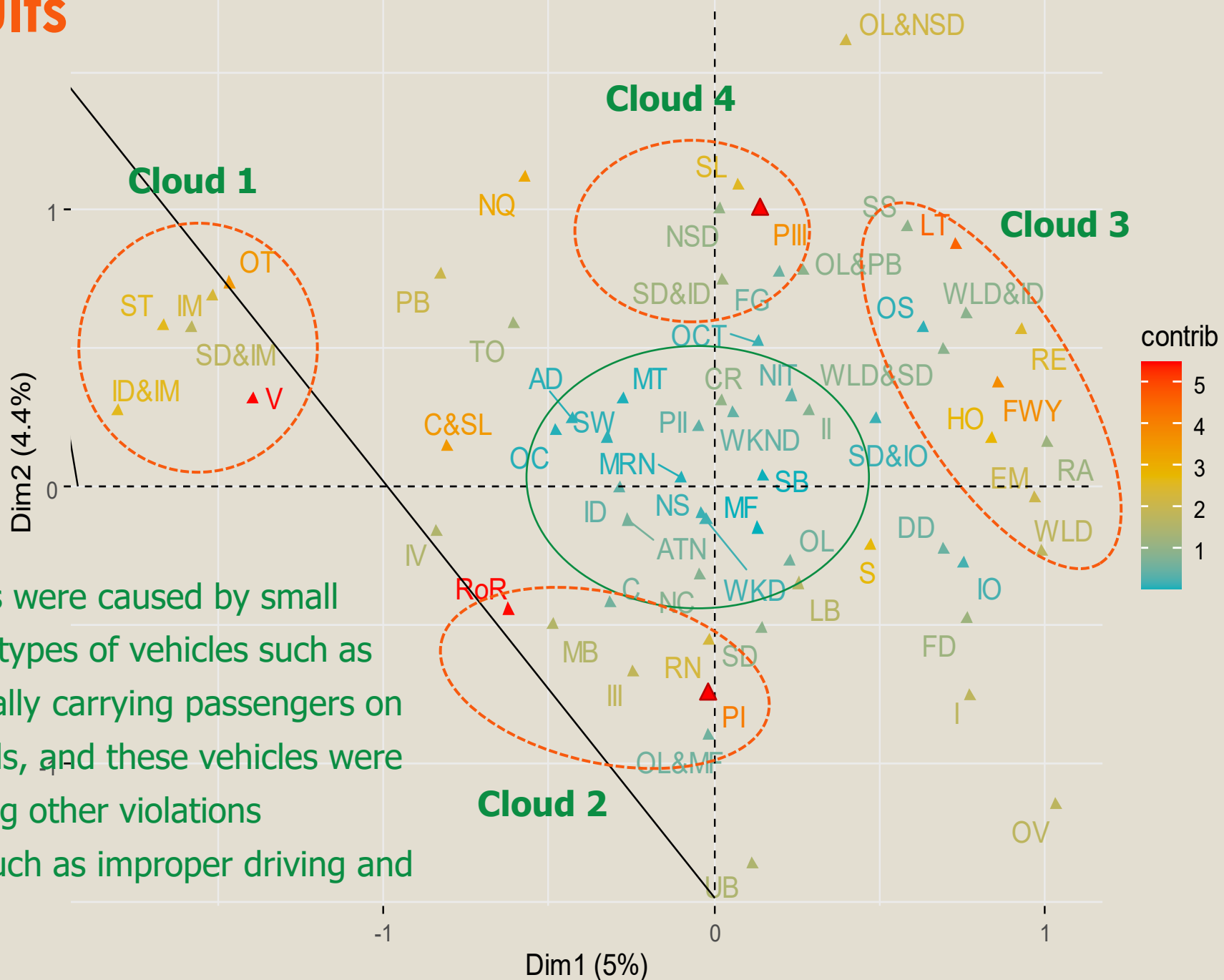
Environment factors



Crash type



MCA results



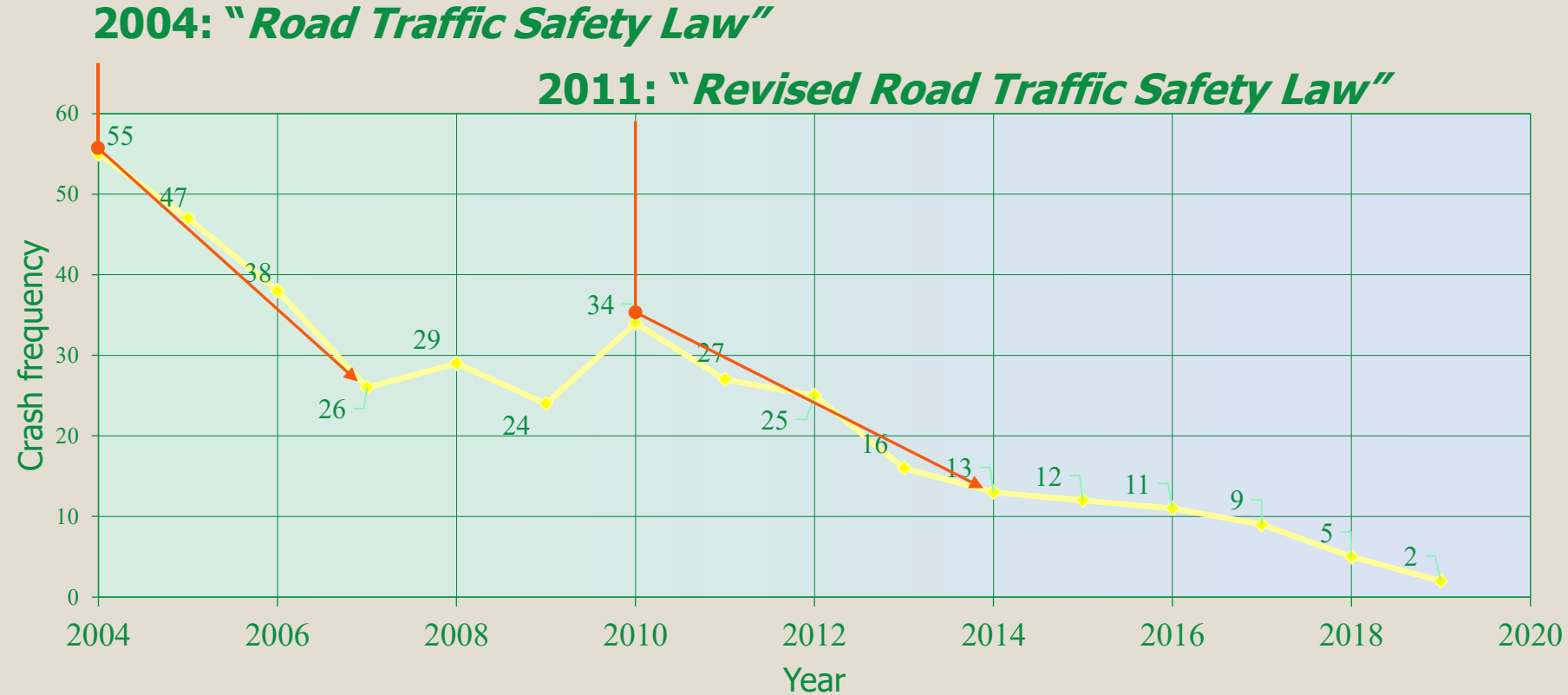
- A group of ESTCs were caused by small trucks and other types of vehicles such as farm tractor illegally carrying passengers on substandard roads, and these vehicles were usually conducting other violations simultaneously such as improper driving and speeding.

4. Discussion

Discussion

□ Changes in characteristics and safety implications

- The most significant change in ESTCs is the sharp decline in crash frequency from period I to period III.



Discussion

□ Changes in characteristics and safety implications

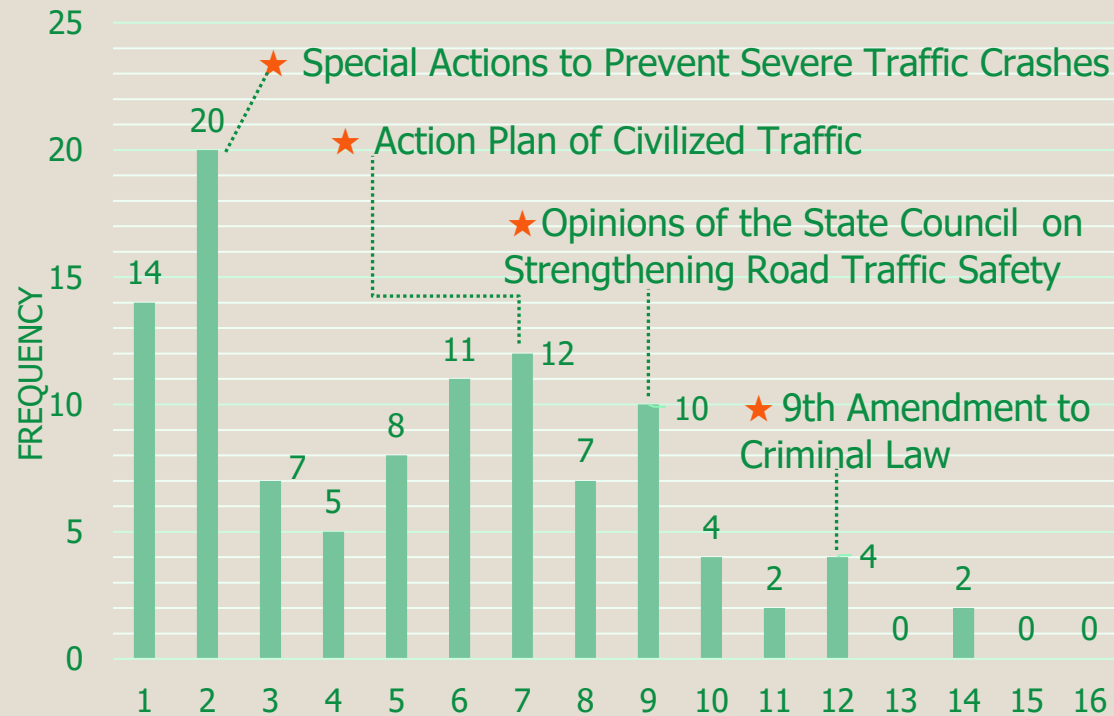
- The significant reduction in ESTCs was also achieved by policies, educational interventions, engineering interventions and other countermeasures.

Year	Type	Countermeasure
2004	Law enforcement	Road Traffic Safety Law
2004	Engineering intervention	Highway safety guarantee project
2006	Safety campaign	Special actions to prevent severe traffic crashes
2006	Engineering intervention	Nationwide black spot screening and treatments
2009	Scientific research	Technology action plan of road traffic safety
2010	Educational intervention	Action plan of civilized traffic
2011	Law enforcement	The 8th Amendment to Criminal Law
2012	Policy	Opinions of the State Council on strengthening road traffic safety
2014	Engineering intervention	Life protection road safety project
2015	Law enforcement	The 9th Amendment to Criminal Law
2017	Regulation	In-depth investigation on typical and severe traffic crashes
2019	Engineering intervention	Demonstration project of rural at-grade intersection improvement

Discussion

□ Changes in characteristics and safety implications

- Frequency of ESTCs with **overloaded/speeding large buses** involved and the targeted interventions



5. Conclusion

Conclusion

- This is the first study that looks into the ESTC characteristics and their changes over a long time span in China.
- It contributes to the knowledge of road traffic safety in China through revealing underlying characteristic patterns with the MCA analysis.
- Understanding the common characteristics, characteristic patterns, and their changes would help authorities in preventing ESTCs.
- These findings would help to shape traffic safety policies and countermeasures for both China and other low- and middle-income countries.

Thanks for your attention!

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