# 2018 Q3

# Traffic Analysis Report

高德地图
amap.com

# The Statement

This research report is made by AutoNavi Traffic Big-data Team of AutoNavi Software Co., and its entire contents are for reference only. The report is made via big data mining and calculation based on AMAP accumulated massive traffic and travel data. The generic algorithms and theories ensure its rationality and scientificity. The report uses the “congestion delay index” as a metric for urban congestion, i.e., the ratio of urban residents’ average actual travel time for one outgoing to their travel time under free flowing. From the perspective of traffic travelers, the index expresses the time costs imposed on travelers due to traffic congestion in a simple and understandable way. This report objectively reflects, in multiple dimensions, the traffic congestions in cities and the solution for relieving congestions in an as much accurate, detailed and precise way as possible, which provides valuable theoretical reference for government decision making.



- For more information about the data of urban congestion in your city, please visit：http://report.amap.com/
- Thanks for your attention, please wait for more research publication coming soon

# Report Description

Amap's massive traffic data is composed of traffic vehicle data and 400 million + Amap users' data

## Cities

360+cities and nationwide highway

选取

50 cities

* Select urban planning central areas or built-up areas as an evaluation range of overall urban road network
* Select major cities with large enough data samples for congestion ranking and level computing
* Amap traffic big-data can support 360+ Chinese cities in terms of traffic index analysis and calculation
* No public transportation data was included for traffic flow calculation in report

## Data

$$\text{Congestion delay index} = \frac{\text{Peak travel time}}{\text{Free-flow (non-congestion) travel time}}$$

See Appendix A for details

* Higher Index means higher level of congestion level

## Time

Whole day：06:00~22:00　　Morning peak：07:00~09:00　　Evening peak：17:00~19:00

* If no explanation specified, the statistical time periods for this report was from Jul.1st to Sep. 30th 2018

# Summary

“Traffic Analysis Reports for Major Cities in China” is proposed by AutoNavi, and it is based on Amap traffic big-data publishing platform, data open platform, Ali cloud MaxCompute and related data mining technology support . The report describes the urban congestion level, presents the congestion change rules, predicts the future development trend, and focuses on the congestion causes and countermeasures. This first quarterly report is jointly published by “Joint Laboratory for Future Transport and Urban Computing”, Transport Planning and Research Institute of the Ministry of Transport, Tsinghua-Daimler Joint Research Center for Sustainable Transportation, Ali Cloud and other organizations. AutoNavi is willing to open our data to governments, enterprises or education institutions, in order to build a traffic community together.

## Cooperate organization

未来交通与城市计算联合实验室
JOINT LABORATORY
FOR FUTURE TRANSPORT AND URBAN COMPUTING

清華大學 DAIMLER
可持续交通联合研究中心
Tsinghua-Daimler Joint Research Center for Sustainable Transportation

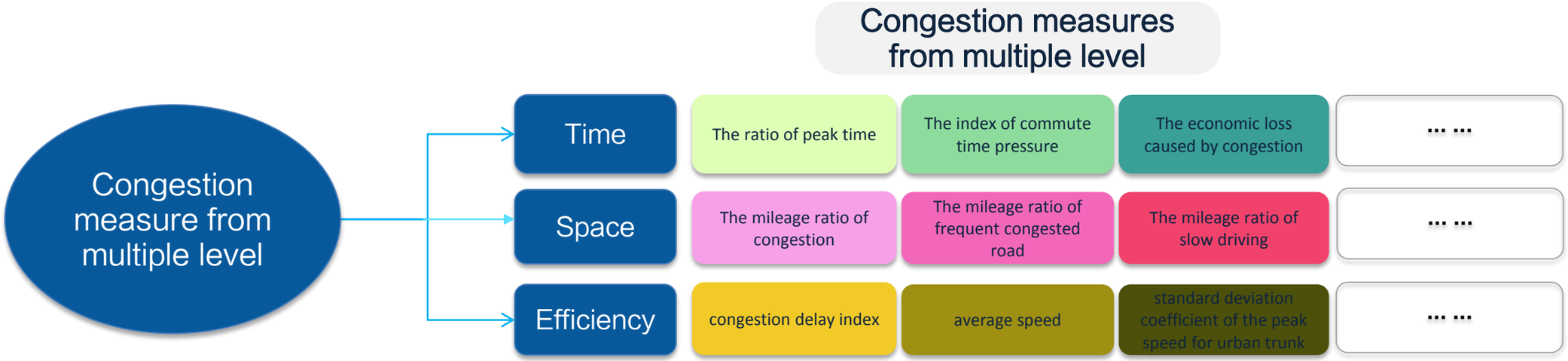
Alibaba Cloud

# City Congestion Pattern from Multiple Level

# City Congestion Pattern From Multiple Level —— More Indexes Considered

## Update city congestion measures from single index to 9 indexes

The report on this quarter has considered more indexes from just single index to 9 indexes. New indexes include firstly the new time dimension(the ratio of peak time, the index of commuter pressure and the economic loss caused by congestion), secondly the new space dimension(the mileage ratio of congestion, the mileage ratio of frequent congested road and the mileage ratio of slow driving), and thirdly the new efficiency dimension(congestion delay index, average speed and standard deviation coefficient of the peak speed for urban trunk. Under these indexes, a comprehensive and multidimensional evaluation for cities can be conducted, which can be a valuable and well-round reference for decision makers and administrations

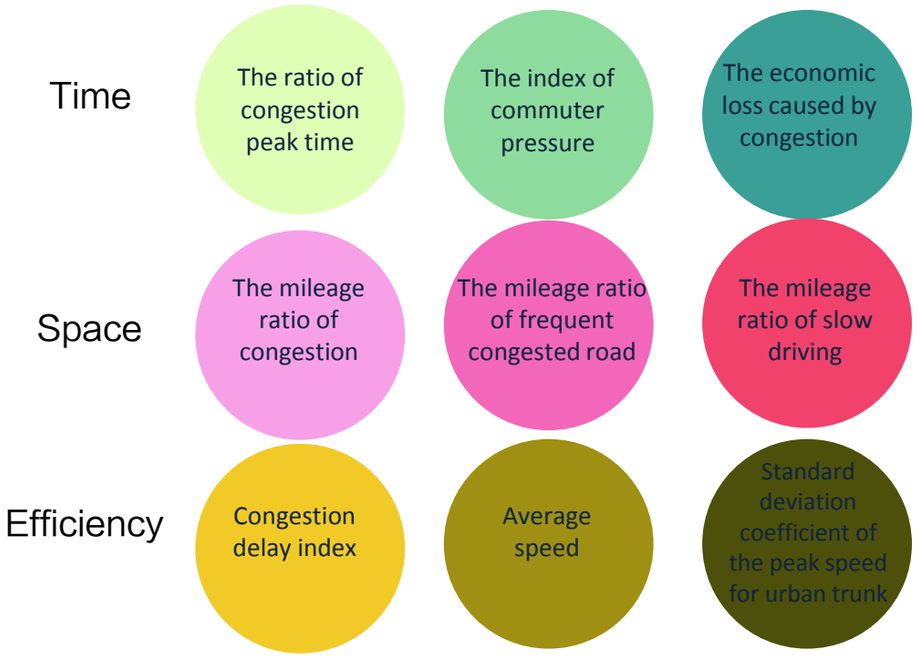


# Congestion Measures From Multiple Level —— Analyses Integrated with Time, Space and Efficiency Index

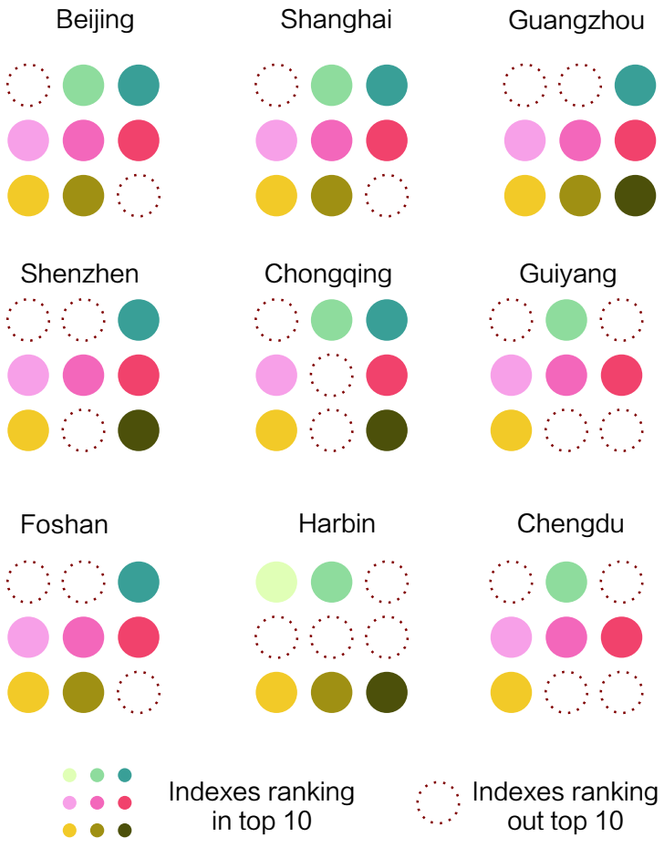
## For single index, at least 6 out of 9 indexes ranked top 10 respectively for first-tier cities

According to measured 9 different indexes from 50 cities recorded by Amap Traffic Big-data in multiple dimensions from time, space and efficiency, urban traffic performance can be measured and evaluated, and real and hidden reason for congestion can be found. First-liter cities ranked top in multiple congestion evaluation, with more than 5 out of 9 in each top list.

9 indexes to measure congestion level in time, space and efficiency




Cities having more than 5 indexes ranking in top 10



# Congestion Measure From Multiple Level —— Analyses Integrated with Time, Space and Efficiency Index

Based on the number of indexes entering top10 in three different dimensions, cities have been classified into five groups in terms of congestion level . Results revel that 7 indexes including the ratio of congestion peak time, the mileage ratio of congestion, average speed , congestion delay index and so on for first-tier cities such as Beijing, Shanghai and Guangzhou are quite outstanding, which means high congestion can be found for these first-tier cities. On the other hand, no single measured index is in top 10 for provincial capital, such as Changsha, Wuhan, Taiyuan and Zhengzhou, and this means congestion is much more less in these cities.

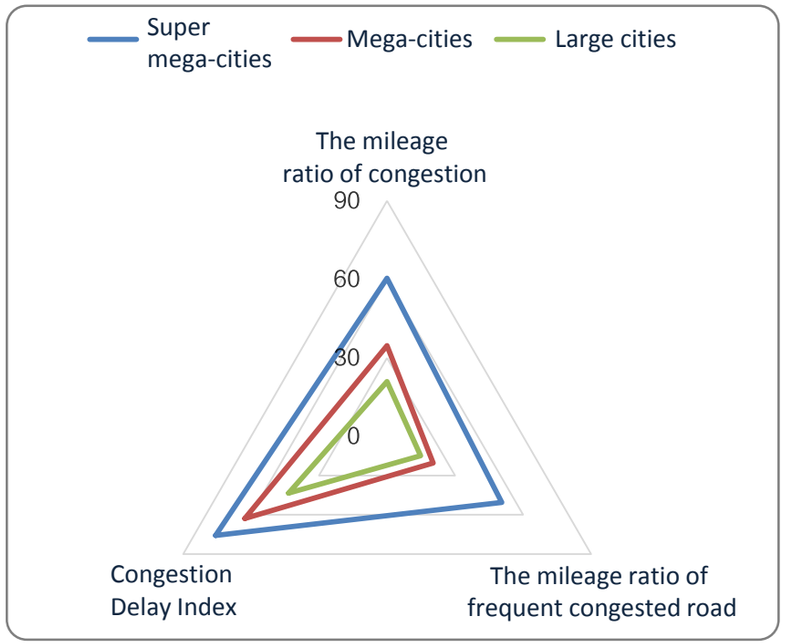
| Numbers of indexes in top10 | Congestion Level Classification considering Multiple Indexes |
| --- | --- |
| **Extremely High** (Cities with more than 7 indexes in top 10) | Beijing, Guangzhou, Shanghai |
| **High** (Cities with nearly 5 to 6 indexes in top 10) | Shenzhen, Chongqing, Guiyang, Foshan, Harbin, Chengdu |
| **Middle** (Cities with nearly 5 to 6 indexes in top 10) | Changchun, Nanning, Dalian, Shenyang, Hohhot, Hangzhou |
| **Low** (Cities with nearly 5 to 6 indexes in top 10) | Hefei, Nanjing, Lanzhou, Kunming, Xi'an, Jinan, Dongguan, Fuzhou, Suzhou, Tianjin, Xiamen, Liuzhou, Baoding, Luoyang, Yangzhou, Zibo, Nantong, Taizhou and Changzhou |
| **Extremely Low** (Cities with nearly 5 to 6 indexes in top 10) | Changsha, Wuhan, Taiyuan, Yantai, Nanchang, Zhengzhou, Qingdao, Xining, Shijiazhuang, Wenzhou, Tangshan, Ningbo, Wuxi, Shaoxing, Urumqi, Quanzhou |

# Congestion Measure From Multiple Level —— Analyses in Terms of Space and Efficiency Indexes

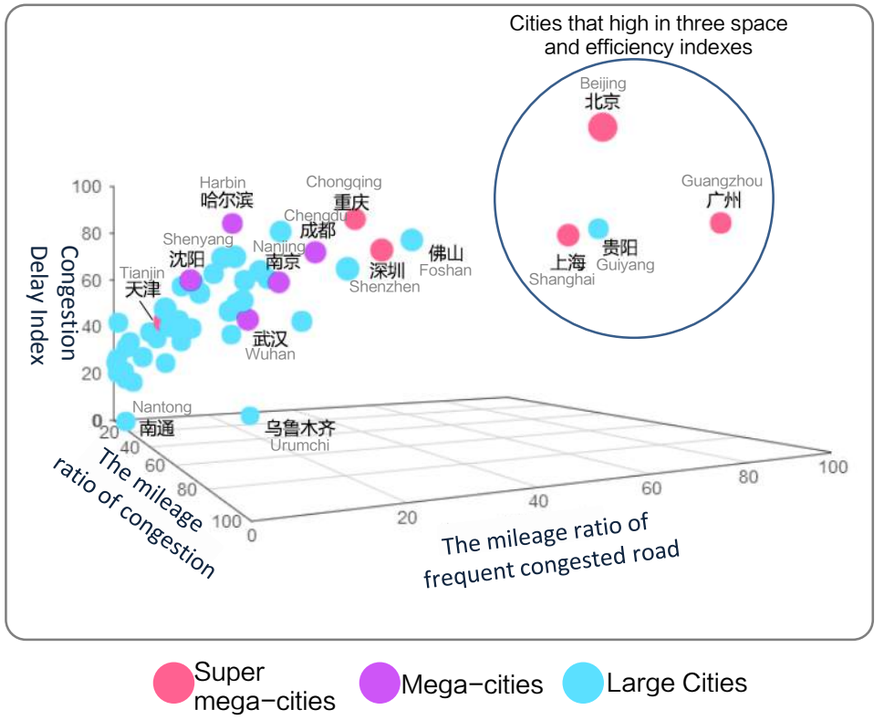
## Considering three indexes in general, the congestion level for cities increases with the increase of city scale, but this level in some smaller scale cities outweighs some larger cities.

From the radar map, three indexes including the congestion delay index, the mileage ratio of congestion and the mileage ratio of frequent congested road increased with the increase of city scale. From 3d point graph, congestion level in super mega-cities usually ranked in the first-tier group, however, congestion level of large cities such as Guiyang and Foshan outweighs that level of some super mega-cities, such as Chongqing and Shenzhen. Congestion level of mega-cities, Tianjin, is quite lower than that level of most mega-cities, and its level is around the level of many large cities.

Radar map for different scale cities considering the mileage ratio of congestion, the congestion delay index and the mileage ratio of frequent congested road




3D point graph considering the mileage ratio of congestion, the mileage ratio of frequent congested road and the congestion delay index




Note: To create standard interval for the mileage ratio of congestion, congestion delay index and the mileage ratio of frequent congested road, figures are cleaned by normalization and then multiple 100.

# Congestion Measure From Multiple Level —— Analyses of Peak Speed Standard Deviation Coefficient

**Peak speed standard deviation coefficient was high and congestion delay index is also high for many cities. The city with the highest standard deviation coefficient of urban expressway is Nanning, while the city with the highest standard deviation of peak speed of urban trunk is Shenzhen.**

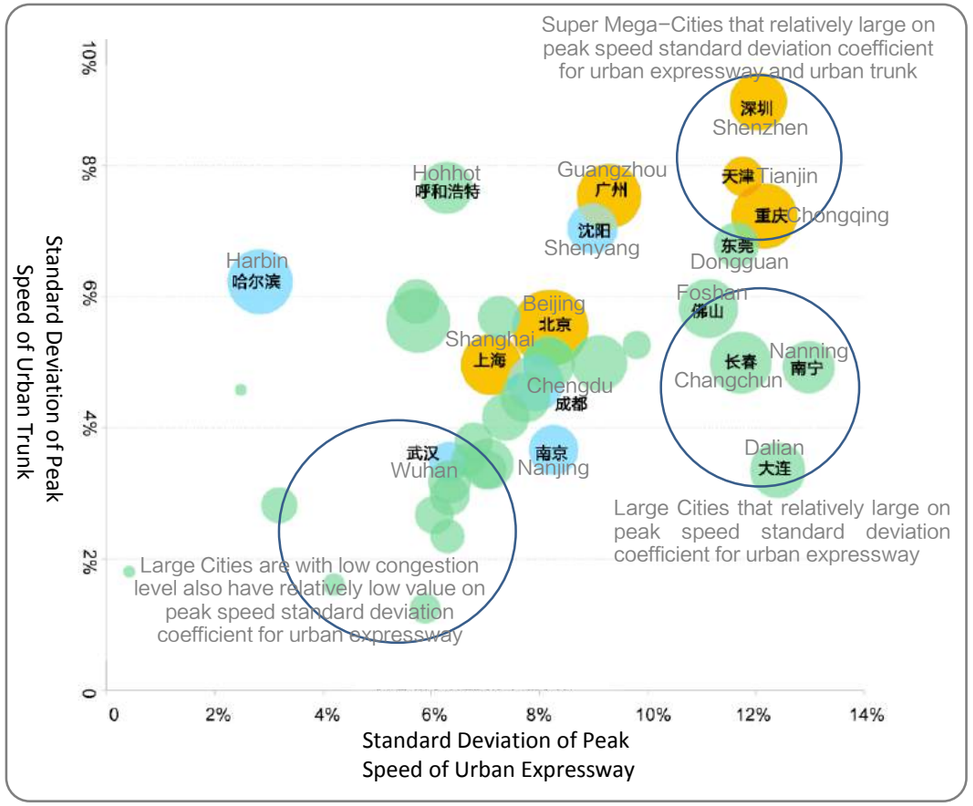
Peak speed standard deviation coefficient is the ratio between standard deviation of peak speed with the average speed, and it reflects the difference and dispersion degree of speed variation from a relative angle. The higher coefficient the higher variation of speed in peaks. There is large difference in coefficient distribution according to different city scale, and super mega-cities are usually high in the standard deviation coefficient for urban expressway and urban trunk. From the angle of road grade, the standard deviation coefficient is usually higher for urban expressway than that for urban trunk. However, as a specification, the standard deviation coefficient of urban trunk is higher than the urban expressway one in Harbin, and this is due to the urban expressways that are far distribution from center and are low in congestion. Referenced by the peak congestion delay index, cities with high standard deviation coefficient on speed variation usually have relative high congestion.

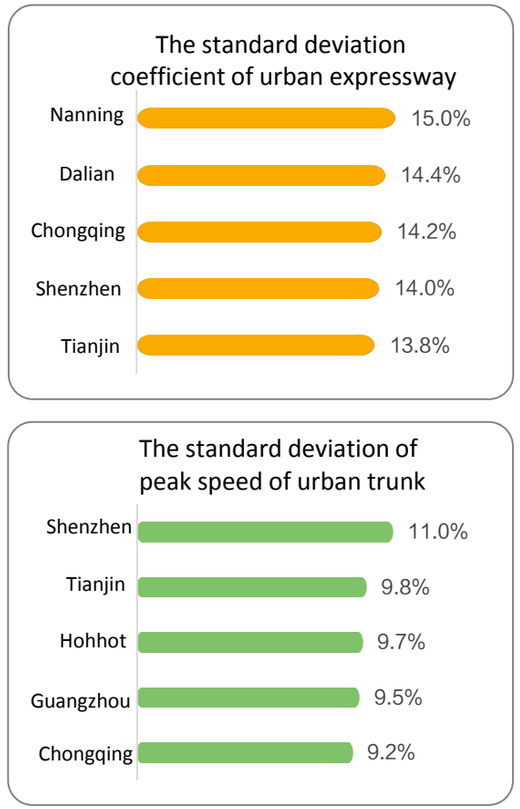
Peak Congestion Delay Index
Low High
Super Mega-Cities

Peak Congestion Delay Index
Low High
Mega-Cities

Peak Congestion Delay Index
Low High
Large Cities

Graph of Peak Speed Standard Deviation Coefficient referenced with Peak Congestion Delay Index

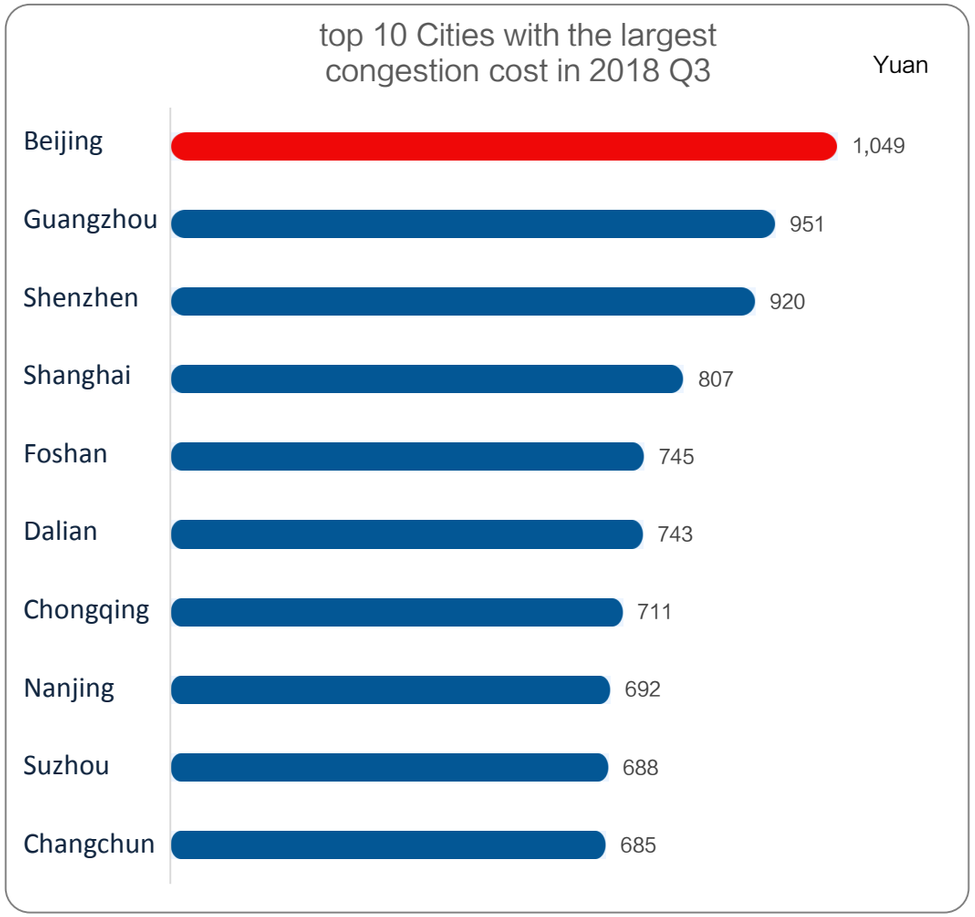


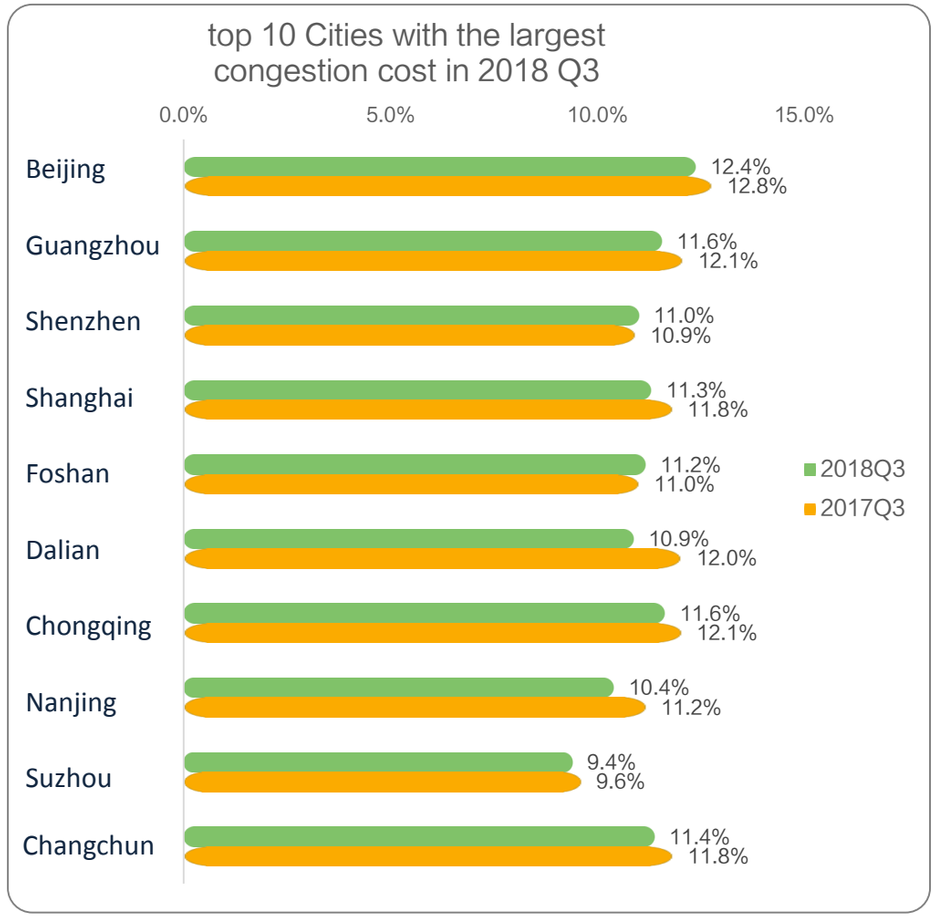



# Congestion Measure From Multiple Level —— Economic Loss Caused by Congestion

## The monthly congestion cost in Beijing is larger than 1000 yuan, and the time cost due to congestion accounts for 12.4% of the average salary monthly.

According to the results from 50 cities recorded by Amap Traffic Big-data, the average monthly cost of congestion in Beijing in the third quarter was 1049 yuan, and Beijing is also the only city with cost of congestion higher than 1000, accounting for 12.4% of the monthly average salary. However, compared with 12.8% last year, the proportion of monthly cost of congestion took up less proportion of total average wages. In the top10 cities with the largest congestion cost, the proportion of monthly cost of congestion in 9 out of the 10 cities has decreased in the proportion of total average wages.



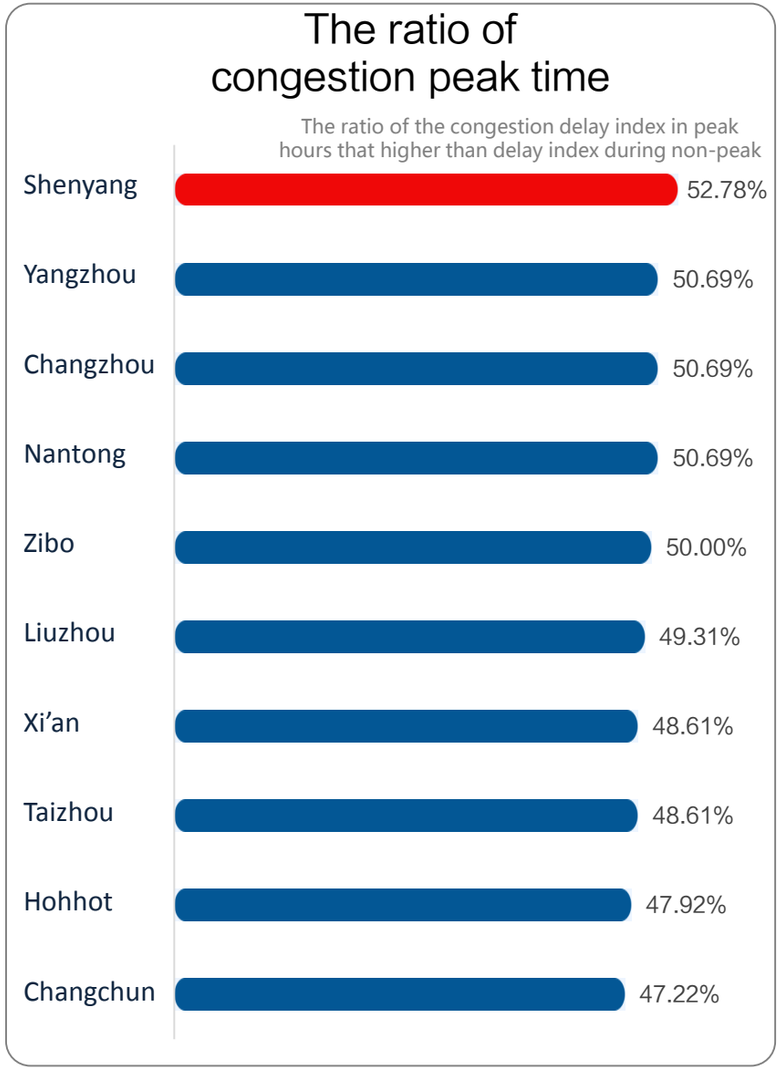



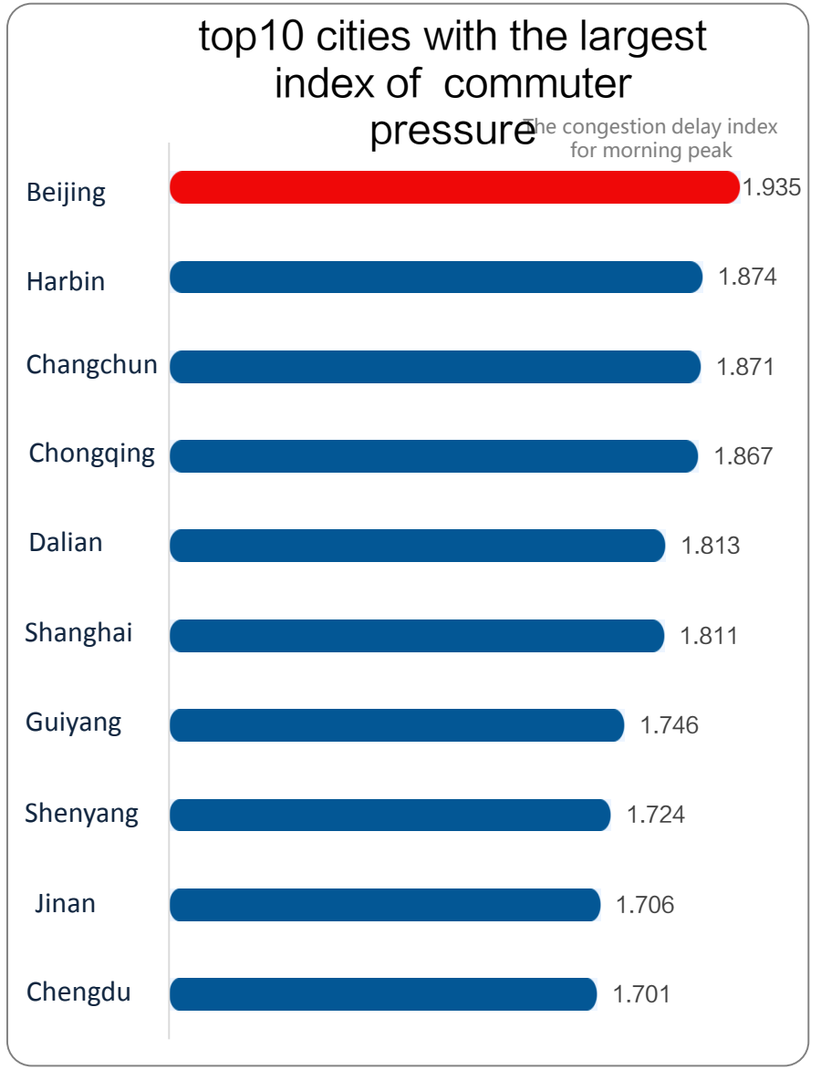

Note：Taking Beijing as an example, For every hour of travel, there are 29.7 minutes of congestion. According to Beijing Municipal Bureau of Statistics in 2017, the average wage in Beijing is 8,467yuan monthly, which is equivalent to 48.1 yuan hourly (22 working days per month and 8 hours per day), and therefore, the congestion cost is 23.8 yuan (48.1/60*29.7)

# Congestion Measure From Multiple Level —— The Ratio of Congestion Peak Time and The Index of Commuter Pressure

## Shenyang is the highest in the ratio of congestion peak time and Beijing is the highest in the index of commuter pressure

According to the results from 50 cities recorded by Amap Traffic Big-data, the highest ratio of congestion peak time was in Shenyang, about 52.76% of time in peak hours is of higher **congestion** level than the level in non-peak hours, and Beijing ranked first with the highest congestion delay index in morning peak, at 1.935.

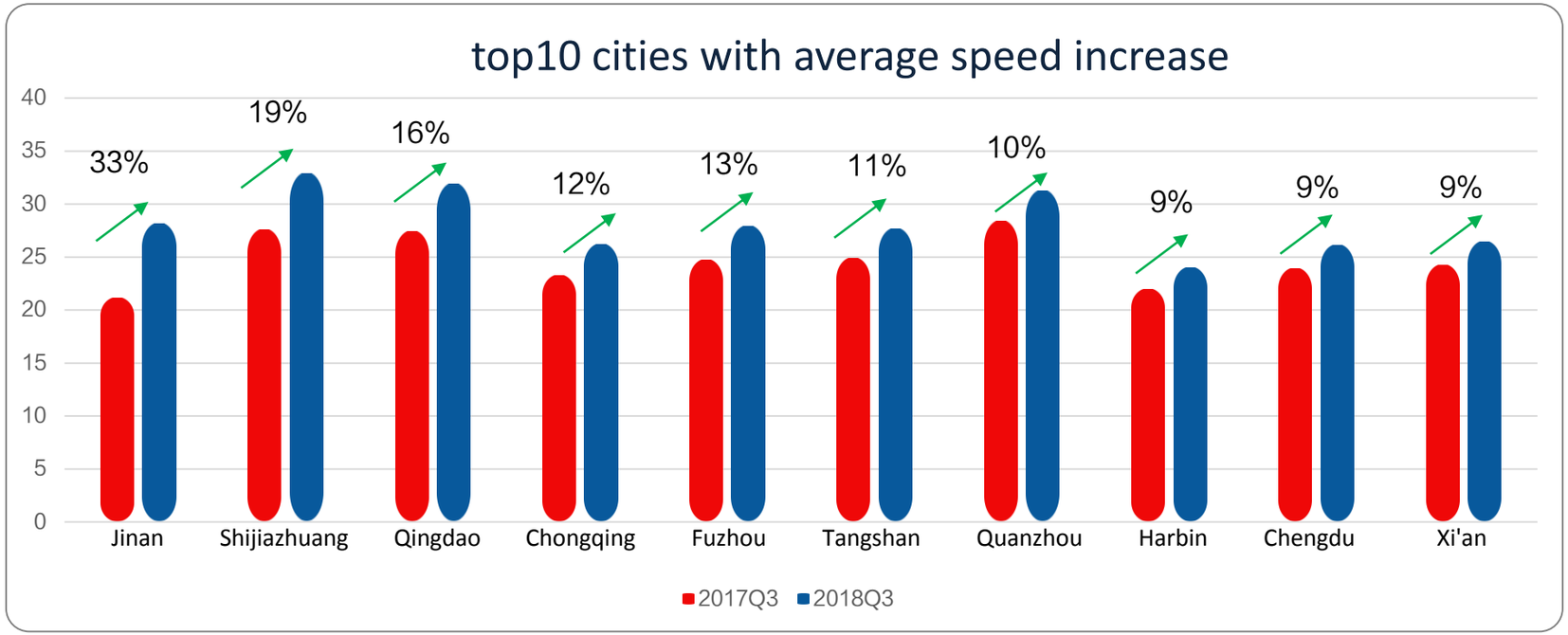


# Congestion Measure From Multiple Level —— Average Speed in Peak hours

**The average speed of Jinan increased the most, and the average speed of more than 80% recorded cities increased in 2018Q3, compared with 2017Q3.**

According to the results from 50 cities recorded by Amap Traffic Big-data, the average speed of Jinan increased the most, at 33%. Compared with last year, the average speed increased in 44 cities out of 55 recorded cities, but it slightly reduced only in 6 cities.(They are Zibo-6.4%, largest average speed reduction due to road construction, Baoding-4.4%, Guiyang-3.5%, Lanzhou-2.9%, Shenzhen-2.2% and Foshan-2.1%)



# Congestion Measure From Multiple Level —— The Mileage Ratio of Congestion

**Beijing is the city with the highest mileage ratio of congestion this quarter. During peak hours, the mileage ratio of congestion is 10.85%.**

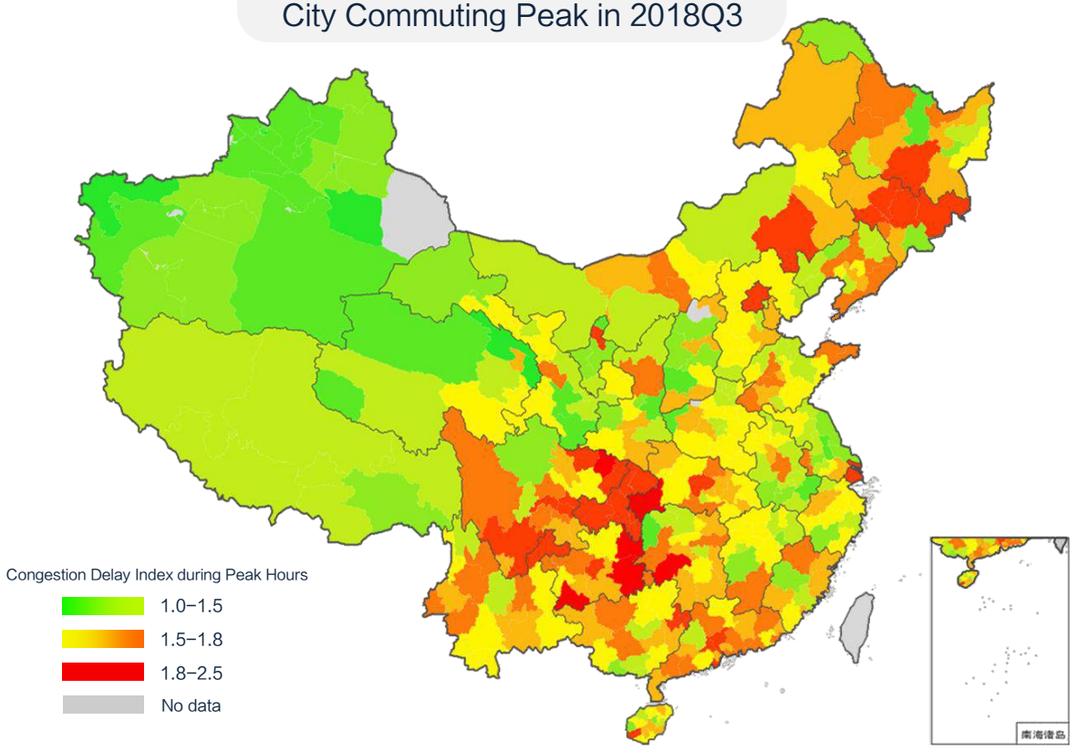
The mileage ratio of congestion mainly measures the level of moderate congestion and severe congestion of different road grades for all recorded cities , and presented by the mileage ratio.

# Congestion Measure From Multiple Level —— Congestion Delay Index

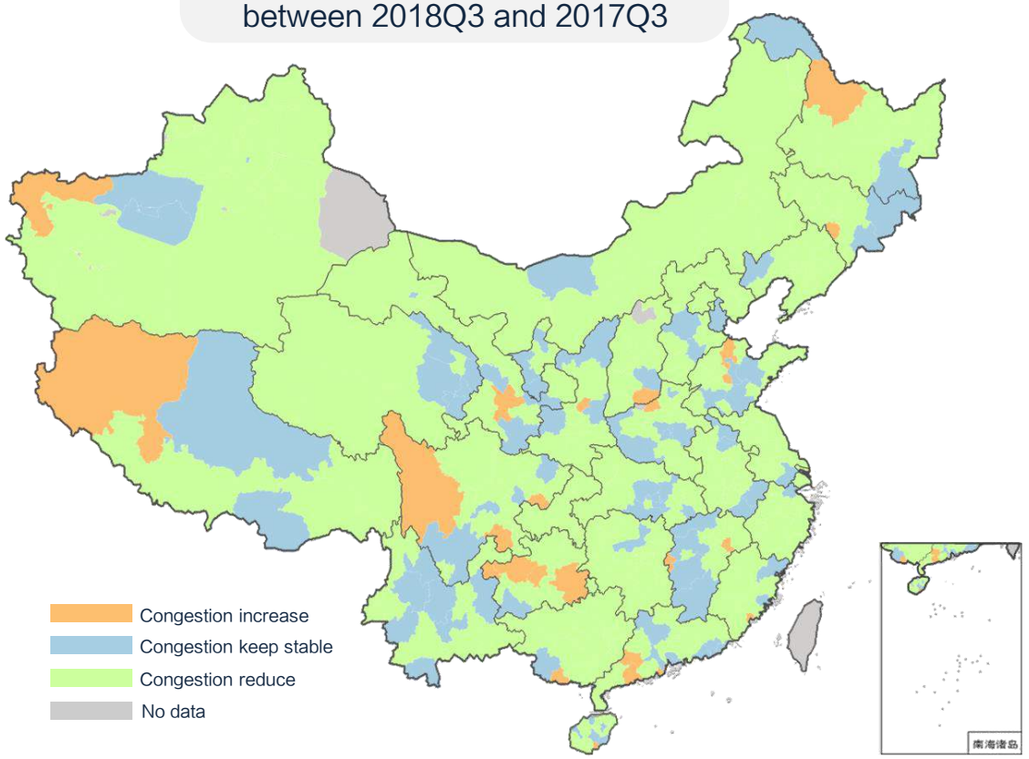
**The national congestion trend has declined overall, with 93% of urban congestion decreased or keeping stable, compared with 2017 Q3.**

According to the results from 361 cities recorded by Amap Traffic Big-data, during urban commuting peaks, 8% of cities suffered congestion, 57% of cities are in slow driving state, and 35% are not threatened by congestion this quarter. Compared with 2017Q3, during urban commuting peaks in 2018Q3, congestion decreased for 69% of cities, little change on congestion for 24% of cities, and congestion increased for only 7% cities.

Heat map of congestion for Urban City Commuting Peak in 2018Q3



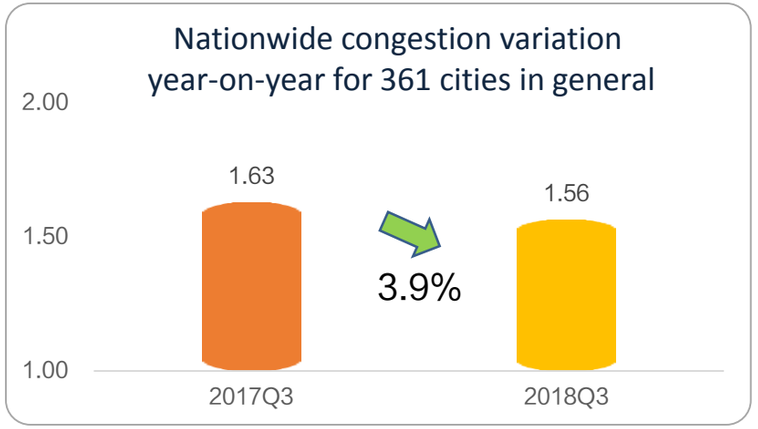

Congestion variation map between 2018Q3 and 2017Q3

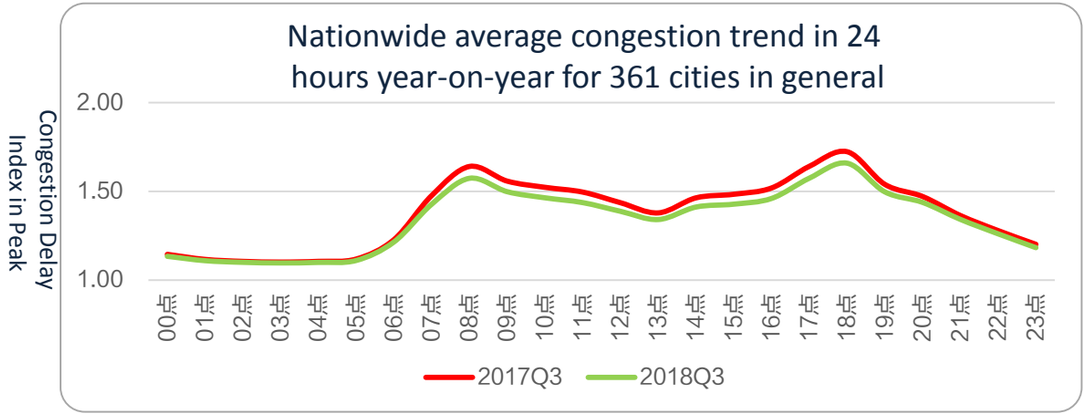


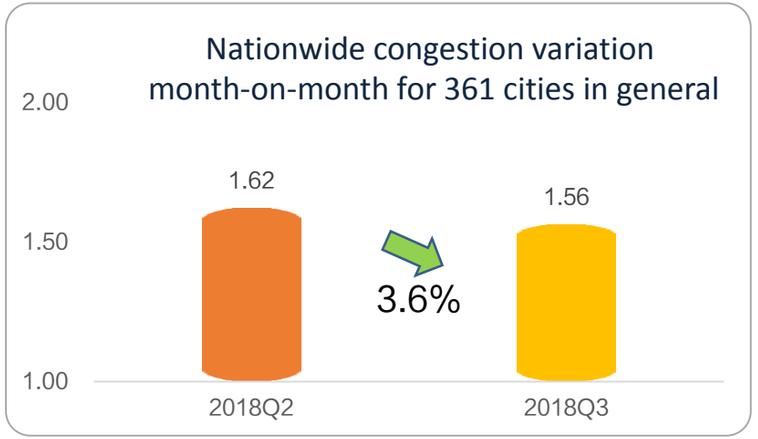
# Congestion Measure From Multiple Level —— Congestion Delay Index

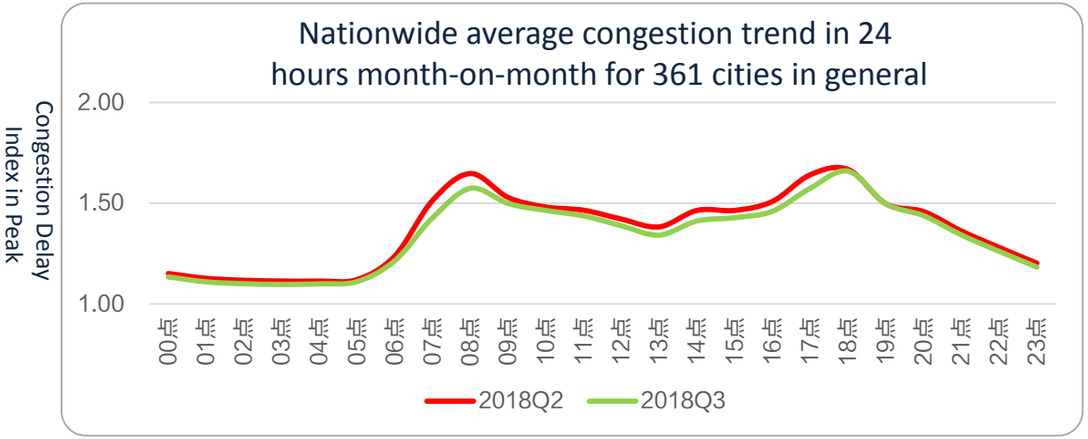
## The overall congestion in 361 cities nationwide alleviated significantly, reduced by 3.9% year-on-year and 3.6% month-on-month.

According to the results from 361 cities recorded by Amap Traffic Big-data, congestion reduced by 3.9% year-on-year and 3.6% month-on-month in general. From the perspective of the 24-hour congestion trend, the morning peak congestion decreased significantly, and the evening peak congestion periods shortened.



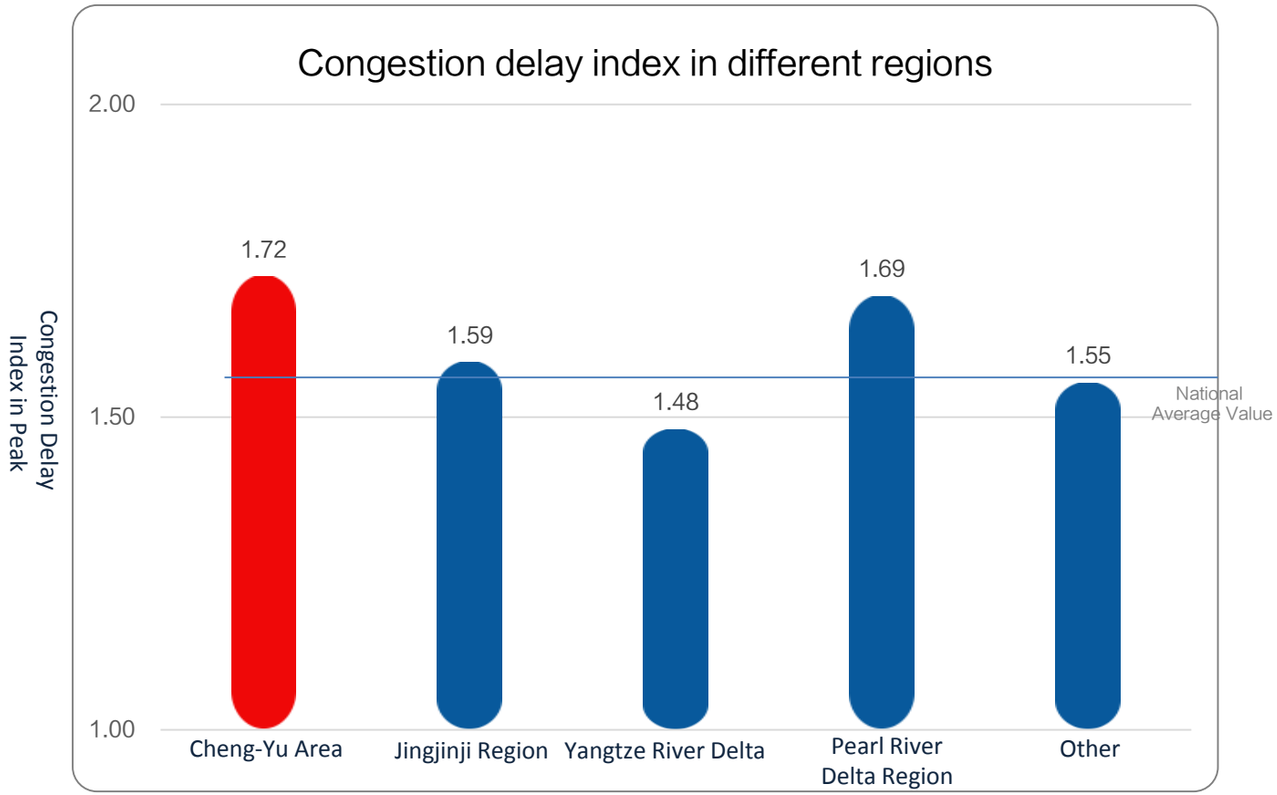



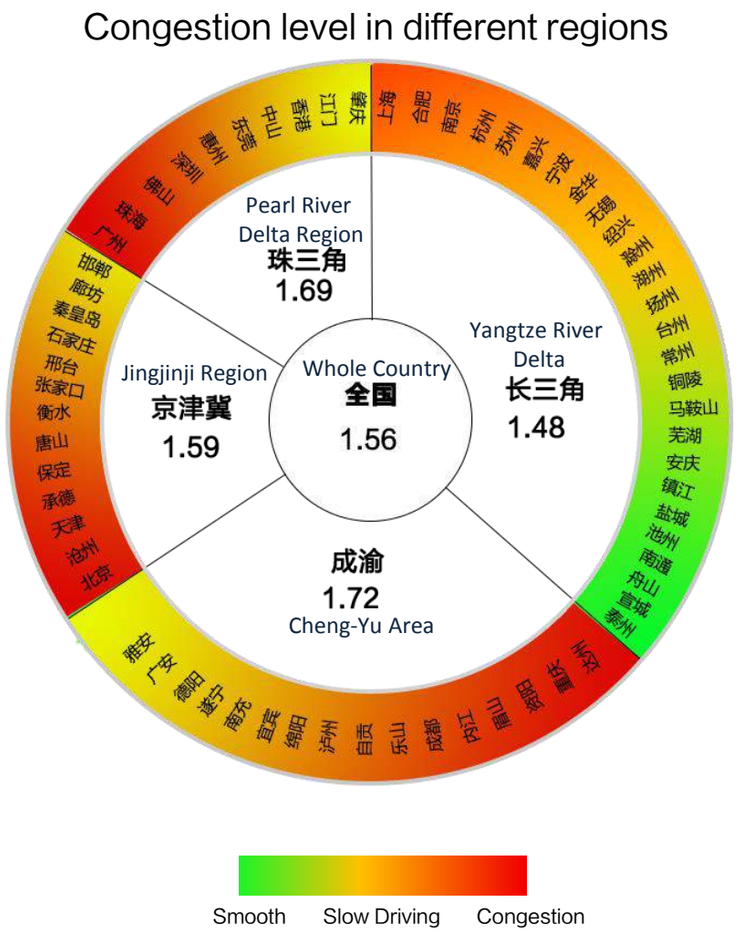



# Congestion Measure From Multiple Level —— Congestion Delay Index

**The congestion in the Yangtze River Delta region is lower than the national average, and the congestion in Cheng-Yu Area is the highest.**

In main economic regions of the County-level Towns, the congestion level in the Chengdu-Chongqing region was the highest in 2018Q3, while the congestion index in peak of the Yangtze River Delta region is 1.48, which is lower than the national level (at 5%) and is the best traffic area.



# Congestion Measure From Multiple Level —— Congestion Delay Index

## Congestion for Beijing still ranked first in 2018Q3, while that for Jinan was out from top 10.

According to the results from 50 cities recorded by Amap Traffic Big-data, the congestion delay index of Beijing was first at 1.982 this quarter, with average driving speed of 23.9km/h during peak; Chongqing ranked second with the congestion delay index at 1.872 and average driving speed at 22.60km/h. Jinan which was usually in top 10 congestion city list, was out of this list and ranked 19th, due to the complement of more linking roads established between urban expressway and the replacement of no through roads to be linking roads.

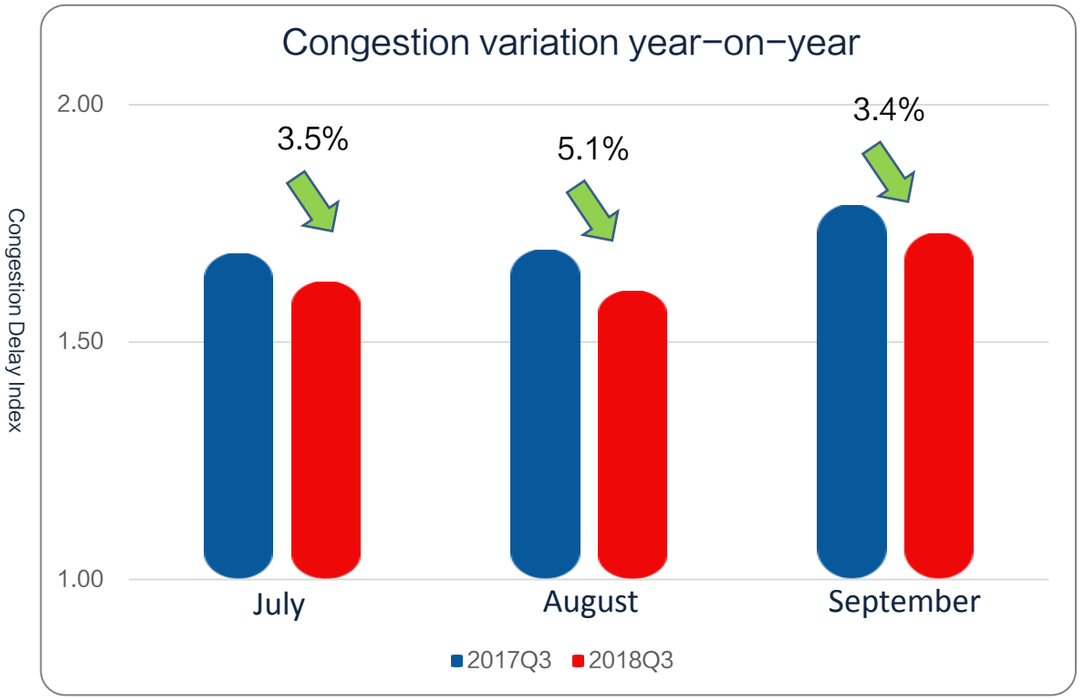
Location of top10 Congested Cities during peak in 2018Q3

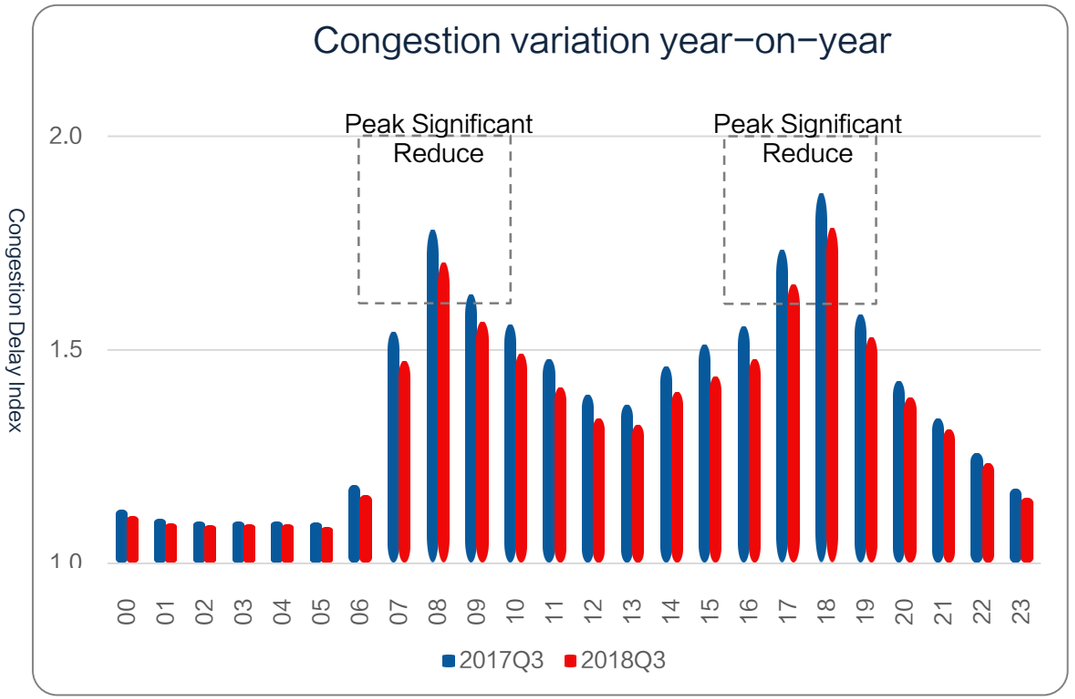

Rank of Congestion of Main Cities in China in 2018Q3

# Congestion Measure From Multiple Level —— Congestion Delay Index

**Compared with the same periods last year, congestion fell significantly in from July to September, and during daytime, the congestion also showed an overall downward trend.**

According to the results from 50 cities recorded by Amap Traffic Big-data, in 2018 Q3, congestion delay index significantly reduced, with August having the largest reduction at 5.1%. From the 24 hours trend of congestion delay index, the peak reduced dramatically. The reason of such reduction may due to more focus on congestion improvement from city government, road network optimization construction, improved traffic management applying by big data technology, the reduction of travel by hired vehicle and so on.

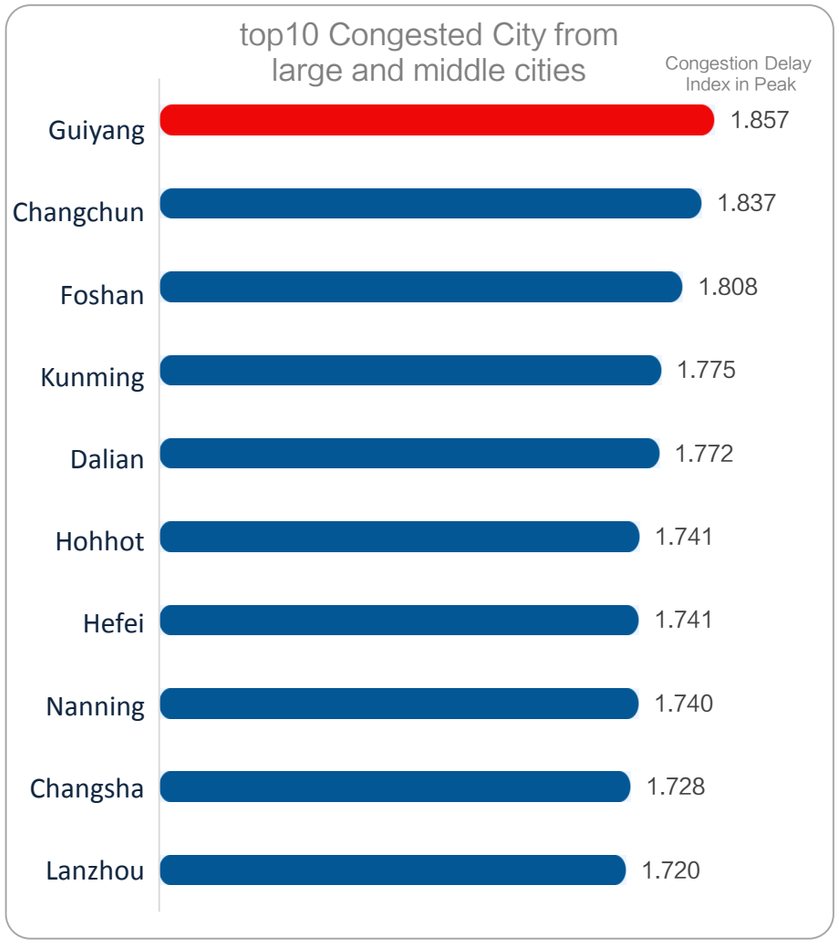


# Congestion Measure From Multiple Level —— Congestion Delay Index（Rank by City Scale）

**For the congestion delay index, in super mega-cities and mega-cities, Beijing ranked the first, and in large and middle cities, Guiyang ranked the first.**

Based on city scale, 50 cities has been selected to rank, for a more multiple dimension congestion level evaluation. Result shows that in this quarter, in super mega-cities and mega-cities, Beijing ranked the first with congestion delay index at 1.982, and Chongqing and Harbin ranked second and third respectively. In terms of large and middle cities, Guiyang ranked the first, and it was followed by Changchun.

# Congestion Measure From Multiple Level ——Congestion Delay Index（Impact of Vehicle Restriction Rule）

**Jing-jin-ji Region applied the most strict vehicle restriction rule, and traffic congestion in Jinan and Harbin significantly decreased without any implementation of new vehicle restriction rule.**

According to the results from 50 cities recorded by Amap Traffic Big-data, Jing-jin-ji Region applied the most strict vehicle restriction rule, and such restriction has been quite normal to find. Traffic congestion in Jinan and Harbin significantly decreased without any implementation of new vehicle restriction rule, and this might due to a better traffic management involved and a better optimization of traffic network. Specifically, in Jinan, more linking roads has been established to replace original no through roads and the complement of more linking roads has been built; for Harbin, congestion reduced by the application of traffic big data technologies, the optimization of bus route and bus stop location, the traffic restriction policy improvement on no stop, left turn limitation and parking slot increase and so on

Strict level of vehicle restriction rule for main cities


Comparison of top20 congestion reduction of main cities and their new traffic policy

| City | Congestion Reduction Rate% | New Traffic Policy Implementation |
|---|---|---|
| Jinan | −16.9% | |
| Shijiazhuang | −13.2% | Regular vehicle restriction rule implementation since 2018.06.25 |
| Tangshan | −10.8% | Regular vehicle restriction implementation since 2018.04.09 |
| Qingdao | −10.5% | Bus running restriction implementation for Qianhai first line since 2018.05.01 |
| Xi’an | −10.0% | Regular vehicle restriction rule implementation since 2018.04.16 |
| Harbin | −8.8% | |
| Dalian | −8.2% | Vehicle restriction about even and odd numbered license driving on some roads since 2018.05.02 |
| Urumqi | −7.4% | Freight driving restriction adjustment since 2018.08.27 |
| Luoyang | −7.3% | Vehicle restriction about even and odd numbered license driving on four areas and four bridges since 2018.08.28 |
| Hefei | −6.7% | New vehicle restriction rule implementation since 2018.09.10 |
| Yangzhou | −6.5% | Freight driving restriction since 2018.09.15 |
| Yantai | −6.4% | |
| Nanchang | −6.1% | |
| Zhengzhou | −5.9% | Regular vehicle restriction rule since end of 2017.12 |
| Quanzhou | −5.8% | |
| Taizhou | −5.4% | Vehicle driving restriction and no freight driving in some areas since 2018.07.20 |
| Nanjing | −5.3% | Vehicle driving restriction for high pollutant release vehicle since 2018.09.01 |
| Kunming | −5.2% | |

New Vehicle Restriction

New driving Restriction for Bus and Freight

None

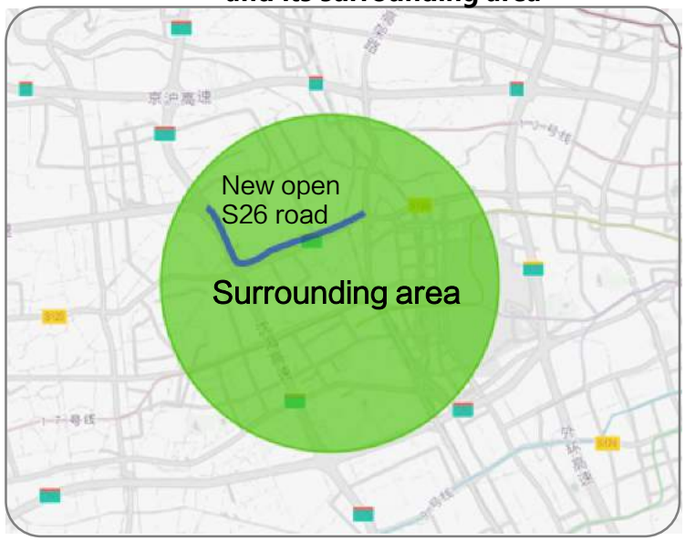
注：极高表示城市市区内有整体尾号限行措施、高表示城市部分区域尾号或单双号限行、中表示有部分道路或重要枢纽有尾号或单双号限行措施、低表示城市有少部分限行路段、无表示没有限行措施。

# Congestion analyses for Shanghai—— Impact of new road open on traffic

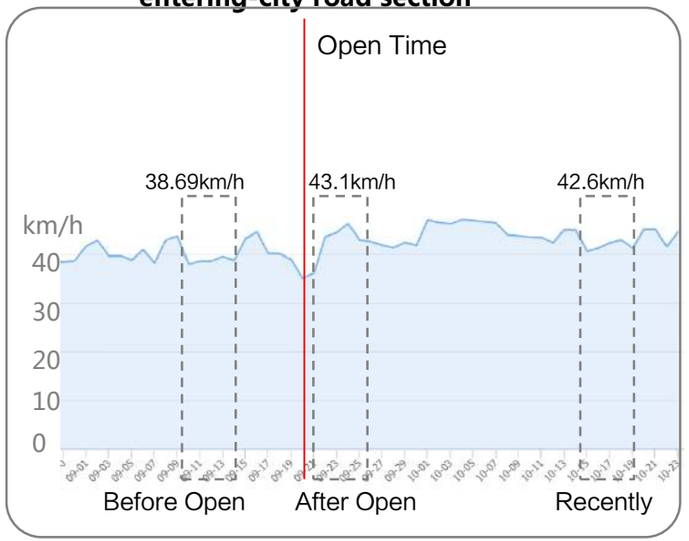
## After S26 entering-city road section open, driving speed of surrounding areas increases 11%, and peak congestion reduces10%

Little congestion can be found in the surrounding area of S26 entering-city road section (G15 Shenhai highway – Jiamin Elevated Road) since it opened, with average speed of 75km/h. Since S26 opened, in surrounding area, the average speed increase at 11% and the congestion delay index during peak congestion reduces at 10% respectively.

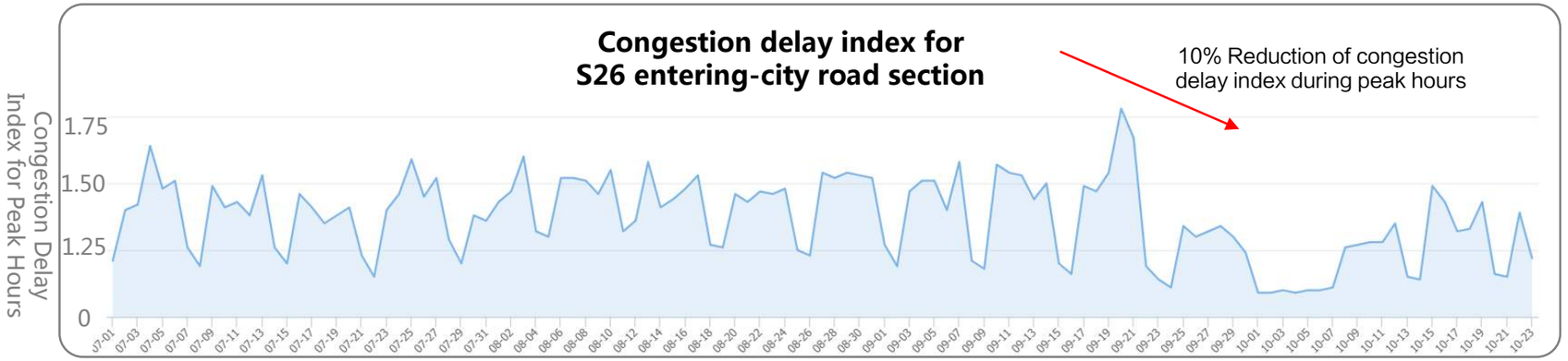
**Location of new open S26 road and its surrounding area**




**Average speed of S26 entering-city road section**

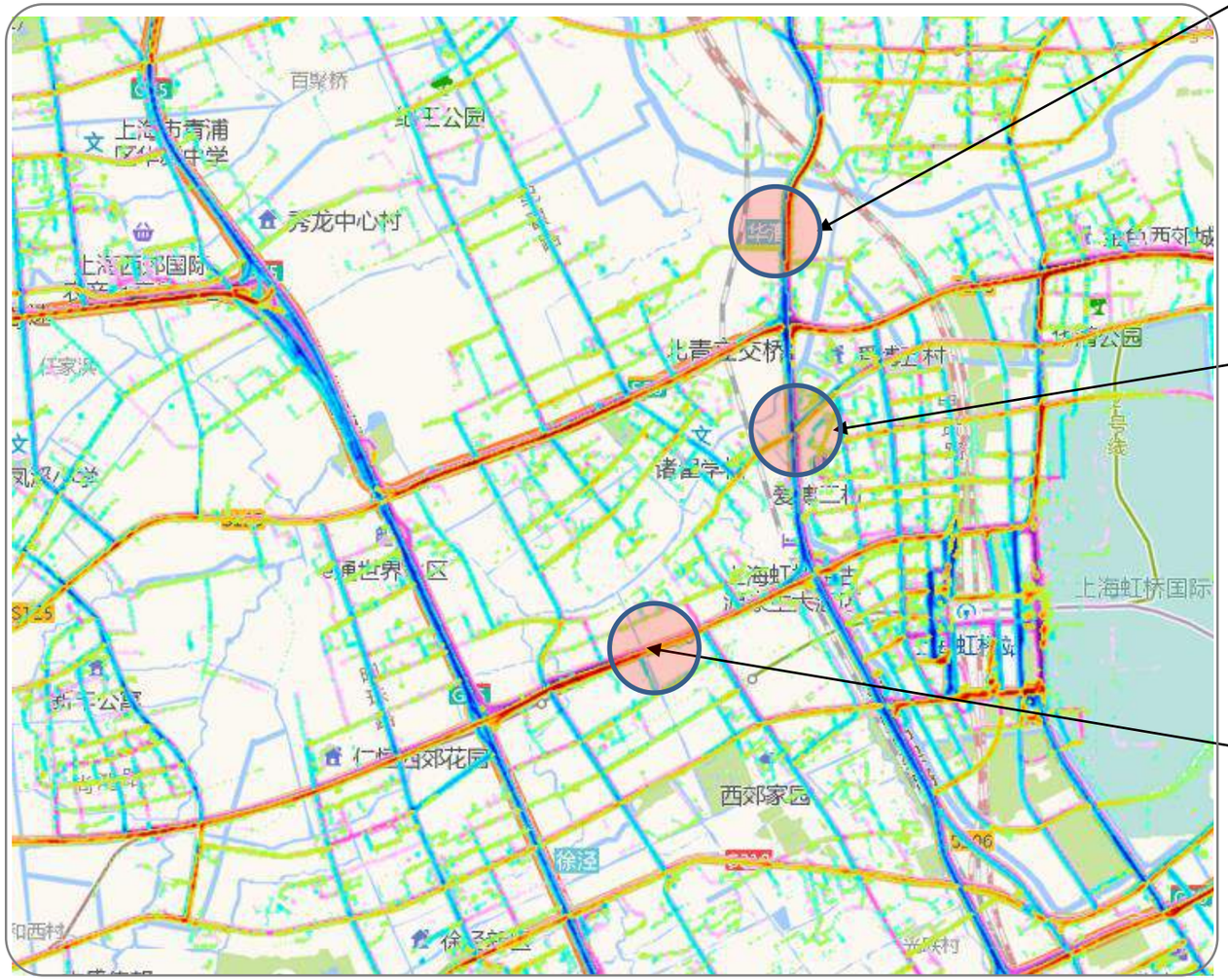


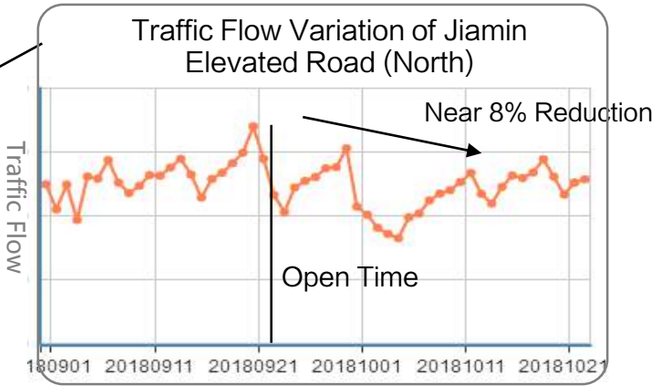

**Congestion delay index for S26 entering-city road section**

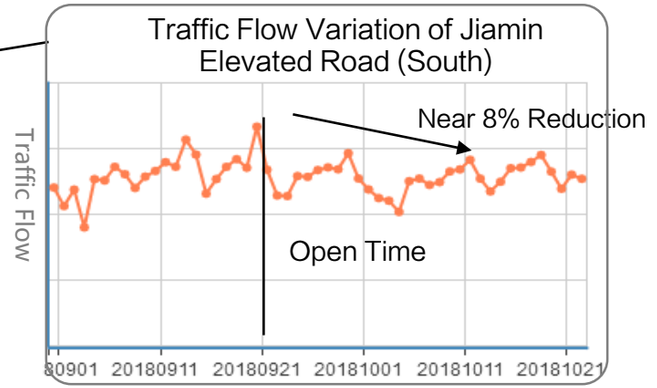


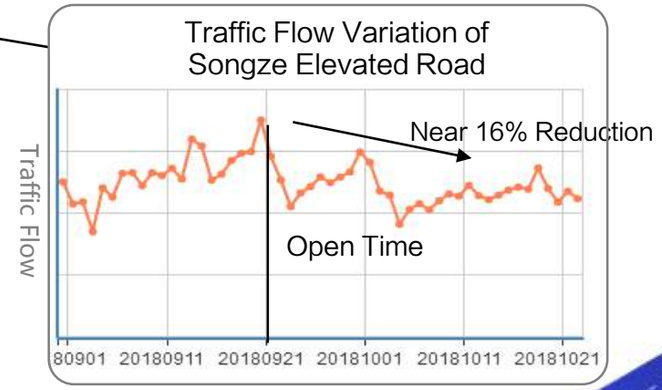
# Congestion analyses for Shanghai—— Impact of new road open on traffic

Significant Impact on traffic flow can be found since the open of S26 entering-city road section (G15 Shenhai highway - Jiamin Elevated Road), with traffic flow reducing at 8% for Jiamin Elevated Road and at 16% for Songze Elevated Road respectively.



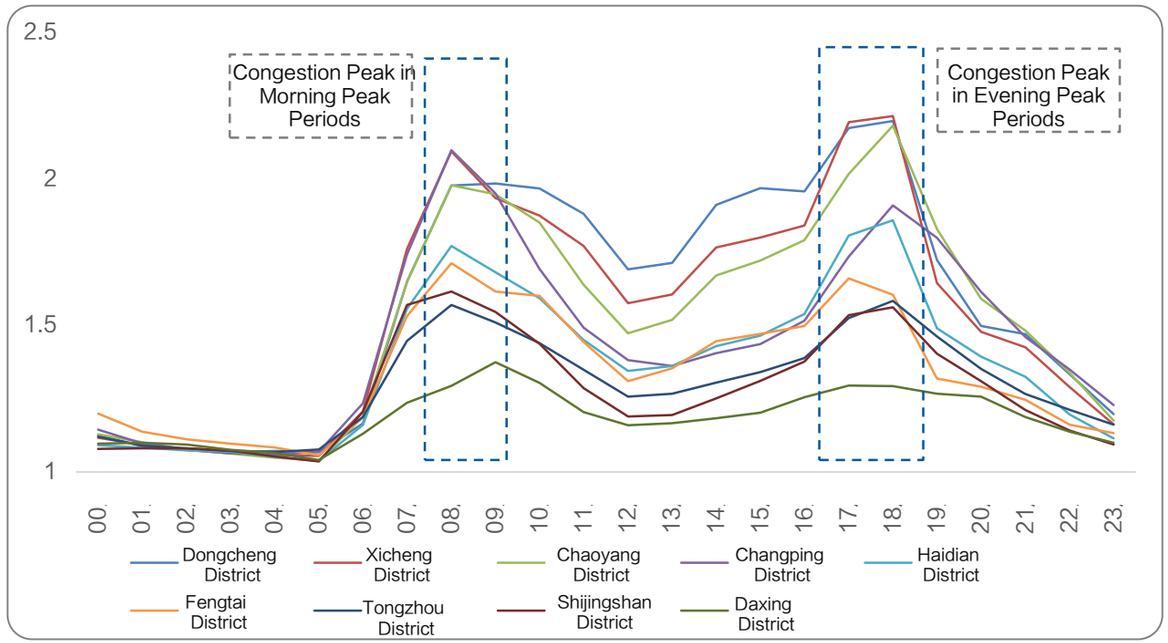



# Congestion analyses for Beijing —— Congestion Pattern

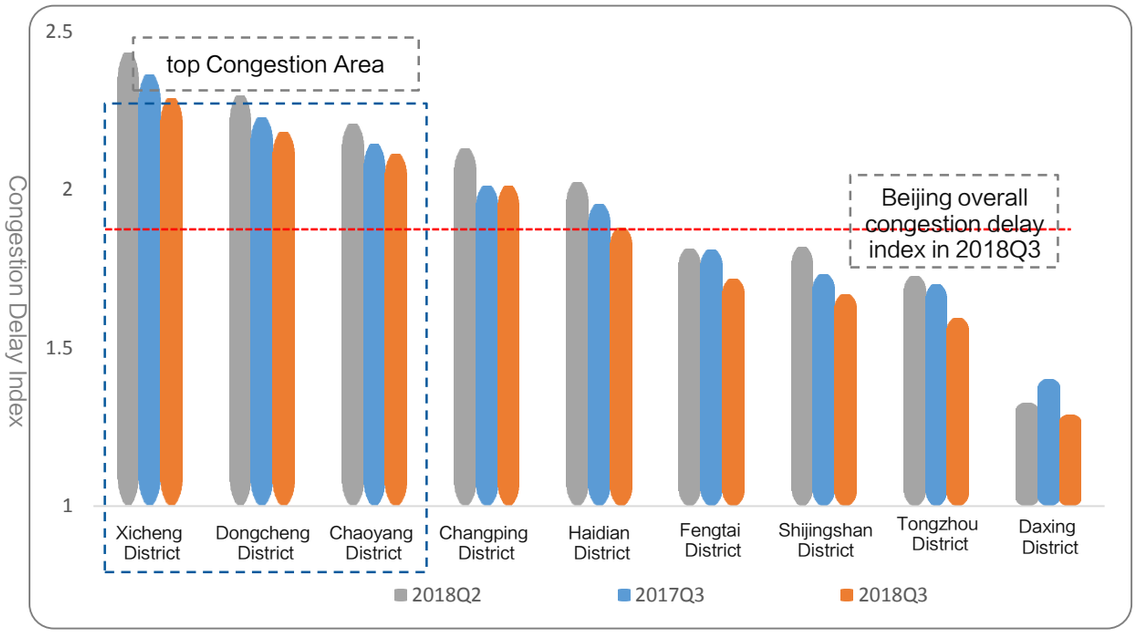
## Peak congestions are still concentrated during the morning and evening peak hours, but the congestion level is slightly better than before

1. The peak congestion in Beijing is still concentrated in the morning and evening peak hours. Congestion is more severe in three major areas, including Xicheng District, Dongcheng District and Chaoyang District, and congestion level in these areas is higher than the overall congestion level in Beijing.
2. In 2018Q3, the peak congestion levels in the morning and evening of each district were slightly lower than those in 2018Q2, and about 5.8% of congestion decline can be found during peak hours.
3. In 2018Q3, the overall congestion levels in each district were also slightly lower than those in 2017Q3, but only 3.7% of congestion decline can be found for the one-year difference, lower than that difference between 2018Q3 and 2017Q3.

24 Hours Average Congestion Delay Index for each Beijing Districts




Comparison between morning and evening peak congestion index in various districts of Beijing



# Congestion analyses for Beijing —— Congestion Pattern

Congestion in Changping District is concentrated in non-urban roads, congestion in other Districts is concentrated in urban roads;

Traffic flows are far more saturated in urban expressway, and traffic guidance need to improve for secondary road and branch road.

| Road Name | Congestion Rank in Q3 | Road Type | Congested Road Number | Slow Driving Road Number | Number for Certain Road Type | Ratio for Certain Road Type | Congestion Rate for Certain Road* | Usage Rate for Certain Road* |
|---|---|---|---|---|---|---|---|---|
| Xicheng District | 1 | Urban Expressway | 8 | 9 | 9 | 4.0% | 88.9% | 100.0% |
| | | Urban Trunk | 41 | 57 | 57 | 20.5% | 71.9% | 100.0% |
| | | Secondary Road | 43 | 123 | 123 | 21.5% | 35.0% | 100.0% |
| Dongcheng District | 2 | Urban Expressway | 8 | 10 | 10 | 4.0% | 80.0% | 100.0% |
| | | Urban Trunk | 28 | 63 | 76 | 14.0% | 36.8% | 82.9% |
| | | Secondary Road | 23 | 67 | 92 | 11.5% | 25.0% | 72.8% |
| Chaoyang District | 3 | Urban Expressway | 19 | 19 | 19 | 9.5% | 100.0% | 100.0% |
| | | Urban Trunk | 29 | 47 | 47 | 14.5% | 61.7% | 100.0% |
| | | Secondary Road | 78 | 117 | 117 | 39.0% | 66.7% | 100.0% |
| Changping District | 4 | Urban Expressway | 0 | 0 | 0 | \ | \ | \ |
| | | Urban Trunk | 2 | 20 | 47 | 1.0% | 4.3% | 42.6% |
| | | Secondary Road | 8 | 36 | 104 | 4.0% | 7.7% | 34.6% |
| Haidian District | 5 | Urban Expressway | 11 | 19 | 19 | 5.5% | 57.9% | 100.0% |
| | | Urban Trunk | 21 | 59 | 59 | 10.5% | 35.6% | 100.0% |
| | | Secondary Road | 40 | 107 | 107 | 20.0% | 37.4% | 100.0% |

* Road selection standard: Select the roads in certain areas that belong to top 200 congested road list in the area and with length more than 200 meters. If there is congestion on the road during the period, it will be selected as a congested road; If there is a slow or congested phenomenon, it is considered to be a road with high frequent usage.

Select the top 200 congested roads in each district to analyze the causes of congestion:

**（1）Traffic flows are far more saturated in urban expressway (red number part)**

In Xicheng District, Dongcheng District, Chaoyang District and Haidian District, the high congested road are all urban expressway, and the usage rate of urban expressway is 100%.

The two indicators indicate that most drivers prefer driving on urban expressway during morning and evening peak hours. Such excessive traffic flow lead to a supersaturated state for urban expressway, and the congestion is therefore aggravated.

**（2）The effect of traffic flow guidance for branch road and secondary road is not good enough (point-shaped circle part):**

The Urban trunk and secondary road have higher usage rates, but the congestion rate of both urban trunk and secondary road is much different to the congestion rate of urban expressway.

Such result indicates that little alteration to branch road or secondary road when congestion is high or severe, and little behavior change for drivers when suffer from congestion on urban expressway.

**（3）Congestion areas of Changping District are concentrated on branch roads and non-urban roads (point box)**

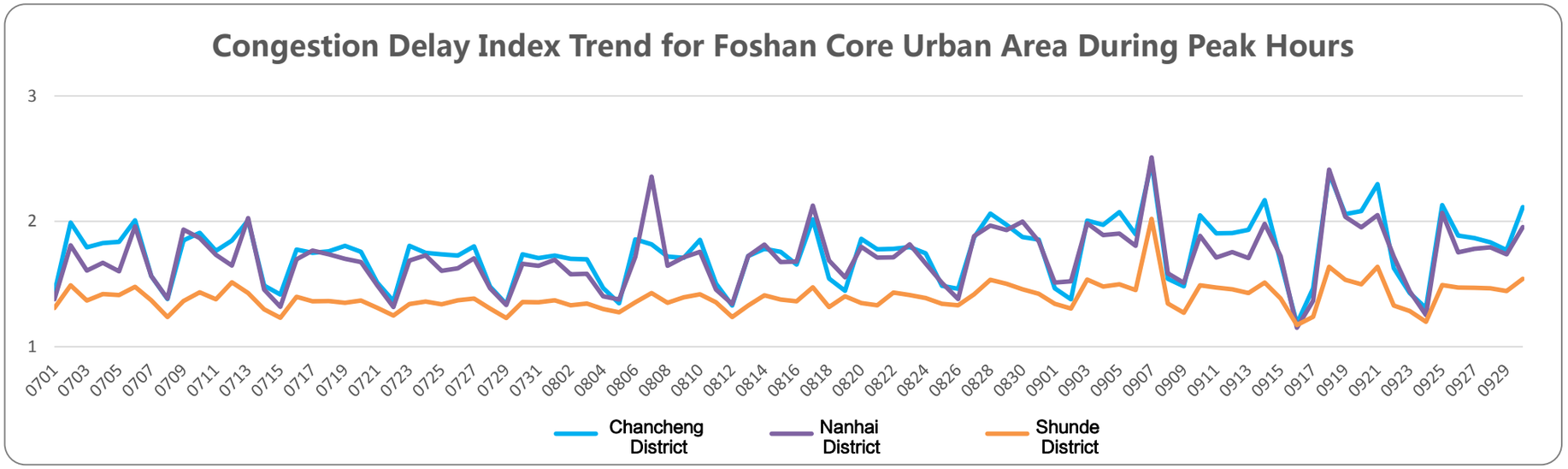
There is no congested expressway in Changping District, and the road congestion rate is also low (less than 10%) under the low usage rate of urban expressway and secondary road. This indicates that the congestion is mostly concentrated on the branch road or non-urban road (namely high highway and country road).

# Congestion analyses for Foshan —— Congestion Pattern

**Foshan Chancheng District has the highest degree of congestion, and Nanhai District has a relatively large increase on congestion compared with last quarter**

1. From the perspective of space, the congestion growth of the core region in Foshan mainly comes from Nanhai District.
2. In Nanhai District, the congestion delay index of working days in 2018 Q3 during peak hours has reached 1.81, with an increase of 3.39% compared with last quarter.

| District | Congestion Delay Index in 2018 Q3 | Congestion Delay Index in 2018 Q2 | Rate of Change between 2018 Q2 and 2018 Q3 |
|---|---|---|---|
| Chancheng District | 1.88 | 1.93 | −2.48% |
| Nanhai District | 1.81 | 1.75 | 3.39% |
| Shunde District | 1.44 | 1.42 | 1.05% |

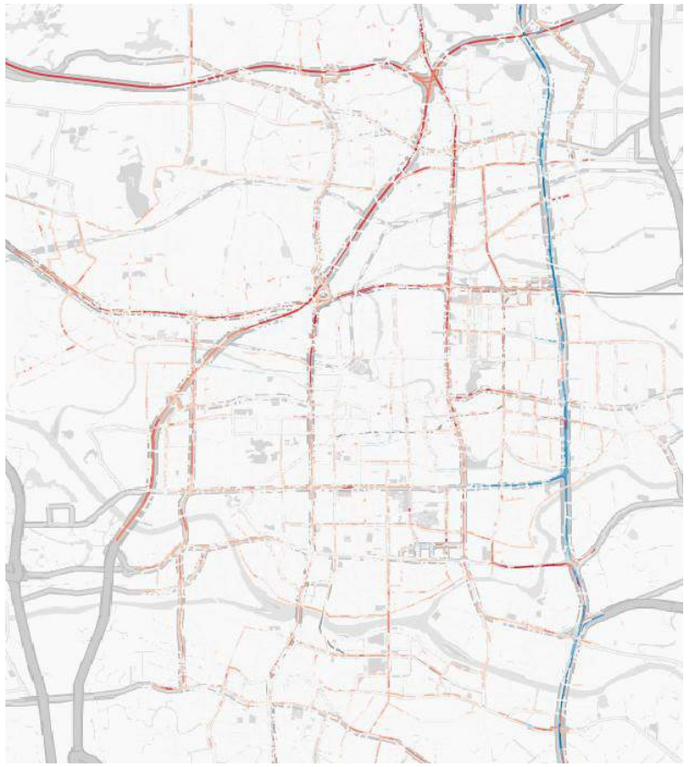


# Congestion analyses for Foshan —— Congestion Pattern

## Road construction and bad weather are main factors in causing congestion

Many road constructions can be found in one ring highway, and many road closures can also be found in east line of Fojiang North Expressway, including the inner ring of Liguang Road to Guiping Road, the inner ring of Zhongxin Avenue to Liguang Road of Fojiang North Expressway, the outer ring of Guiping Road to Lishui Interchange, etc. Road constructions make traffic imbalanced in surrounding area and result in traffic congestion in some areas. Besides, abnormal weather also aggravated road congestion. For example, the heavy rains on August 7, September 7 and September 18, due to the transit of typhoon Mangosteen has aggravated urban congestion.

Variation on road traffic flow between Q3 and Q2, and a large amount of traffic flow is shared between urban roads and other main roundabouts around the city, due to road construction on Foshan One Ring road.



Blue means less traffic volume, red means more traffic volume, the darker the color, the greater the change of road traffic.

On August 7, Guihe Road, as frequent congested road in evening peak, suffered from heavy rain, which aggravated congestion and traffic accidents.

On September 7, Friday evening peak and sudden strong thunderstorm resulted in a wide range of serious congestions

On September 18, the first day of resumption of work after the transit of Typhoon Mangosteen, heavy traffic and road repairs resulted in continuous congestion on a large scale throughout the day.

# Appendix A（Peak Congestion Delay Index Rank 1~25）

| Rank | Change Rate vs 2018 Q2 | Change Rate vs 2017 Q3 | City Name | Congestion Delay Index in Peak | Actual Peak Speed km/h | Congestion Delay Index All Day | Congestion Delay Index Morning Peak | Congestion Delay Index Evening Peak | Congestion Delay Index Non Peak* |
|---|---|---|---|---|---|---|---|---|---|
| 1 | −5.4% | −3.1% | Beijing | 1.982 | 23.91 | 1.68 | 1.94 | 2.03 | 1.57 |
| 2 | −3.8% | −3.0% | Chongqing | 1.872 | 26.15 | 1.56 | 1.87 | 1.88 | 1.46 |
| 3 | −4.2% | −8.8% | Harbin | 1.869 | 23.97 | 1.58 | 1.87 | 1.86 | 1.48 |
| 4 | −8.3% | −3.8% | Guangzhou | 1.862 | 24.51 | 1.66 | 1.59 | 2.13 | 1.60 |
| 5 | −1.3% | 3.1% | Guiyang | 1.857 | 25.26 | 1.59 | 1.75 | 1.97 | 1.50 |
| 6 | −1.9% | −3.3% | Changchun | 1.837 | 24.73 | 1.53 | 1.87 | 1.80 | 1.43 |
| 7 | −4.1% | −3.8% | Shanghai | 1.827 | 23.29 | 1.57 | 1.81 | 1.84 | 1.48 |
| 8 | 0.4% | 1.1% | Foshan | 1.808 | 24.02 | 1.56 | 1.59 | 2.02 | 1.48 |
| 9 | −2.4% | 0.5% | Shenzhen | 1.788 | 26.14 | 1.63 | 1.60 | 1.97 | 1.57 |
| 10 | −2.4% | −2.3% | Chengdu | 1.784 | 26.08 | 1.59 | 1.70 | 1.87 | 1.53 |
| 11 | −0.9% | −5.2% | Kunming | 1.775 | 24.04 | 1.59 | 1.58 | 1.97 | 1.52 |
| 12 | −2.5% | −8.2% | Dalian | 1.772 | 26.60 | 1.50 | 1.81 | 1.73 | 1.40 |
| 13 | −0.6% | −6.7% | Hefei | 1.741 | 25.34 | 1.47 | 1.67 | 1.82 | 1.38 |
| 14 | −6.5% | −5.0% | Hohhot | 1.741 | 26.38 | 1.51 | 1.67 | 1.81 | 1.44 |
| 15 | −4.0% | −2.3% | Nanning | 1.740 | 23.00 | 1.59 | 1.54 | 1.93 | 1.53 |
| 16 | −2.4% | −2.2% | Changsha | 1.728 | 25.34 | 1.50 | 1.63 | 1.83 | 1.42 |
| 17 | −4.8% | −4.1% | Shenyang | 1.720 | 26.40 | 1.48 | 1.72 | 1.72 | 1.40 |
| 18 | −3.9% | 0.2% | Lanzhou | 1.720 | 23.81 | 1.57 | 1.67 | 1.77 | 1.52 |
| 19 | −9.1% | −16.9% | Jinan | 1.717 | 28.16 | 1.48 | 1.71 | 1.73 | 1.41 |
| 20 | −3.1% | −5.3% | Nanjing | 1.714 | 25.52 | 1.49 | 1.68 | 1.75 | 1.41 |
| 21 | −3.7% | −6.4% | Yantai | 1.709 | 26.07 | 1.45 | 1.70 | 1.72 | 1.36 |
| 22 | −4.6% | −10.0% | Xi'an | 1.691 | 26.45 | 1.53 | 1.62 | 1.76 | 1.48 |
| 23 | −1.4% | 0.5% | Dongguan | 1.669 | 29.87 | 1.50 | 1.54 | 1.80 | 1.44 |
| 24 | −4.8% | −5.0% | Fuzhou | 1.664 | 27.86 | 1.46 | 1.58 | 1.75 | 1.40 |
| 25 | −0.8% | 3.9% | Xiamen | 1.650 | 28.32 | 1.45 | 1.50 | 1.80 | 1.38 |

**Note:** Only 50 cities have been selected for congestion rank, according to the conditions of urban population, GDP, car parc and city size.

Non Peak periods stands for time between 6:00~22:00 except 7:00~9:00 and 17:00~19:00

# Appendix A（Peak Congestion Delay Index Rank 26~50）

| Rank | Change Rate vs 2018 Q2 | Change Rate vs 2017 Q3 | City Name | Congestion Delay Index in Peak | Actual Peak Speed km/h | Congestion Delay Index All Day | Congestion Delay Index Morning Peak | Congestion Delay Index Evening Peak | Congestion Delay Index Non Peak* |
|---|---|---|---|---|---|---|---|---|---|
| 26 | −1.6% | −1.9% | Taiyuan | 1.642 | 30.00 | 1.44 | 1.62 | 1.67 | 1.38 |
| 27 | −5.9% | −4.9% | Wuhan | 1.622 | 30.05 | 1.42 | 1.59 | 1.65 | 1.35 |
| 28 | −3.7% | −4.1% | Xining | 1.619 | 31.05 | 1.48 | 1.52 | 1.72 | 1.44 |
| 29 | −3.9% | −0.1% | Tianjin | 1.618 | 29.25 | 1.41 | 1.64 | 1.60 | 1.35 |
| 30 | −1.9% | −4.4% | Hangzhou | 1.616 | 25.58 | 1.51 | 1.60 | 1.63 | 1.48 |
| 31 | −4.1% | −7.3% | Luoyang | 1.607 | 24.28 | 1.49 | 1.55 | 1.66 | 1.45 |
| 32 | −2.8% | −1.4% | Suzhou | 1.603 | 30.06 | 1.37 | 1.59 | 1.62 | 1.29 |
| 33 | 3.0% | −10.5% | Qingdao | 1.599 | 31.86 | 1.39 | 1.58 | 1.62 | 1.32 |
| 34 | −3.5% | −5.9% | Zhengzhou | 1.593 | 30.29 | 1.46 | 1.54 | 1.64 | 1.41 |
| 35 | −2.0% | 0.3% | Baoding | 1.585 | 30.66 | 1.43 | 1.56 | 1.61 | 1.38 |
| 36 | −3.1% | −6.1% | Nanchang | 1.581 | 27.34 | 1.40 | 1.54 | 1.63 | 1.35 |
| 37 | −5.2% | −10.8% | Tangshan | 1.568 | 27.68 | 1.41 | 1.54 | 1.60 | 1.35 |
| 38 | −2.9% | −3.1% | Ningbo | 1.560 | 26.52 | 1.37 | 1.53 | 1.59 | 1.30 |
| 39 | −0.9% | −4.5% | Wenzhou | 1.558 | 27.71 | 1.41 | 1.47 | 1.65 | 1.36 |
| 40 | −1.7% | −2.7% | Liuzhou | 1.547 | 24.74 | 1.43 | 1.45 | 1.64 | 1.39 |
| 41 | −1.2% | −5.2% | Wuxi | 1.522 | 31.65 | 1.33 | 1.47 | 1.57 | 1.27 |
| 42 | −2.5% | −3.9% | Shaoxing | 1.513 | 29.22 | 1.35 | 1.47 | 1.56 | 1.30 |
| 43 | −11.4% | −13.2% | Shijiazhuang | 1.503 | 32.90 | 1.36 | 1.46 | 1.55 | 1.31 |
| 44 | −10.9% | −0.4% | Zibo | 1.502 | 29.90 | 1.36 | 1.46 | 1.55 | 1.31 |
| 45 | −2.0% | −5.8% | Quanzhou | 1.477 | 31.25 | 1.36 | 1.35 | 1.60 | 1.32 |
| 46 | −7.0% | −6.5% | Yangzhou | 1.471 | 33.80 | 1.35 | 1.43 | 1.52 | 1.31 |
| 47 | −1.6% | −5.4% | Taizhou | 1.454 | 30.49 | 1.33 | 1.42 | 1.49 | 1.29 |
| 48 | −3.1% | −4.4% | Changzhou | 1.442 | 34.66 | 1.31 | 1.42 | 1.47 | 1.26 |
| 49 | −3.6% | −7.4% | Urumqi | 1.338 | 34.48 | 1.48 | 1.19 | 1.48 | 1.53 |
| 50 | −1.9% | −4.9% | Nantong | 1.335 | 38.65 | 1.23 | 1.30 | 1.37 | 1.20 |

**Note:** Only 50 cities have been selected for congestion rank, according to the conditions of urban population, GDP, car parc and city size.

Non Peak periods stands for time between 6:00~22:00 except 7:00~9:00 and 17:00~19:00

# City Congestion Management Case Study Applying Internet+

# AMAP services improve traffic management and reduce congestion

Intelligence route guidance alleviates road congestion by the means of early diversion and extreme congestion avoidance. Pre-diversion, through optimizing the flow distribution, smoothly increase traffic capacity for the intervened road under the premise of stable traffic speed. Integrated with smart IOT-based traffic cone, AutoNavi has developed a series of road safety solutions, based on the Internet of Things in conjunction with a number of industry management units. For example, updated traditional traffic safety facilities (such as traffic reflective cone, traffic accident rack, etc) with new Internet of Things modules and location modules, the smart IOT-based traffic cone can collect and publish traffic events information, such as road construction, traffic accident and road closed or road control

## Intelligent route guidance

Extreme congestion avoidance during National Day reduced traffic flow by 23.2% and increased speed by 22.6%.

Traffic Flow Reduce

23.2%

Speed Increase

22.6%

Compared with May 1, the number of route plan changed by dispatching intervention has been greatly increased, the impact of route planning has increased by 5.3 times, and the impact of users has increased by 3.5 times.

Number of route plan changed

5.3 Times

Number of route changed users

3.5 Times

## Smart IOT-based traffic cone

Until now, smart IOT-based traffic cone has been popularized in 20 provinces and cities, and applied in more than 80 industry management departments

Province and city

20

Industry management departments

80

Since two months that applied Smart IOT-based traffic cone, the overall rate of traffic accidents notifications for users has increased by 39%, the proportion of rear-end accidents has decreased from 81% to 69%, and the secondary accidents have decreased by 34% (the figures are fed from some users).

Overall rate of traffic notifications reduce

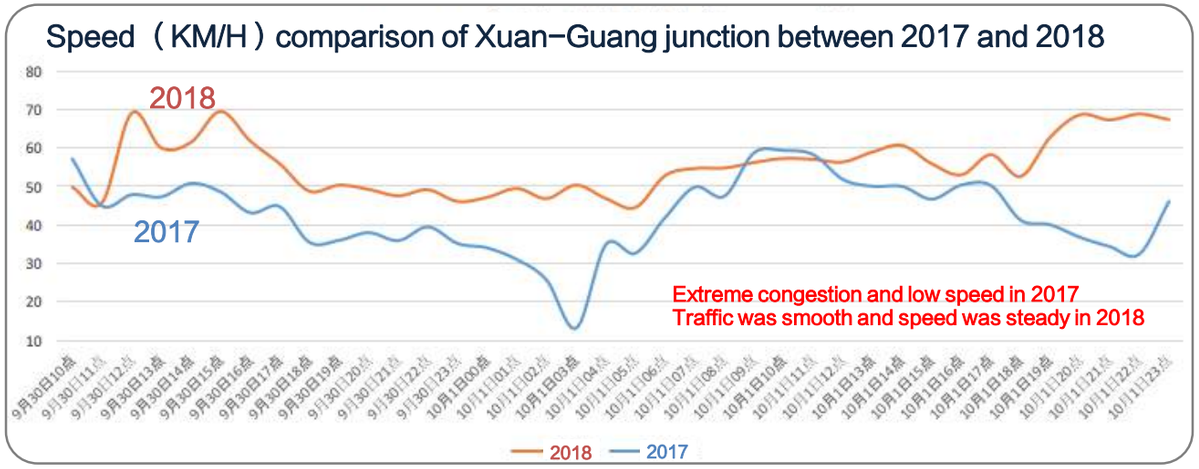
39%

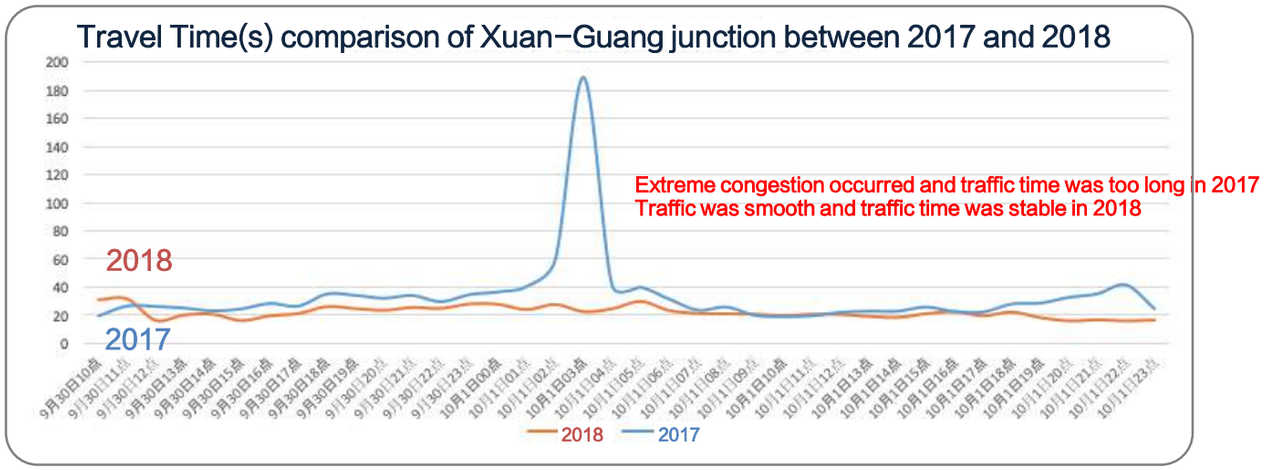
Rate of the secondary accidents reduce

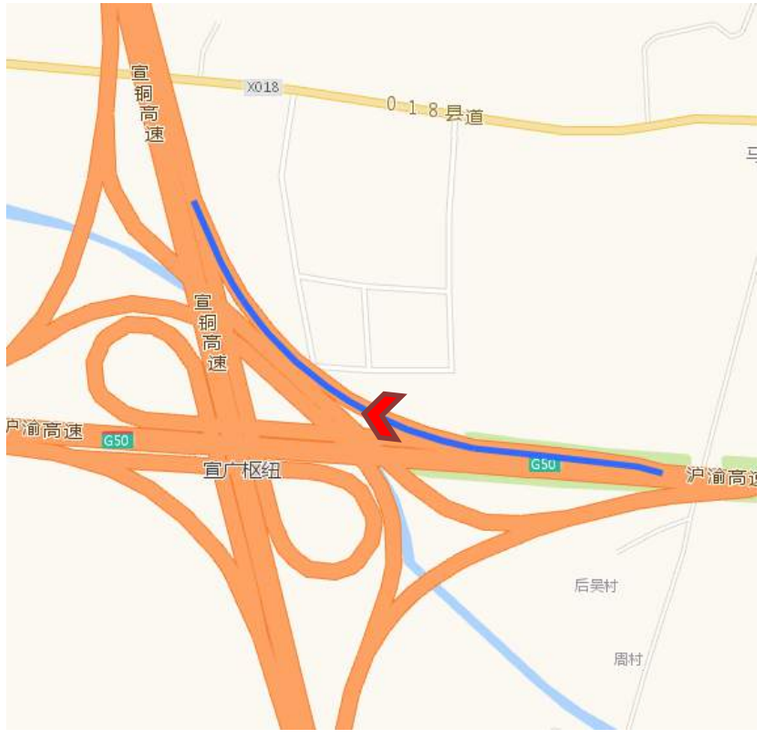
34%

## Route recommendation priority alternation for Xuancheng Xuanguang Junction east part

During holiday, Xuancheng Xuanguang Junction in east to west direction is prone to congestion, but after route recommendation priority alternation since Sep.30 and Oct.01, traffic congestion reduced dramatically due to early traffic flow distribution. During the intervention period, the road congestion was effectively alleviated. The traffic condition of the intervention road was stable compared with that of last year, and there was no serious congestion, with overall traffic speed increasing by 30.0% and traffic time decreasing by 34.7%. At the same time, the alternative recommended road is in good traffic condition and is with no congestion.



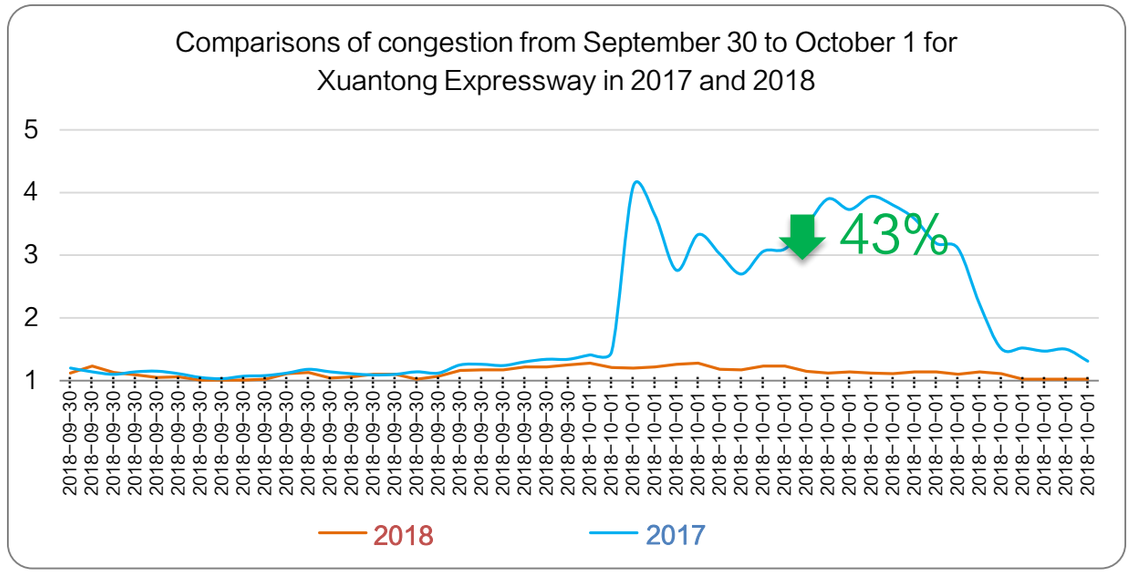



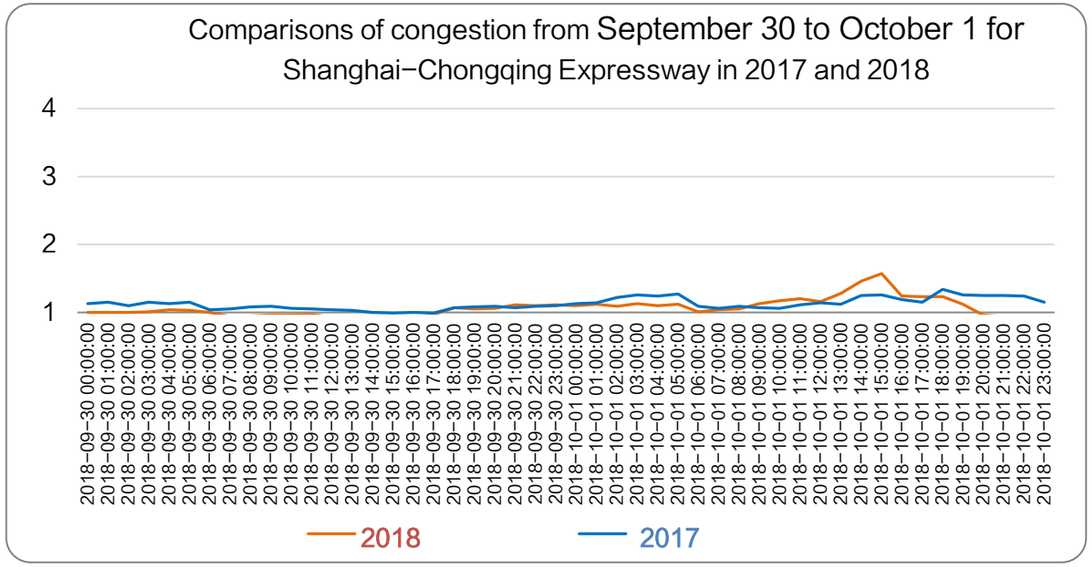



# City traffic management case analyses —— Intelligent route guidance

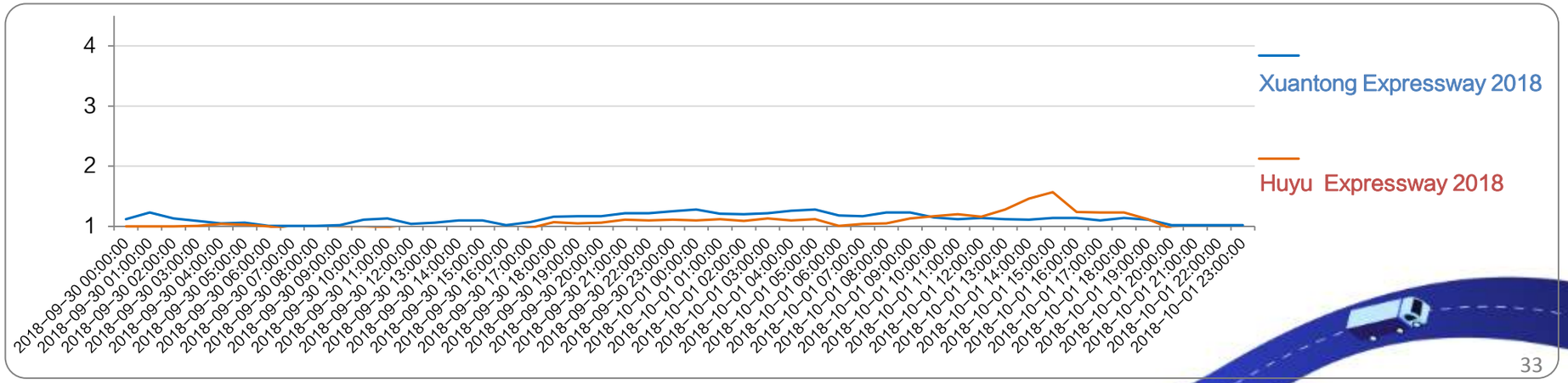
## Congestion improvement evaluation for Xuancheng Xuanguang Junction east part after route recommendation priority change

During holiday, Xuancheng Xuanguang Junction in east to west direction is prone to congestion, but after route recommendation priority alternation since Sep.30 and Oct.01, traffic congestion reduced dramatically due to early traffic flow distribution. **During the intervention period, the congestion of Xuantong Expressway was effectively alleviated. The average congestion index of Xuantong Expressway in 2017 was 1.97, while in 2018 it was only 1.12, and the congestion relief rate was 43%.At the same time, new alternative recommended road was steady compared last Q3 in 2017, and traffic was overall smooth.**



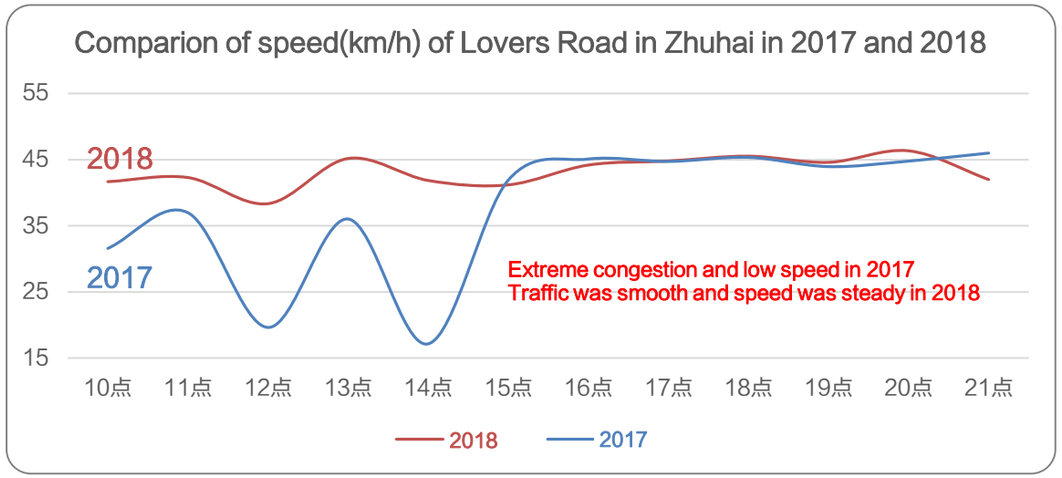


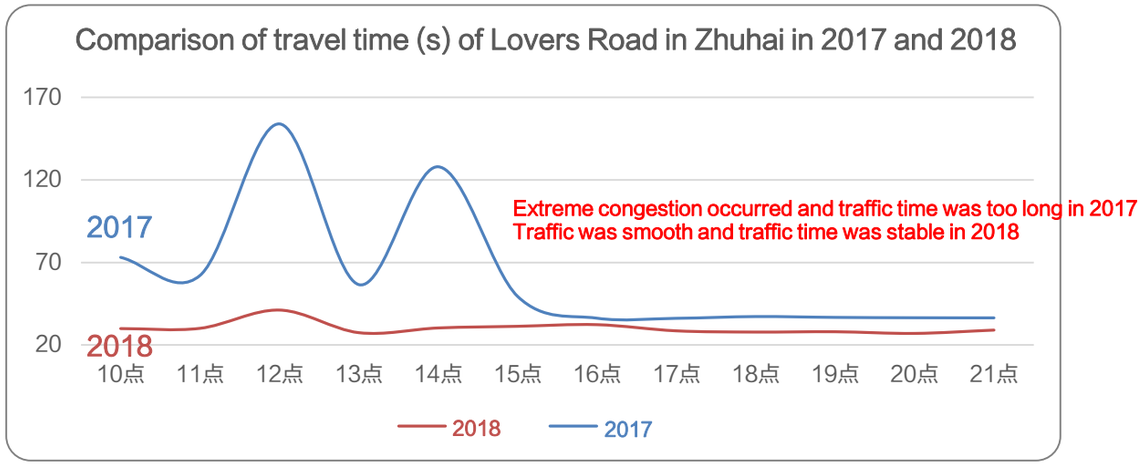


# City traffic management case analyses —— Intelligent route guidance

## Route recommendation priority alternation and traffic flow distribution in arrival point.

During the National Day, a beach music festival was held near Lovers Road in Zhuhai. In order to alleviate the congestion, road recommendation priority has been adjusted for the related roads, in which traffic flow can be distributed in advanced in 2018.10.2；At the same time, arrival points have been intervened and parking points are guided for traffic flow distribution. **The traffic condition of the intervention roads was stable and there was no congestion compared with last year. The overall traffic speed increased by 14.3% and the traffic time decreased by 51.1%. At the same time, it is recommended that the road traffic condition is good and there is no congestion.**

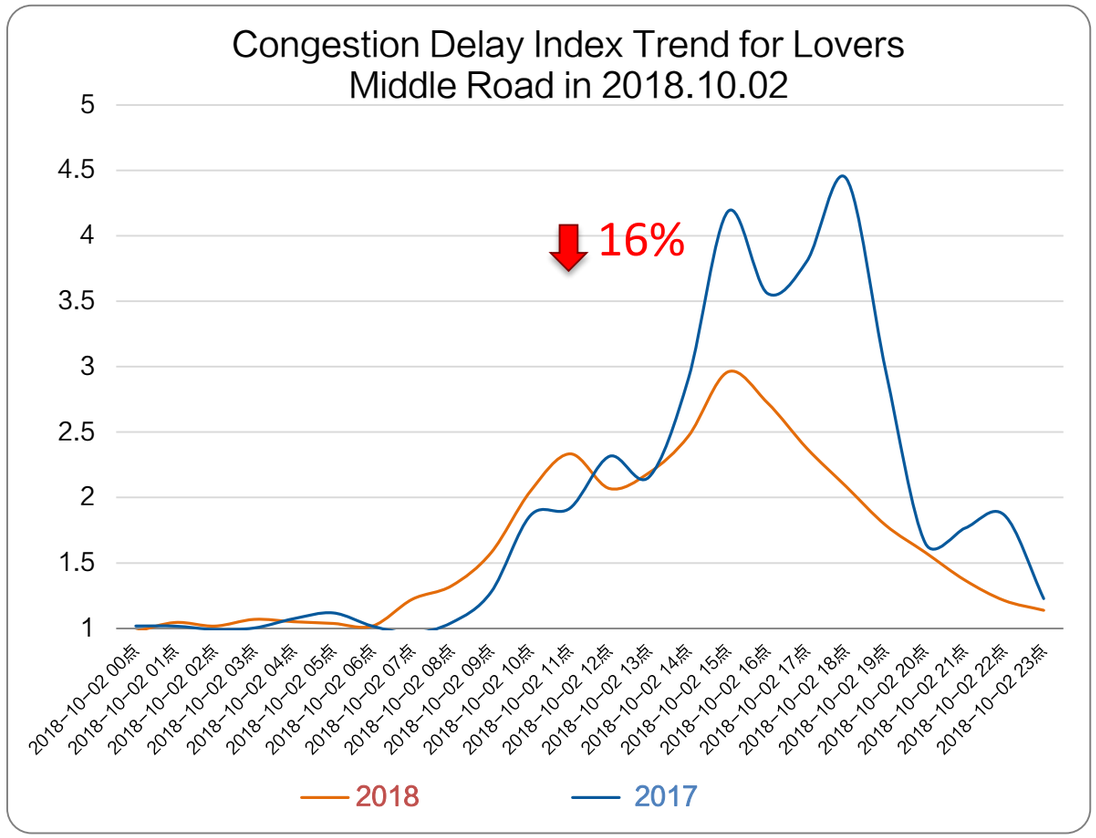


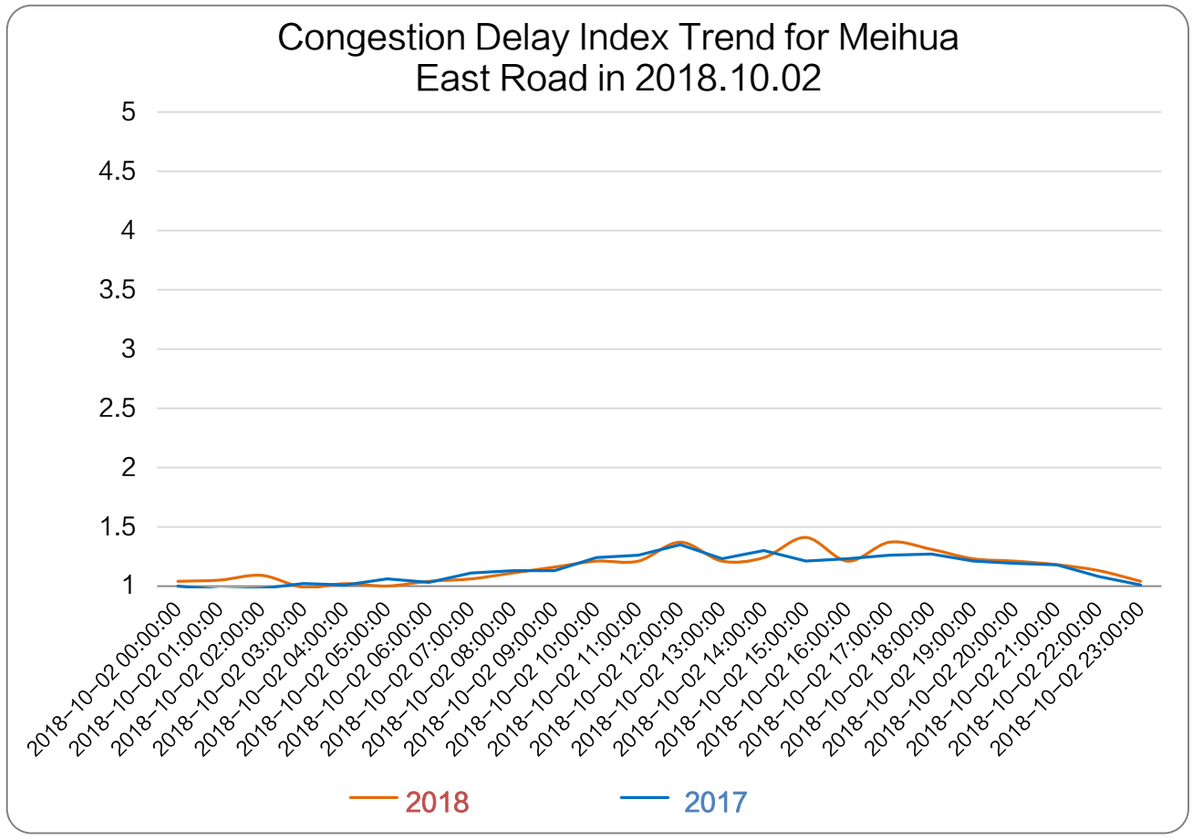




# City traffic management case analyses —— Intelligent route guidance

**Congestion improvement evaluation during beach music festival in Zhuhai after route recommendation priority change**

During the National Day, a beach music festival was held near Lovers Road in Zhuhai. In order to alleviate the congestion, road recommendation priority has been adjusted for the related roads, in which traffic flow can be distributed in advanced in 2018.10.2；**The traffic condition of the intervened Lovers Middle Road is more stable than that of last year. The all-day congestion delay index is only 1.65, which is about 16% lower than that of last year's National Day. At the same time, the recommended alternative road of Meihua East Road has good traffic conditions and no congestion.**

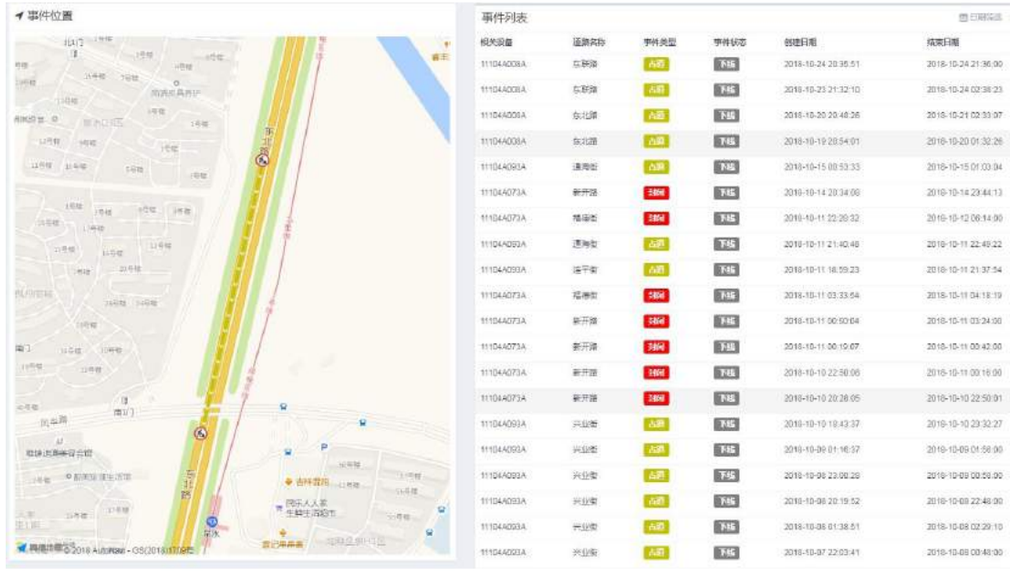


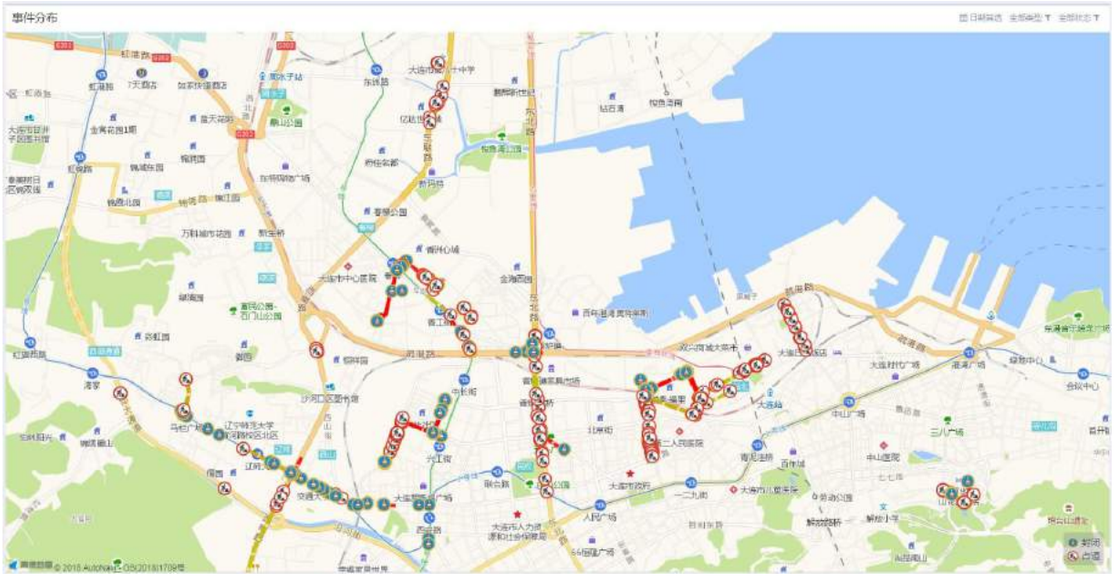
# City traffic management case analyses —— Smart IOT-based traffic cone

Dalian Traffic Police use the Smart IOT-based traffic cone throughout the city. Road closure and construction information can be broadcasted accurately, and the location can be accurate within second-level and within meter-level. These services remind users to drive carefully and bypass in time, which effectively improves road traffic efficiency. 2018 Q3 is the peak season for tourism in Dalian, but more tourisms did not lead to an increase on congestion level, the congestion in Dalian decreased by 8.2% year on year. From the average speed, the average speed of Dalian in this season was 26.6 km/h, which was 9.1% higher than Q3 2017.

Traffic Events Record in Dalian

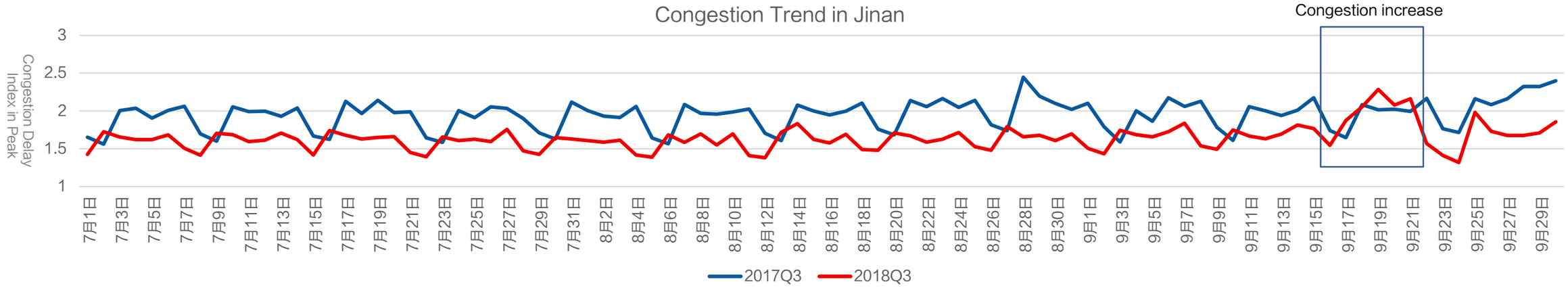



Traffic Events Broadcast in Dalian



## Congestion of Jinan in 2018Q3 decreased compared with 2017Q3

From the all-day congestion trend of Jinan in 2018 Q3, the congestion was relatively stable from July to early September. Only in mid-September, there was a serious congestion, which was due to continuous rainfall. The congestion degree in other periods has improved significantly, compared with 2017 Q3. Spatially, compared with 2017 Q3, the numbers of road in slow driving state in urban area of Jinan decreased, and the congested areas was also smaller. Such improvement on travel efficiency is closely related to more road establishment that to shape network connection for urban expressway in Jinan.




2017.9.30.18：00

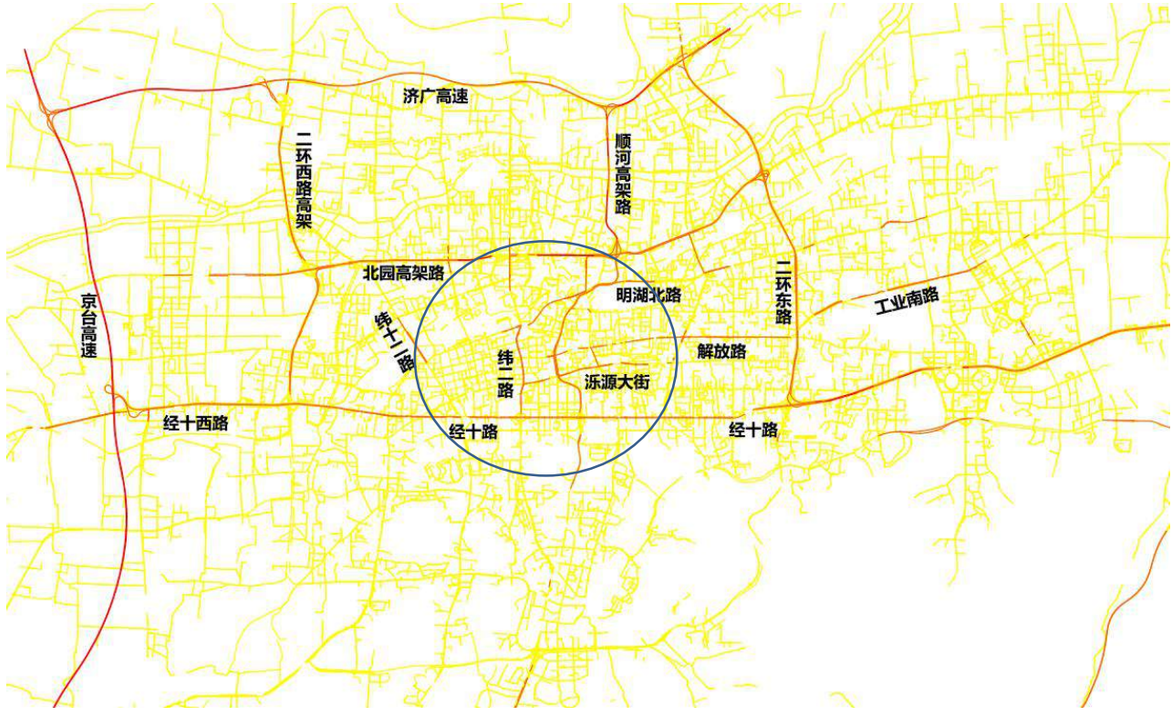
2018.9.30.18：00

# City traffic management case analyses —— Jinan

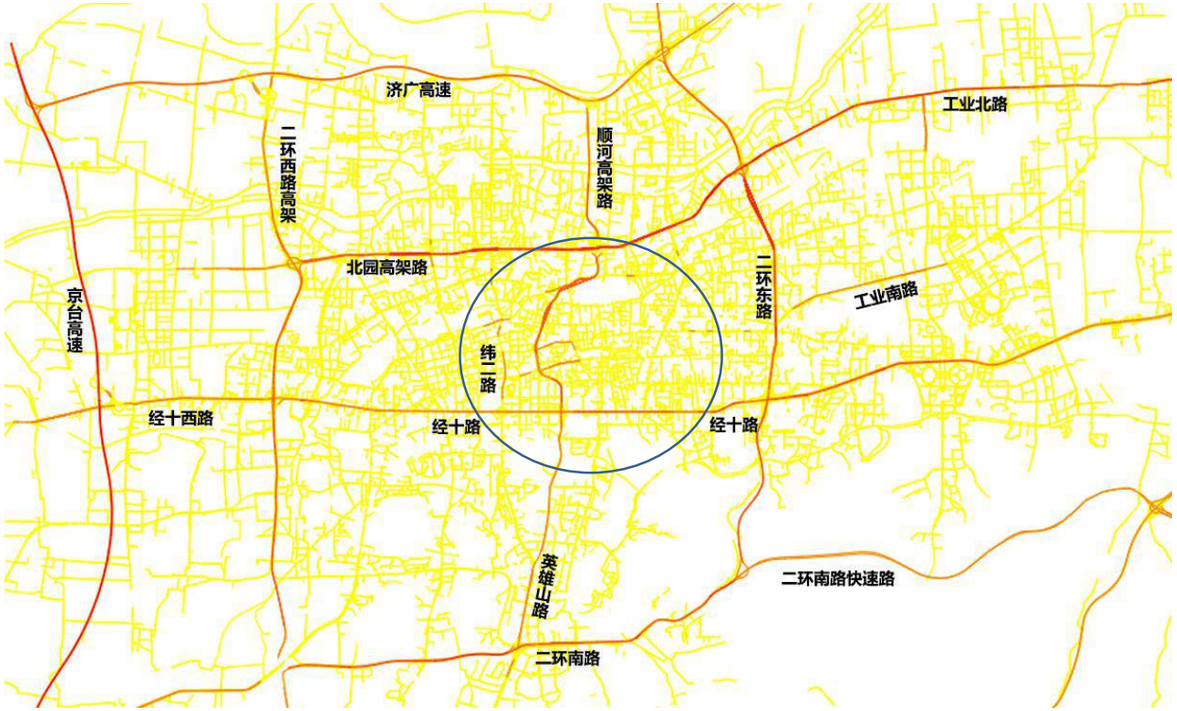
**Network shaped connection for urban expressway has relieved the traffic pressure of the main roads in the urban area of Jinan and made the congestion in Jinan decrease significantly.**

The traffic congestion of Wei12 Road (north to south) declined by 28.7% compared with 2017 Q3, while that of Minghui North Road (east to west) declined by 16.3% compared with 2017 Q3. According to the traffic flow distribution, road in urban area took part of the transit traffic in 2017 Q3, because no establishment on the shaped network connection for Jinan's expressway; However, after the establishment on the shaped network connection for Jinan's expressway, no transit traffic flow needed to be bear, which made the main road traffic flow reduced and congestion alleviated.

Main Traffic Flow Distribution of Jinan in Evening Peak in 2017Q3 in urban area




Main Traffic Flow Distribution of Jinan in Evening Peak in 2018Q3 in urban area

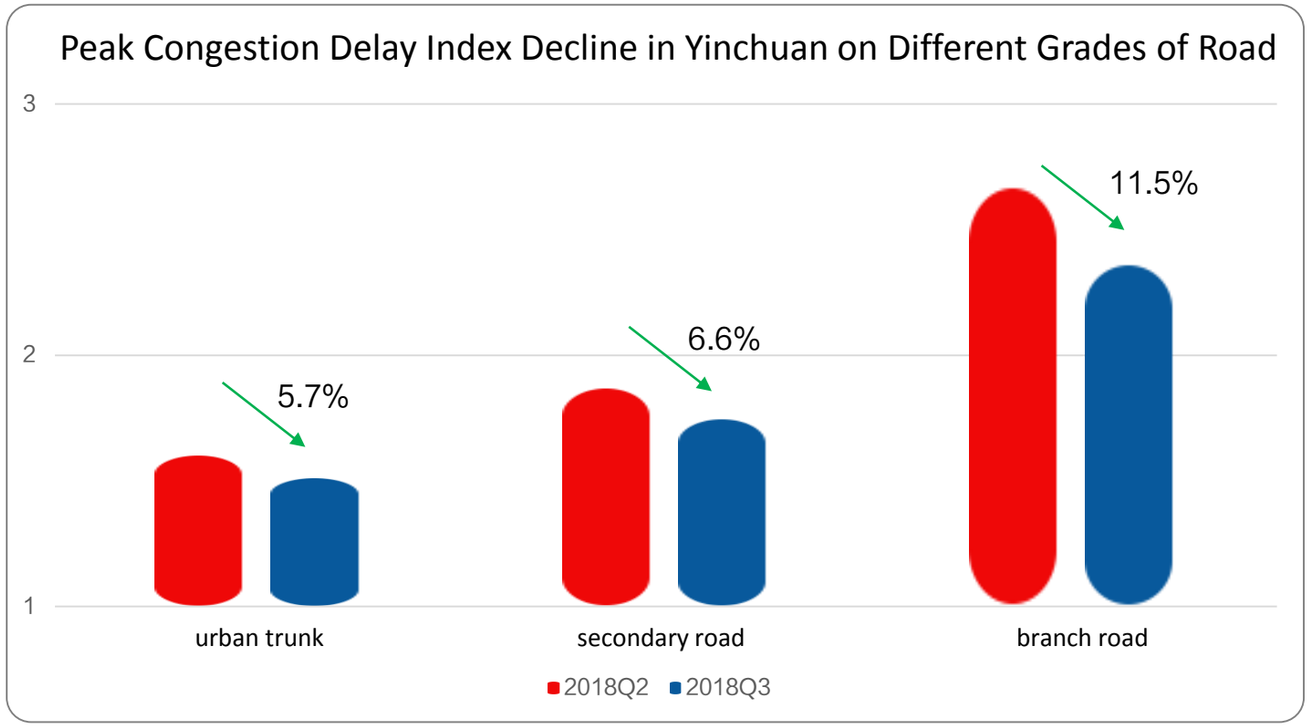


## Congestion in Yinchuan decreased by 0.4% compared with 2017 Q3 and 6.5% compared with 2018 Q2.

We monitored the congestion situation in Yinchuan by comparing with 2017 Q2 and 2018Q3. The data showed that the congestion situation in Yinchuan has decreased by 0.4% and 6.5% respectively compared with 2017 Q3 and 2018 Q2.The decreased congestion in this quarter might be related to the "smooth congestion activity" proposed by Yinchuan municipal government at the end of April. At present, from the perspective of congestion alleviation on all levels of roads, the effect of Yinchuan's congestion control is beginning to show. It is reported that in the future, Yinchuan will make great efforts in traffic signal optimization, intelligent guidance, command and dispatch, traffic organization planning and function optimization, so as to build Yinchuan's transportation city brain, serving for traffic management and public travel.

## The ratio of different grades of roads in Yinchuan gradually declined, compared with 2018 Q2,and the decrease of branch roads was the largest.

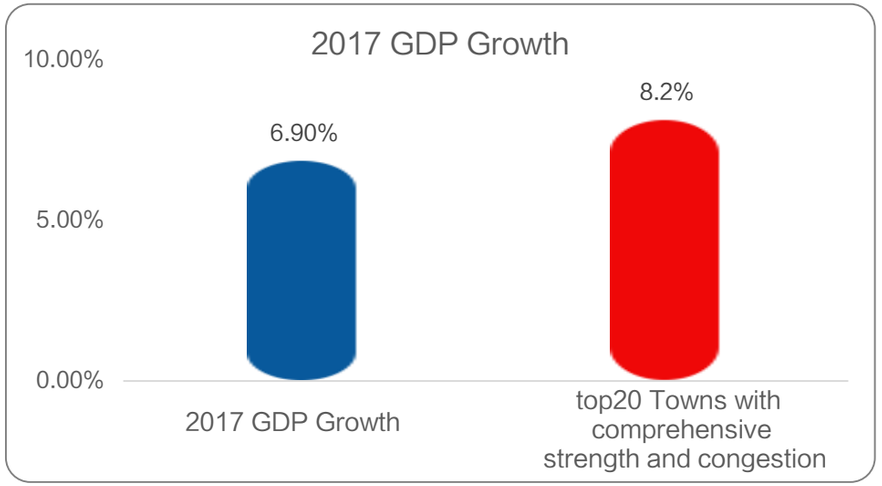
From the comparison of different grades of roads, Yinchuan branch road has the highest degree of congestion but has the biggest congestion decline at 11.5%, while the main road and sub-main road congestion have decreased by 5.7% and 6.6% respectively.

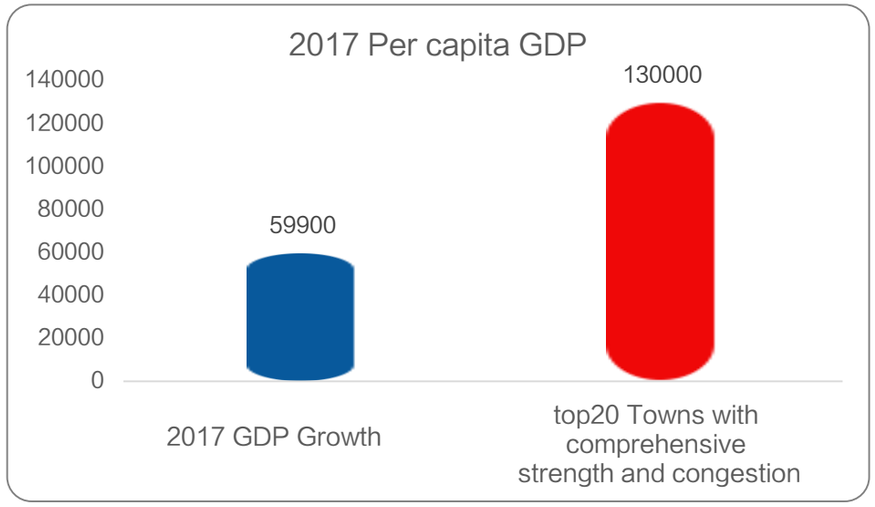


# Vitality and Travel Characteristics of County-level Towns

## The per capita GDP of County-level Towns with strong comprehensive strength is more than twice that of the whole County-level Towns, and the growth rate of GDP is obviously higher than the national average.

According to AMAP traffic big data, by monitoring on County-level Towns with relative higher comprehensive strength and higher congestion level, the economic development of the towns has certain local characteristics. For example, Yiwu is featured by commodity-based economy, Fujian is featured by several sports and leisure brand-based economy.




The GDP and growth data on this page are the average value considering 100 top counties and the top20 congested cities, using the official data published in 2017.

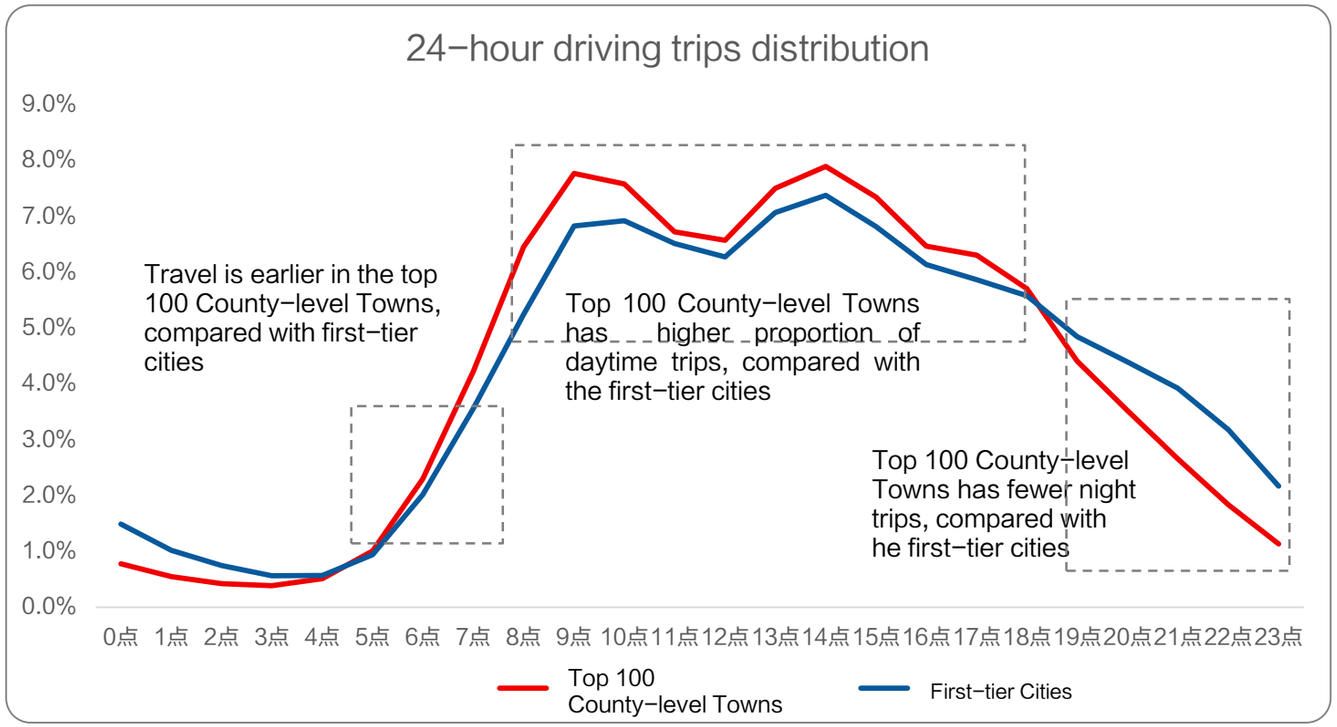
County-level Towns' Economic Pillar and Characteristic Label

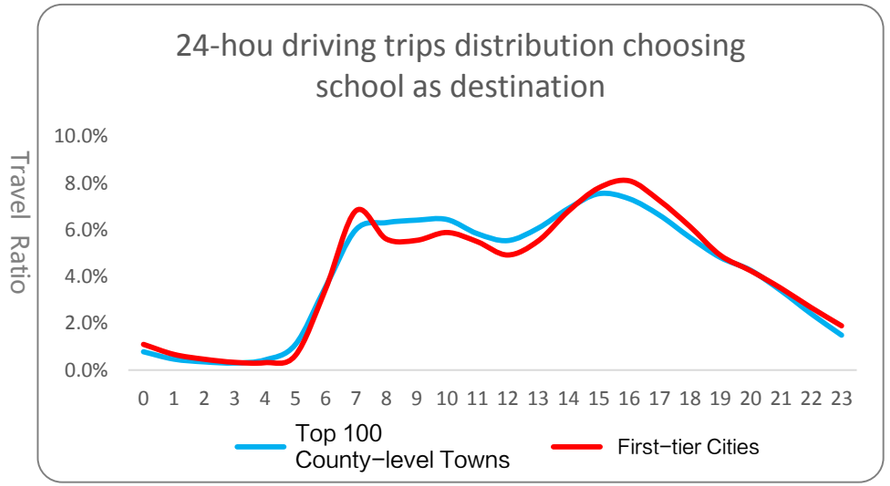
| County-level Towns | Economic Pillar or Characteristic Label |
|---|---|
| Kunshan | electronic products |
| Zhangjiagang | Iron and Steel Textile |
| Changsha County | Capital of Heavy Industries |
| Yiwu | small commodities |
| Yuyao | plastic products |
| Qidong | the hometown of Printmaking |
| Haining | home textiles |
| Wenling | the hometown of pumps |
| Renqiu | oil |
| Taicang | Auto |
| Ruian | plate |
| Jinjiang | sports brand |
| Yuhuan | SUPOR |
| Jiangyin | Huaxi Village |
| Shishi | clothing |
| Tengzhou | preserved egg |
| Changshu | lace |
| Longkou | Loukou vermicelli |
| Haimen | textile town |

# County-level Towns Travel Characteristics —— 24 hours Distribution

**Compared with the people in first-tier cities, people living in the top 100 County-level Towns get up early, their travel is active in the daytime, but the travel frequency is relatively low; the morning travel peak in top 100 County-level Towns is one hour earlier than that in the first-tier cities.**

According to the amount of driving, people in top 100 County-level Towns get up early, so the morning traffic peak is early. The day travel in County-level Towns is also significantly higher than that in first-tier cities, but after 18:00 the travel in County-level Towns is significantly reduced. For driving frequency, people in top 100 County-level Towns drive less than people in first-tier cities. According to the 24-hour distribution on travel percentage of choosing schools as travel destination, people in top 100 County-level Towns also travel early than people in first-tier cities. The proportion of school trips in top 100 County-level Towns in the morning is significantly higher than that in the first-tier cities, and the peak of afternoon trips in top 100 County-level Towns is also one hour earlier than that that in the first-tier cities.



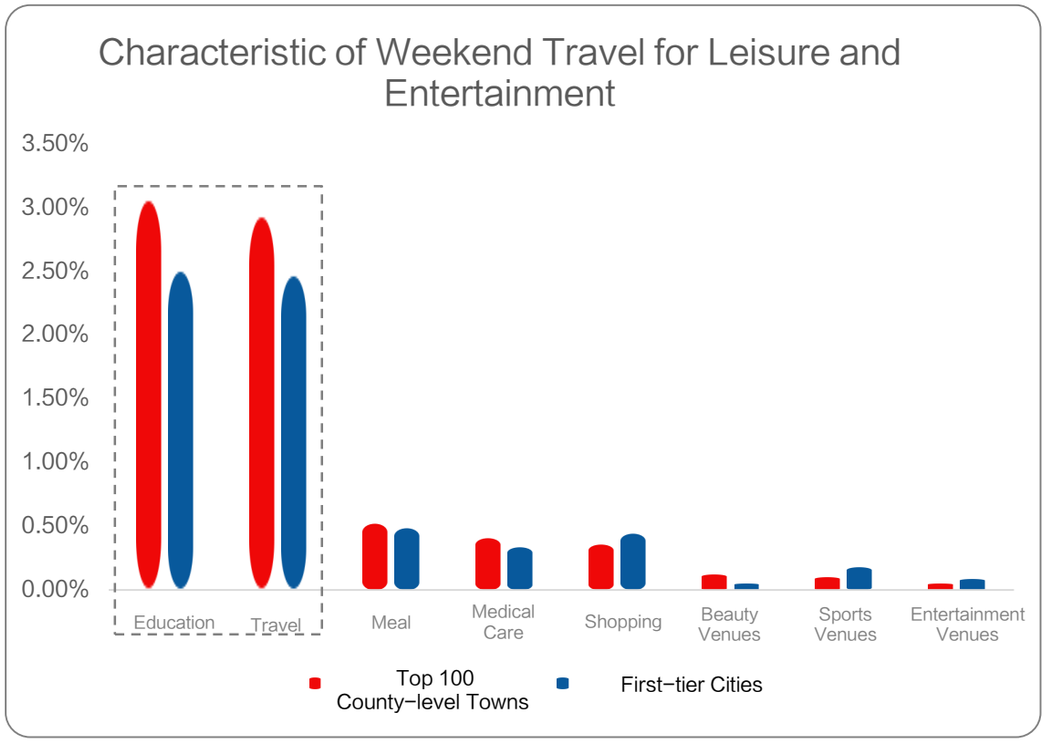



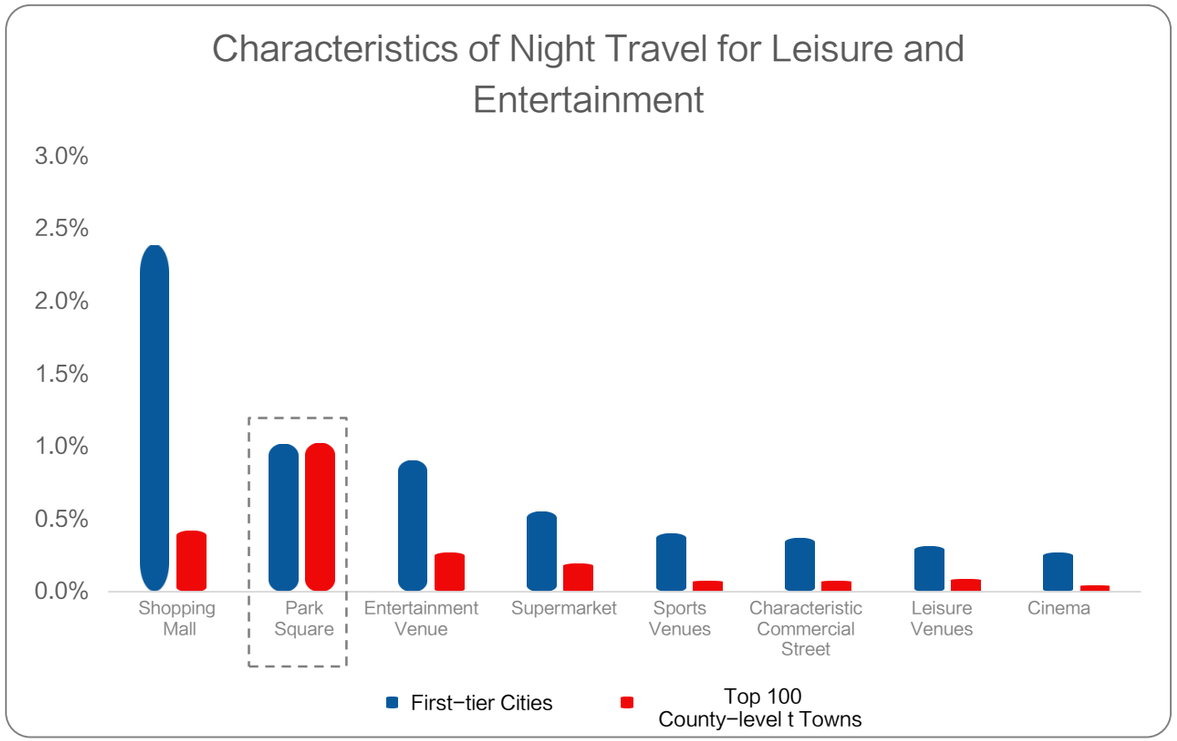

Note: Data are from AMAP Navigation and Planning Data

# County-level Town Travel Characteristics —— Weekend Travel Destination

**The most weekend travel destinations were education and tourism for top 100 County-level Towns. The most night trips destination was Park Square for top 100 County-level Towns, but the most night trips destination was shopping malls in first-tier City.**

From the distribution of weekend travel proportion, weekend travel for leisure and entertainment mainly focuses on education and tourism; the night life of top 100 County-level Towns  is also more distinctive, although less than the first-tier cities in travel for shopping, sports and leisure, but the proportion of weekend travel to park square is same as that in first-tier cities.



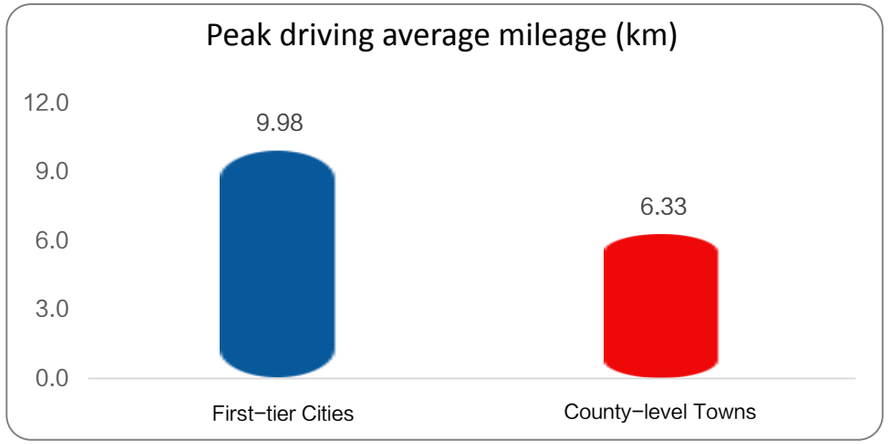



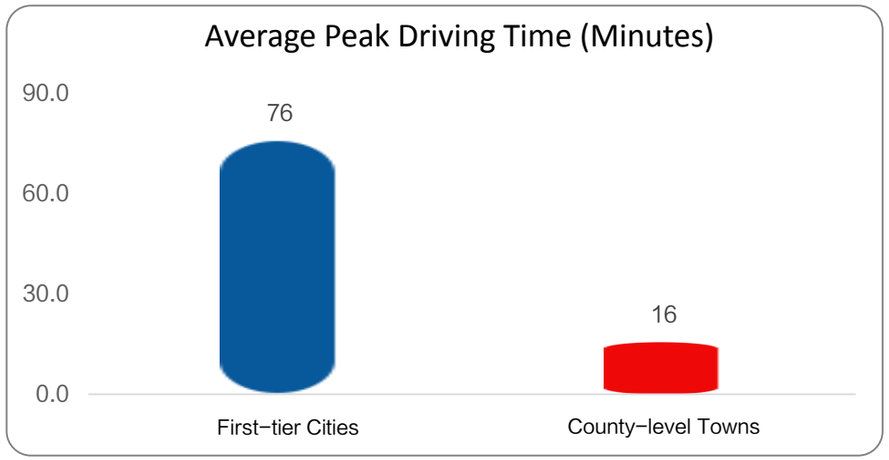

Note: Data were from AMAP Navigation and Planning Data. Weekend time is all day time, and night time is 20:00-00:00.

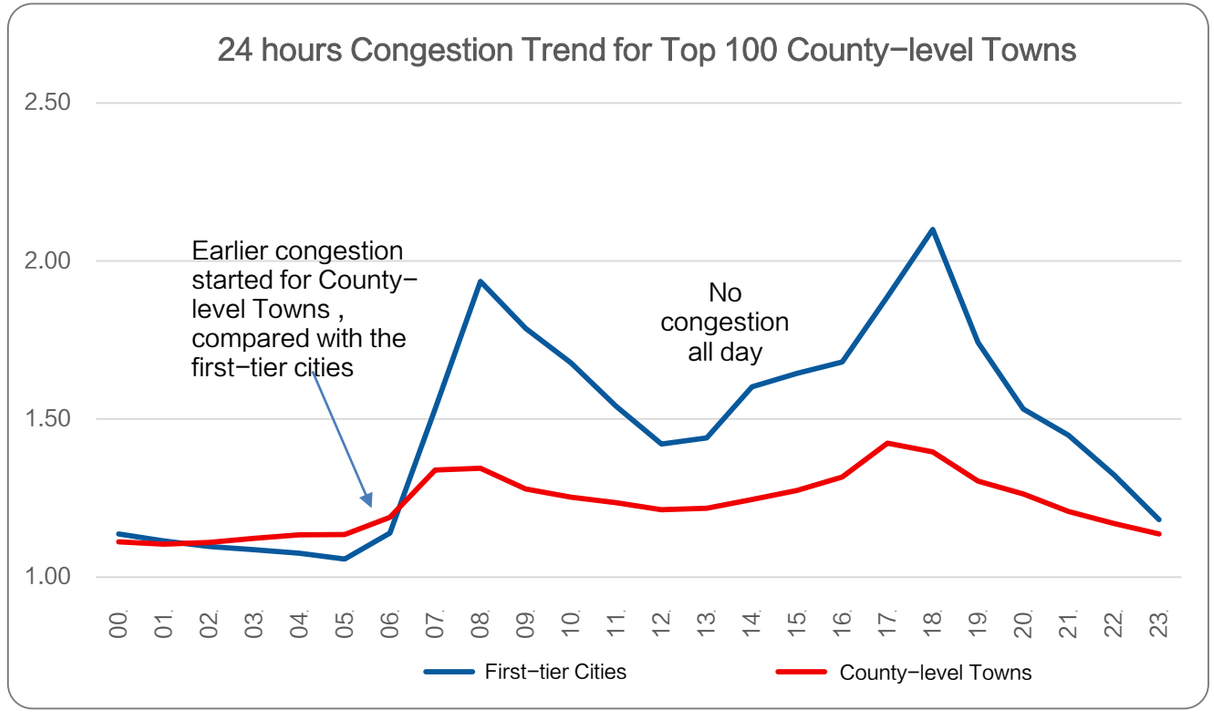
# County-level Towns Travel Characteristics —— Commuting

**The commuting distance of top 100 County-level Towns is 36% less than that of the first-tier cities. The commuting time is one fifth of that of the first-tier cities and there is no congestion all day.**

According to the AMAP traffic data monitoring on top 100 County-level Towns , the driving mileage of County-level Towns is 36% lower than that of first-tier cities, and the commuting time of first-tier cities is five times higher than that of County-level Towns . Taking Kunshan City, which is adjacent to Shanghai, for example, the peak commuting mileage of 7.5 km is less than 9.3 km of Shanghai. From the driving time, Kunshan has only 17.4 minutes, while Shanghai has 46.7 minutes.



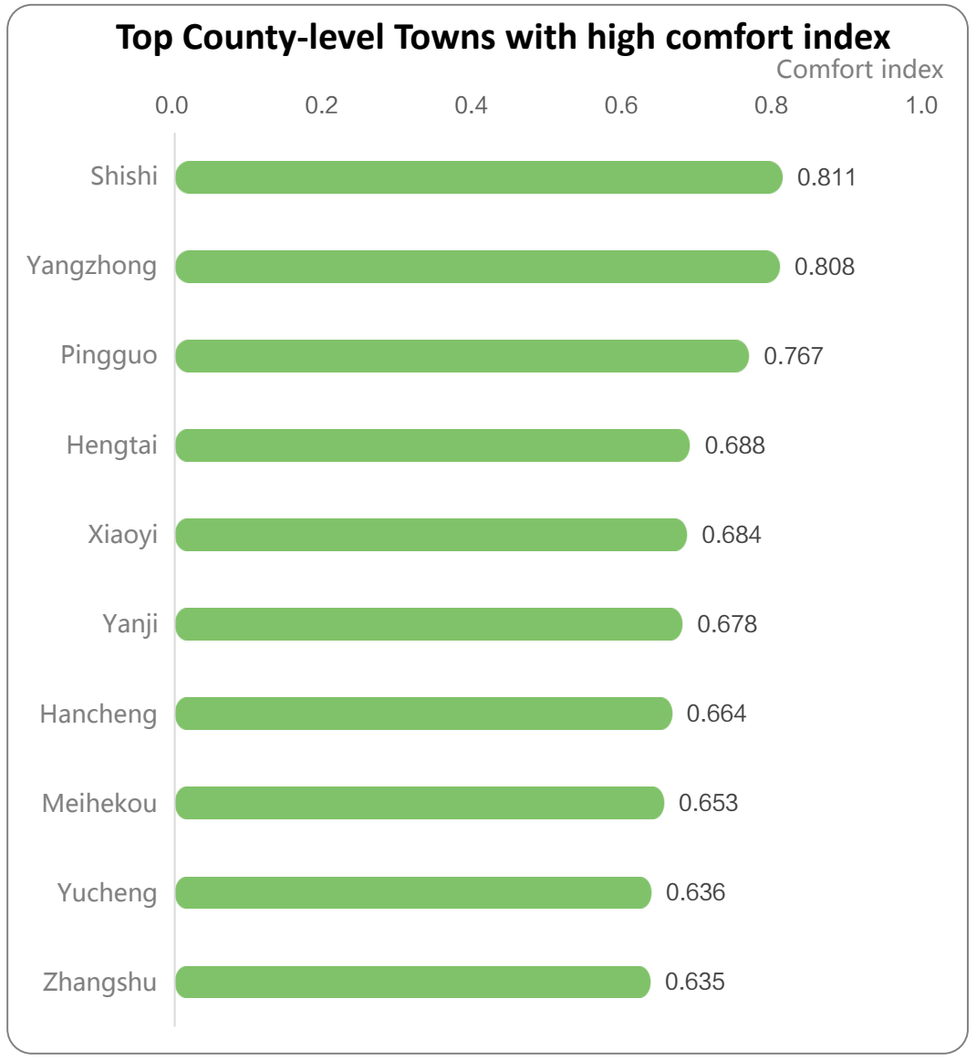



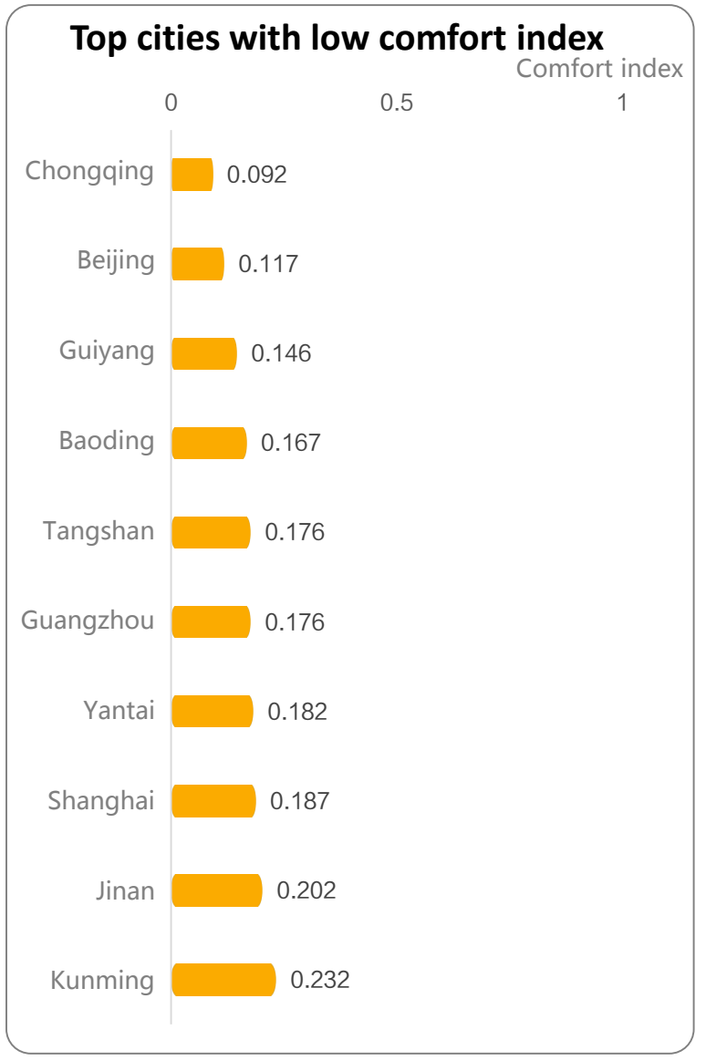



# County-level Towns Travel Characteristics —— Travel

## In all top 100 County-level Towns , Shishi has the highest comfort index , and Chongqing has the lowest comfort index.

The comfort index is obtained through normalized weighting of congestion delay, commuting distance and commuting time. ， The higher the value, the more comfortable the County-level Towns is. Among all top 100 County-level Towns , Shishi has the highest comfort index, because of the lowest congestion, a shorter commuting distance and less commuting time. The lowest comfort index is Chongqing due to a high congestion delay index, long commuting distance and a long travel time.

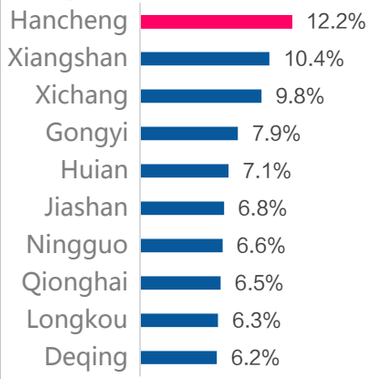


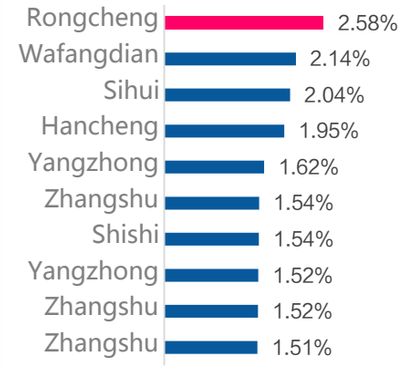
# County-level Towns Travel Characteristics —— travel, entertainment, meal and Shopping

## Travel

### Counties with relatively high tourist attractions

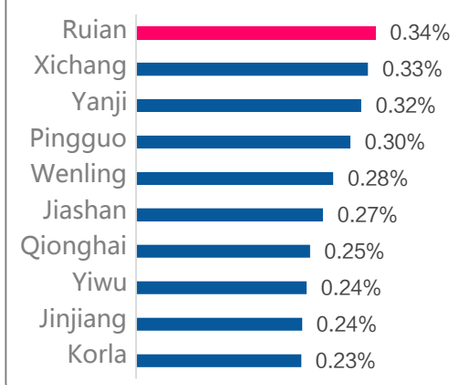



### Counties with relatively high travel in Park Square

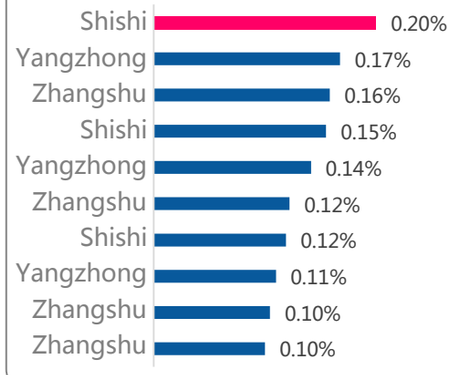



## Entertainment

### County-level Towns with Relatively more Entertainment Travel

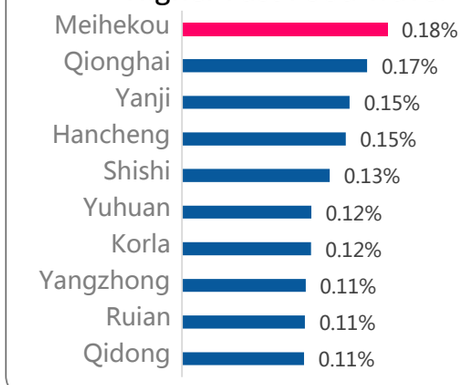



### County-level Towns with Relatively High Travel Rate in Cultural Palace

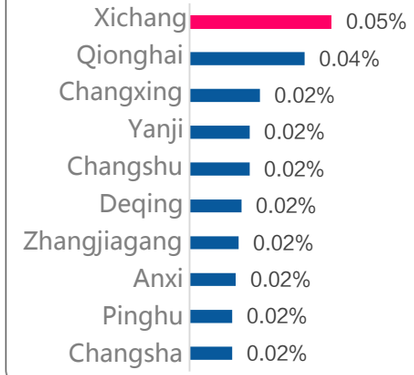



## Meal

### County-level Towns with Higher Fast Food Travel

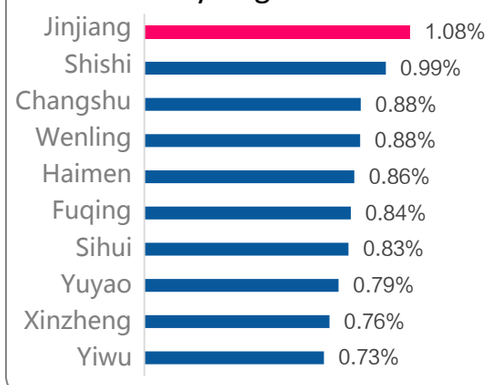



### County-level Towns with Relatively High Tea House Travel

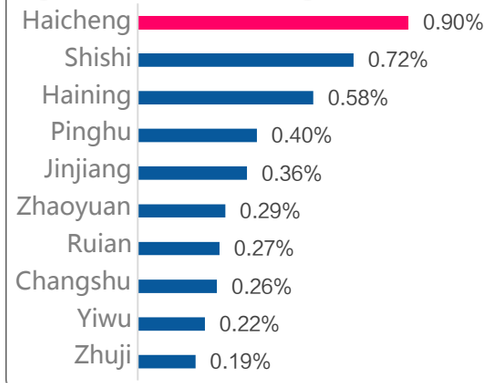



## Shopping

### County-level Towns with Relatively High Market Travel




### County-level Towns with Relatively High Travel for clothing, shoes and hats



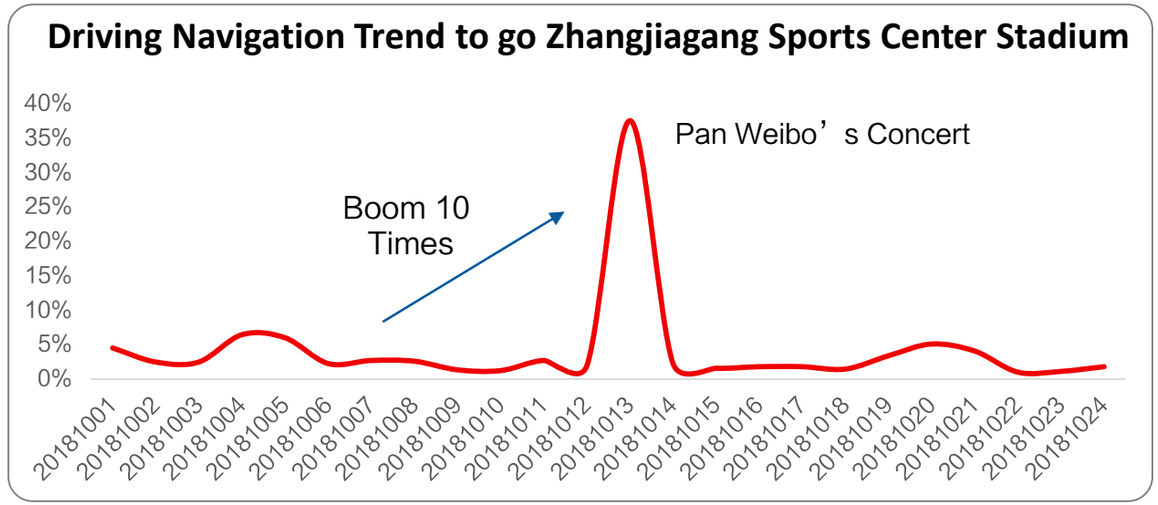

Note: The data used in figures are from AMAP all-day travel navigation and planning data.

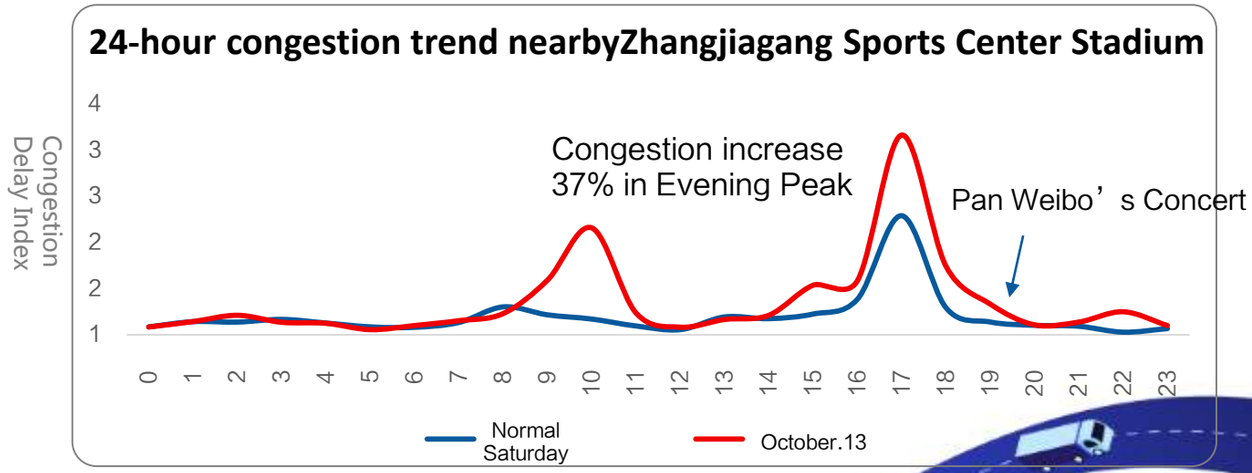
# County-level Towns Travel Characteristics —— Star Concert

**The top 100 County-level Towns in Suzhou is the most popular County-level Towns among stars. It is hard to get a ticket for a concert in these County-level Towns , and when it comes to concerts, the congestion for the County-level Towns has increased dramatically.**

Many famous stars, such as Zhang Xueyou, Liu Dehua, Zhou Jielun and Pan Weibo, recently gave a concert at Zhangjiagang Sports Center Stadium. The venue was full of people and one ticket was hard to get. The evening peak congestion level rose 37%, compared with the usual day, and the number of driving users increased 10 times.

| Major places that stars give concerts among top 100 County-level Towns | Stars who have given concerts in top 100 County-level Towns |
|---|---|
| Zhangjiagang | Jay Chou |
| Changshu | Jacky Cheung |
| Jinjiang | Andy Lau |
| Kunshan | Wilber Pan |
| Yiwu | Elva Hsiao |

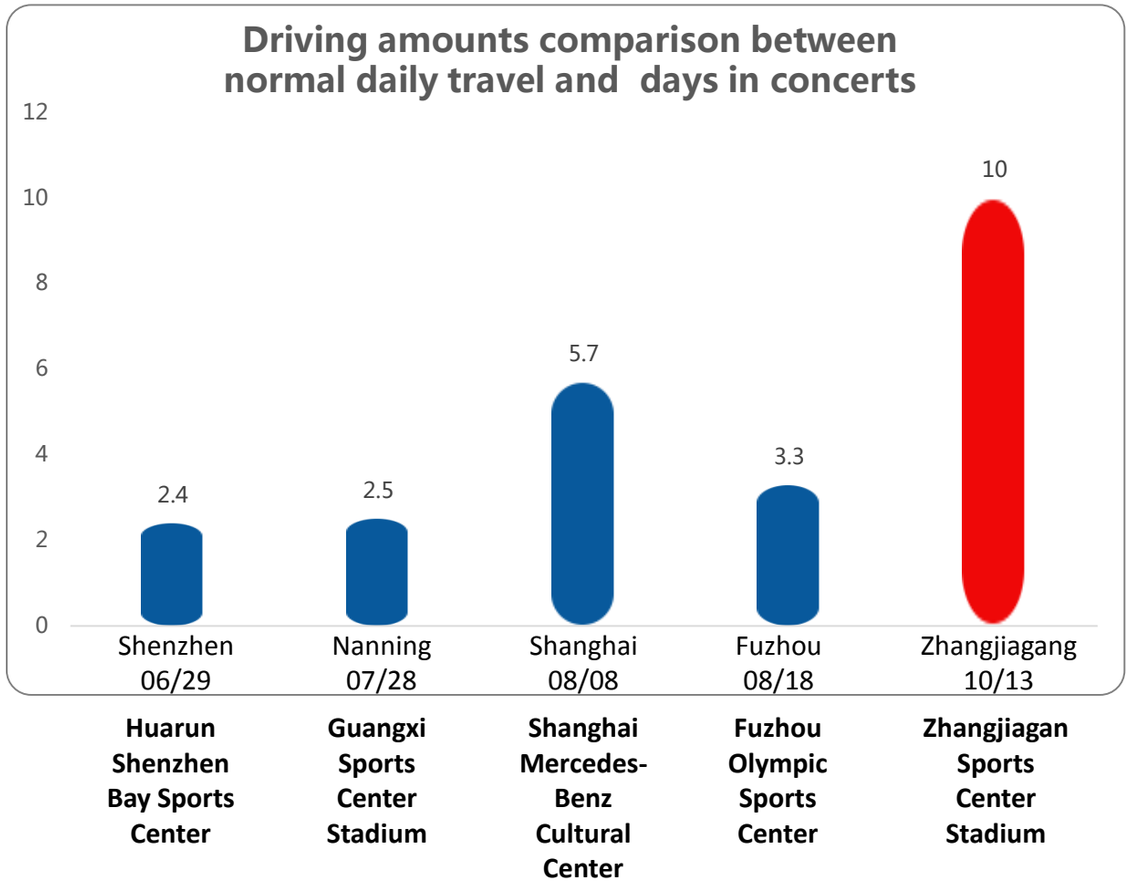


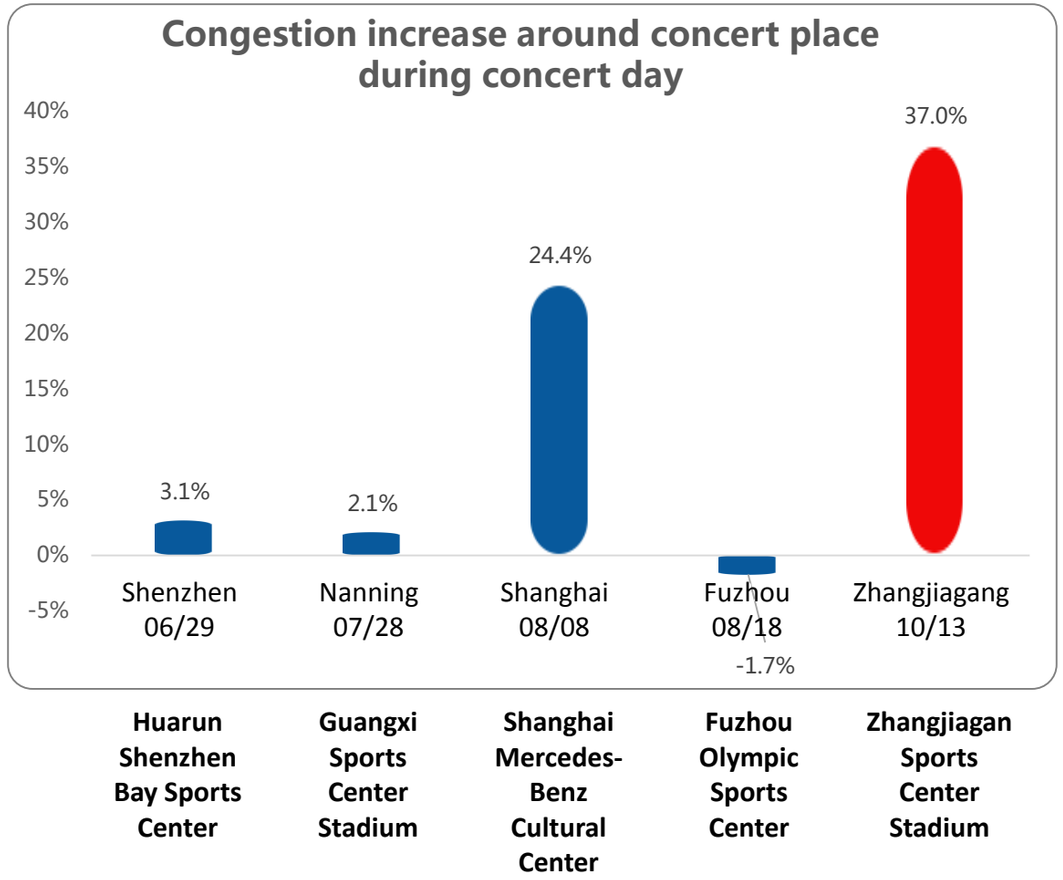



# County-level Towns Travel Characteristics —— Star Concert

## Driving amounts and congestion increase in top 100 County-level Towns are higher than the first-tier cities when it comes to star concert

After analyzing five recent concerts of a star, what can be found is that navigation to arrive concert place and the congestion level around concert place in Zhangjiagang County-level Towns were significantly higher than those in other cities.



# Cooperation results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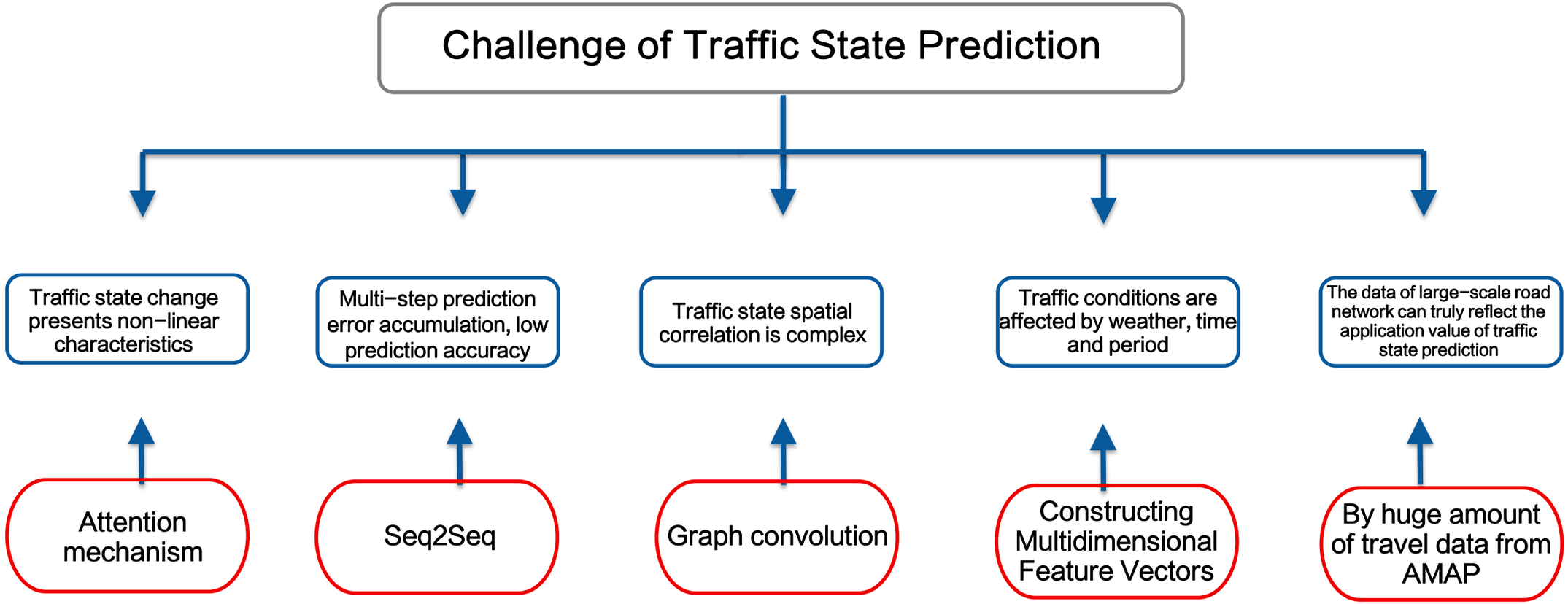
清華大學 DAIMLER
可持续交通联合研究中心
Tsinghua-Daimler Joint Research Center for Sustainable Transportation


未来交通与城市计算联合实验室
JOINT LABORATORY
FOR FUTURE TRANSPORT AND URBAN COMPUTING



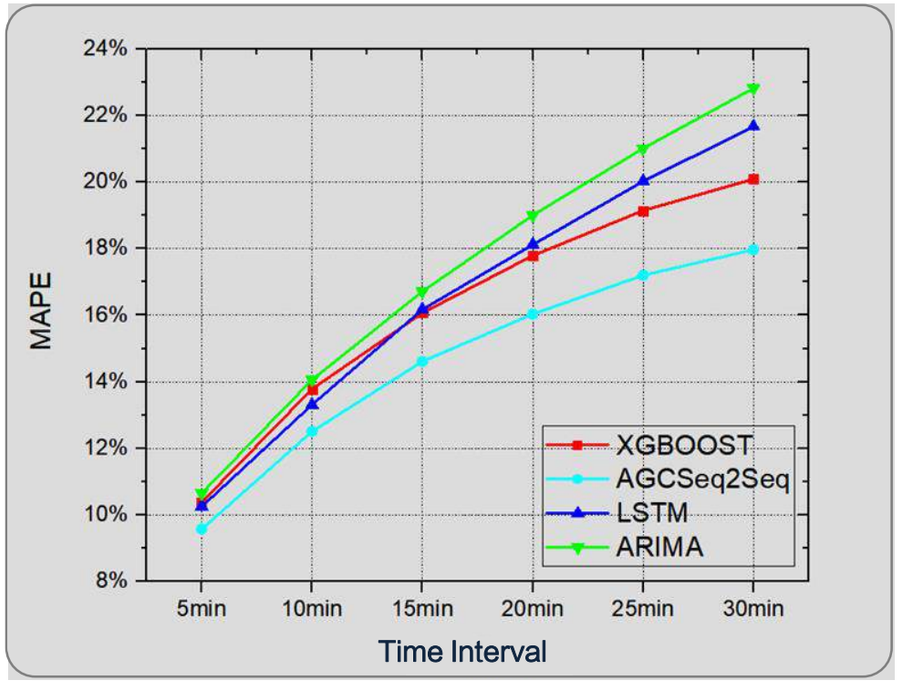

Link for preprint paper：https://arxiv.org/abs/1810.10237

# New Technology Pre-research —— multi-step prediction make more advantages for model and traffic state can better predicted.

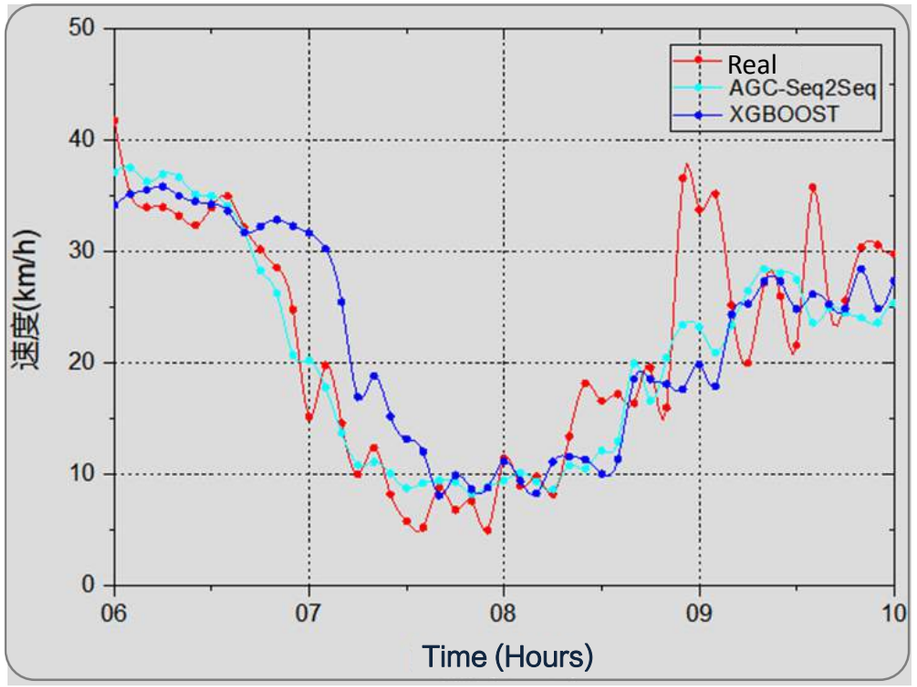
**In the case of multi-step prediction, the advantages of the model are more obvious, which means during morning peak period, the model can better capture the trend of traffic state change.**

Travel by metro has always been welcomed by the public. One of the most important factors is punctuality and no influenced by congestion. Driving, especially during the periods of severe congestion, the time is becoming more and more uncontrollable. If we can have a precise prediction of travel, we can improve the driving experience very well. Referring daily travel time, traffic condition prediction is achieved based on road congestion level prediction and dynamic route planning. In such way, driving can be more comfortable by saving travel time and by avoiding congestion in advance. Through study different forecast time and prediction models, the Joint Laboratory For Future Transport and Urban Computing can make better forecast on traffic condition based on the multi-step prediction model which has more obvious advantages.

MAPE for different models in different time intervals

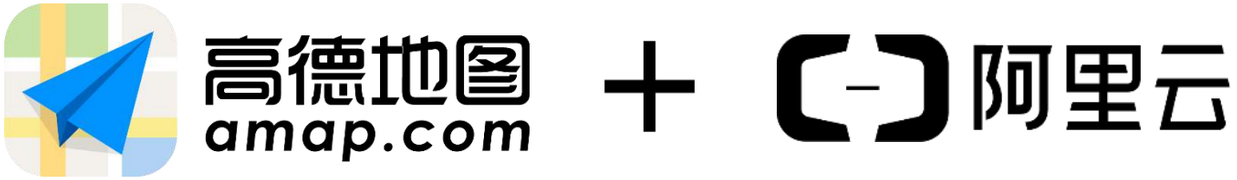



Prediction results in morning peak




(Take the section of East Second Ring Road on November 23, 16 as an example)

Link for preprint paper：https://arxiv.org/abs/1810.10237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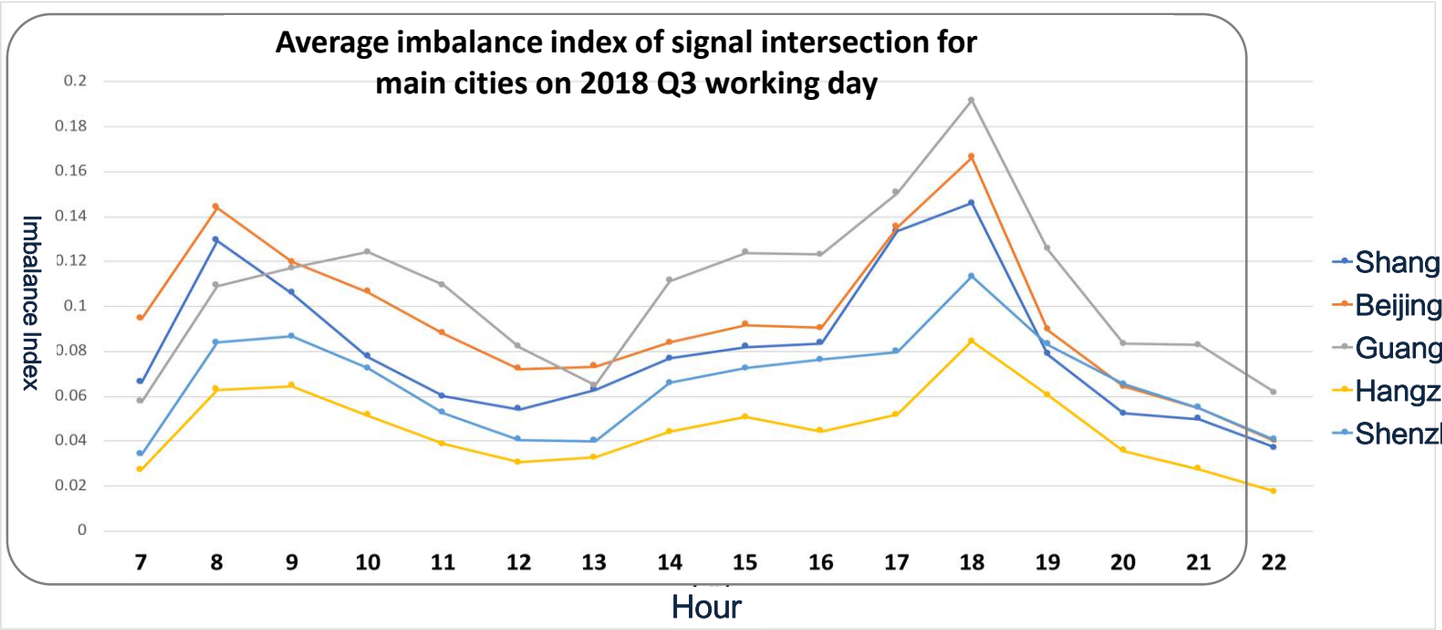
## Beijing has the highest imbalance index in morning peak and Hangzhou has the lowest imbalance index in morning and evening peak period

We use the difference value between real intersection state and designed equilibrium state (measured by imbalance index) to evaluate the signal control ability at intersections. The imbalance index is evaluated comprehensively from two aspects: (1) the imbalance state between intersection entrance and another intersection entrance; (2) the imbalance state between intersection entrance and intersection exit; The higher the imbalance index is, the more serious the imbalance of intersection state is. The imbalance state can be divided into five levels: balance, imbalance of mild, moderate, serious and extreme. This time, we still choose major signal intersections (T-shaped and cross) in main urban areas of Beijing, Shanghai, Hangzhou, Guangzhou and Shenzhen as the evaluation objects.




Trend Analysis

- In general ,all urban signalized intersections did not appear to be unbalanced on the 2018Q3 working day, but there were two peaks of imbalance index on the working day – 8:00 a.m. and 18:00 p.m., respectively.

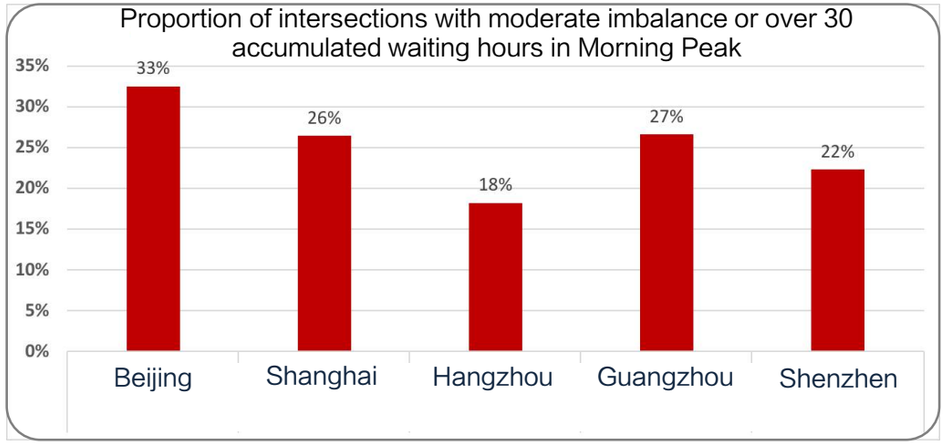
Comparative Analysis

- Within working days, the imbalance index of Beijing was the highest in morning peak and that index of Guangzhou was the highest in the evening peak.
- Hangzhou had the lowest imbalance index in the morning and evening peak during working day.

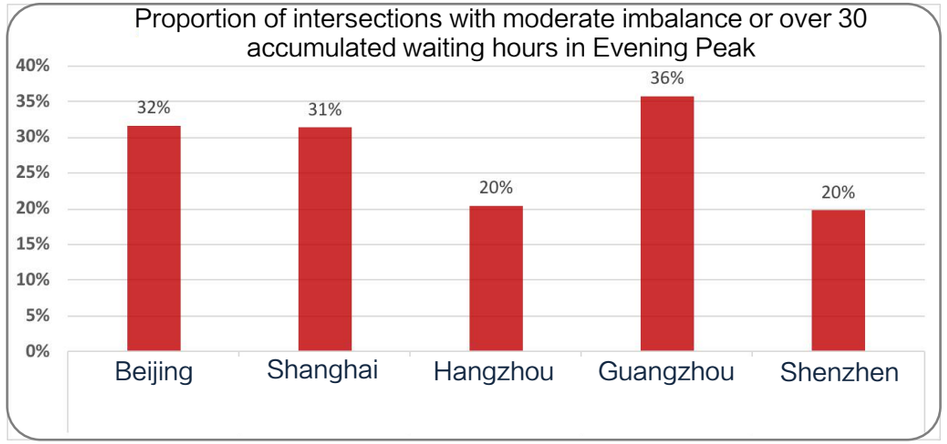
# Proportion Analysis for intersections with moderate imbalance or over 30 minutes accumulated waiting Times in Peak Hours of working days in 2018 Q3

Based on the analysis of the proportion of traffic lights at the intersections having moderate imbalance index or accumulated over 30 minutes waiting time during the peak period of each city in 2018 Q3 every day: Beijing accounts for the highest proportion in the morning peak, Guangzhou for the highest proportion in the evening peak and Hangzhou for the lowest proportion in the morning and evening peak.

Morning Peak




Evening Peak




Intersections with frequent moderate imbalances or higher imbalances in Beijing and Guangzhou during peak hours working days of 2018 Q3


# 附录：Terminology List

| Keyword | Definition |
|---|---|
| **Congestion delay index** | Congestion delay index = The travel time under traffic congestion / The travel time under free flow |
| **Congestion delay time** | Congestion delay time = The travel time under traffic congestion – The travel time under free flow |
| **Average travel length** | The average travel length in a city |
| **Average travel speed** | The average travel speed in a city |
| **Average travel time** | The average travel time in a city |
| **Average delay time** | The average delay time in a city |
| **The most congested day** | The day of the highest congestion delay index of a city during a certain time period |
| **Hot business districts** | Urban regions with many people, heavy traffics and developed commerce |
| **Daily commuting delay** | Congestion time during commuting each day |
| **Peak-period road average travel speed** | On a certain road, vehicles' mean speed in morning and evening peaks |
| **Peak-period road travel time** | On a certain road, vehicles' mean travel time in morning and evening peaks |
| **Peak-period road travel delay time** | A certain road' s delay time; the congestion delay time = the travel time under traffic congestion – the travel time under free flow |
| **Ordinary–period road travel speed** | On a certain road, vehicles' mean travel speed in the free-passing and non-congestion state, usually at night |
| **Ordinary–period road travel time** | On a certain road, vehicles' mean travel time in the free-passing and non-congestion state, usually at night |
| **Urban trunk** | The backbone of urban road networks, connecting the city' s main roads in different districts and playing the role of transport functions |
| **Average daily tempo-spatial oversaturation equivalent** | Total oversaturation units in a certain tempo-spatial range; |
| **Oversaturation temporal density** | Average daily oversaturation units per kilometer; |
| **Oversaturation spatial density** | Average daily oversaturation units per hour; |
| **Carbon oxides (COx)** | Collective name for carbon monoxide, carbon dioxide and other oxygen compounds from automobile exhausts. |
| **Popular places going by vehicles** | Collect all POI from the users of Amap, no matter about navigation or route planning, based POI classification system, cluster the users going to different POI. The destination with more times of users for navigation or route planning, the higher popularity may be received for this destination. |

Amap Software

Amap Transportation

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