
2018 | Q1
Traffic Analysis Report
Of Major Cities in China
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 AutoNavi 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 express 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 in an as much accurate and precise.

- For more information about the data of urban congestion about the city you are living, please visit: http://report.amap.com/
- Thanks for your attention, please focus on later research publication

Summary

“Traffic Analysis Reports for Major Cities in China” is proposed by AutoNavi, and it is based on AutoNavi traffic big-data publishing platform, data open platform, Ali cloud MaxCompute and related data mining technology supports. The reports describes the urban congestion states, 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.

The research results of the AutoNavi “Joint Laboratory for Future Transport and Urban Computing” are firstly published in this quarterly report.

Cooperate organization

Transport Planning and Research Institute
Ministry of Transport

清華大學 DAIMLER
Tsinghua-Daimler Joint Research Center for Sustainable Transportation

Alibaba Cloud

Joint Laboratory for Future Transport and Urban Computing

Report Description

AutoNavi’ s massive traffic data is combined with traffic vehicle data and 700 million + AutoNavi users’ data

Cities

364 cities+ national wide highway

Select

100 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
* AutoNavi Traffic Big-data can support 364 Chiense cities in terms of traffic index analysis and calculation

Data

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

See Appendix A for details

* 指数越高表示出行延时占出行时间的比例越大，也就越拥堵

Time

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

* If no specified, the statistical time periods of this report are Jan.-Mar. 2018

Urban
Congestion Portrait

Travel Characteristics in
the Spring Festival

Cooperative
Research Results

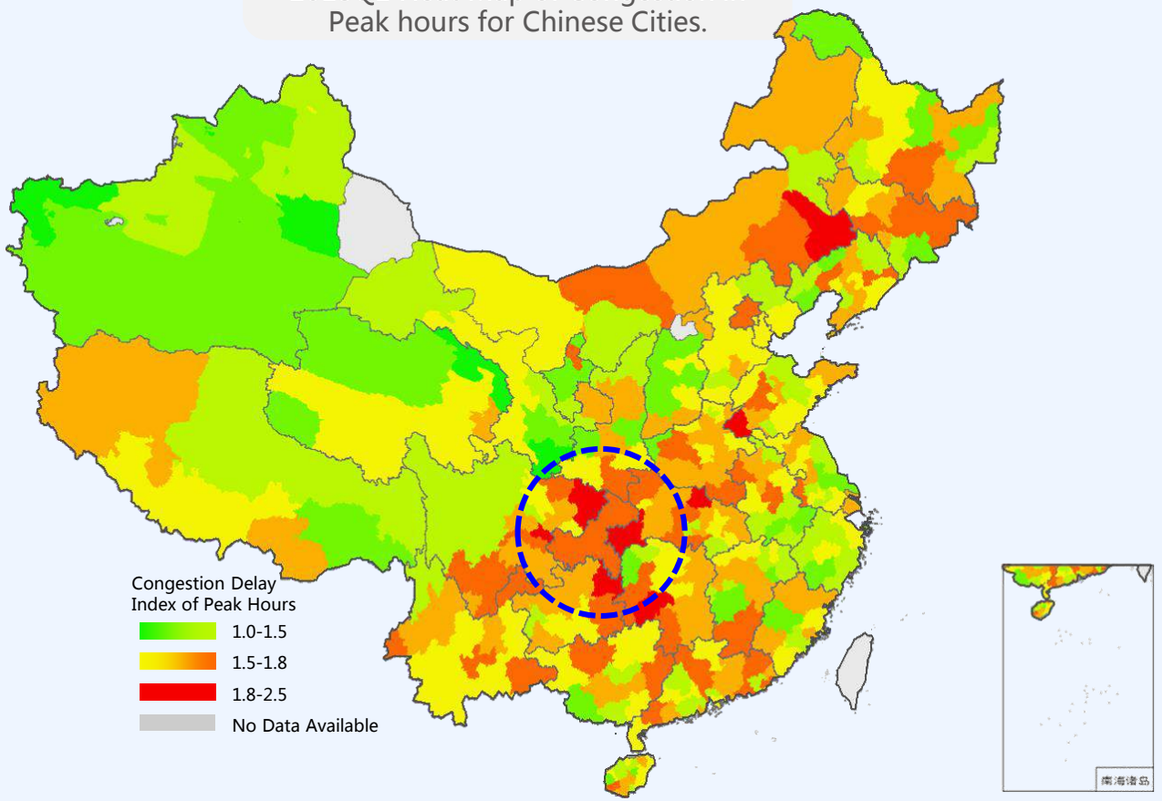
01

Urban Congestion Portrait

65 of 361 Cities Across the Country Are Threatened by Congestion in Peak Hours, 2018 Q1.

Under the records of AutoNavi Traffic Data Platform for 361 cities, the degree of congestion differs between cities and cities. The congestion delay index of 65 cities is higher than 1.8 in peak hours, suffering from severe congestion threat; there are 231 cities under slow driving speed, with congestion delay index from 1.5 to 1.8; and 65 cities suffer little congestion in an overall smooth driving speed, with the congestion delay index of 1.0 - 1.5 . From the location, there the many areas with the degree of congestion being relative high in the first quarter of 2018, such as Chengdu, Chongqing and their surrounding areas, Hubei, Guizhou, western of Hunan, eastern of Sichuan, and some cities in the Northeast China. However, the Yangtze River Delta and the western cities are relatively low in congestion.

2018Q1 Heat Map of Congestion in Peak hours for Chinese Cities.



Top 10 Congested Cities in Peak Hours in China, 2018 Q1

Yinchuan was the most congested city in China in 2018, Q1

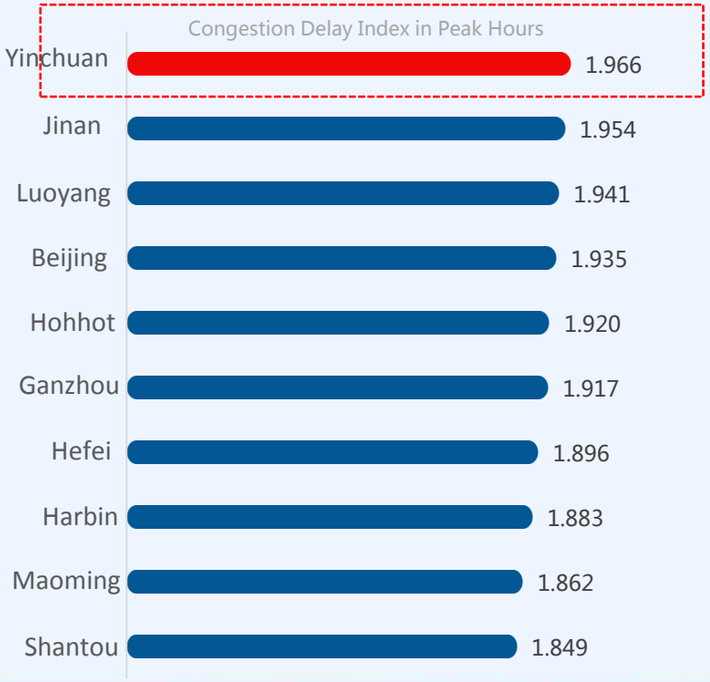
According to the congestion results of the 100 major cities recorded by AutoNavi traffic data, the congestion delay index of Yinchuan was 1.966 in Q1, with 21.4km/h of average speed. In 2018 Q1, Yinchuan has exceed the most frequently congested city Jinan, hitting first in the top 10 congested cities list. The following cities in this top 10 list are Jinan, Luoyang, Beijing, Hohhot, Ganzhou, Hefei, Harbin, Maoming and Shantou.

Many large and middle cities hit the top 10 list of congestion cities in 2018, Q1

Affected by travel characteristics of the Spring Festival, there was a reduction on the congestion rank of first-tier cities, such as Beijing, Shanghai, Guangzhou and Shenzhen in 2018, Q1. On the contrast, many large and middle cities, such as Luoyang, Ganzhou, Maoming, Shantou and Hefei, has increased their congestion rank, and hit top 10 congestion list in 2018, Q1. The reason for this might be related to the high density of passengers flow going out of cities and going home to cities, purchasing special goods for the Spring Festival, large activities and the mixed of severe weathers (rain and snow weather).

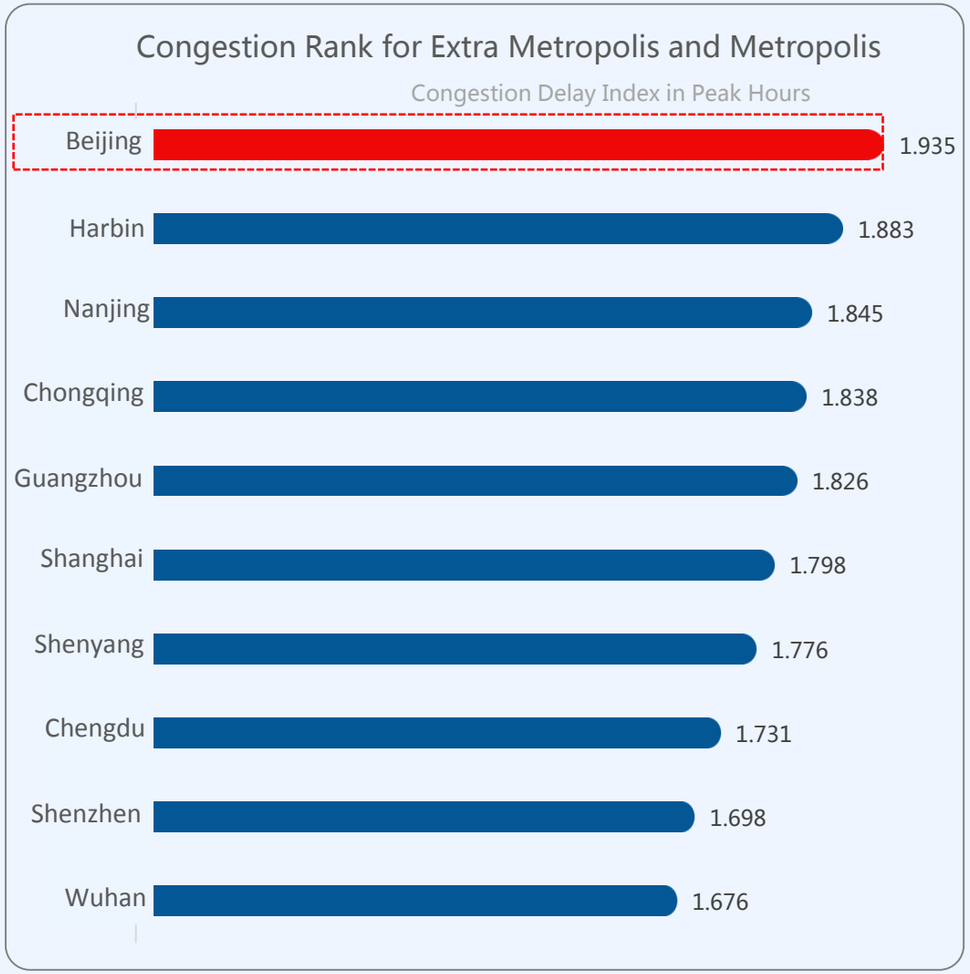
Location of Top 10 Congested cities, 2018Q1

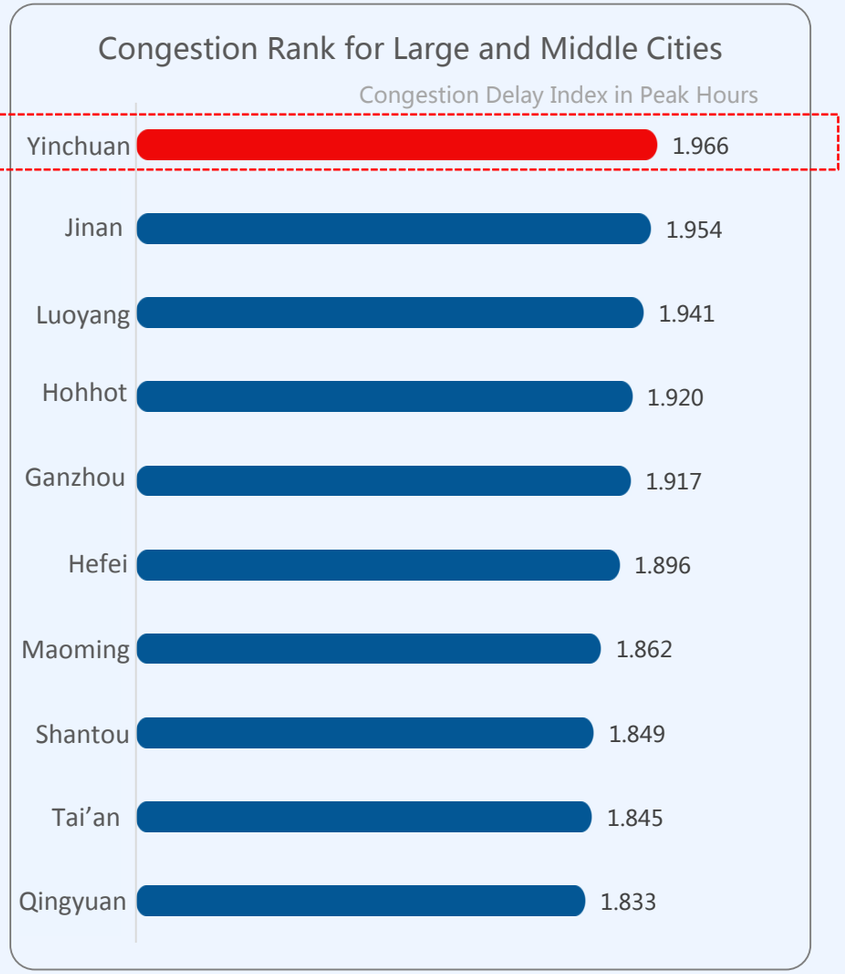
Top 10 Congested Cities, 2018 Q1



Congestion Rank Listed on City Scale

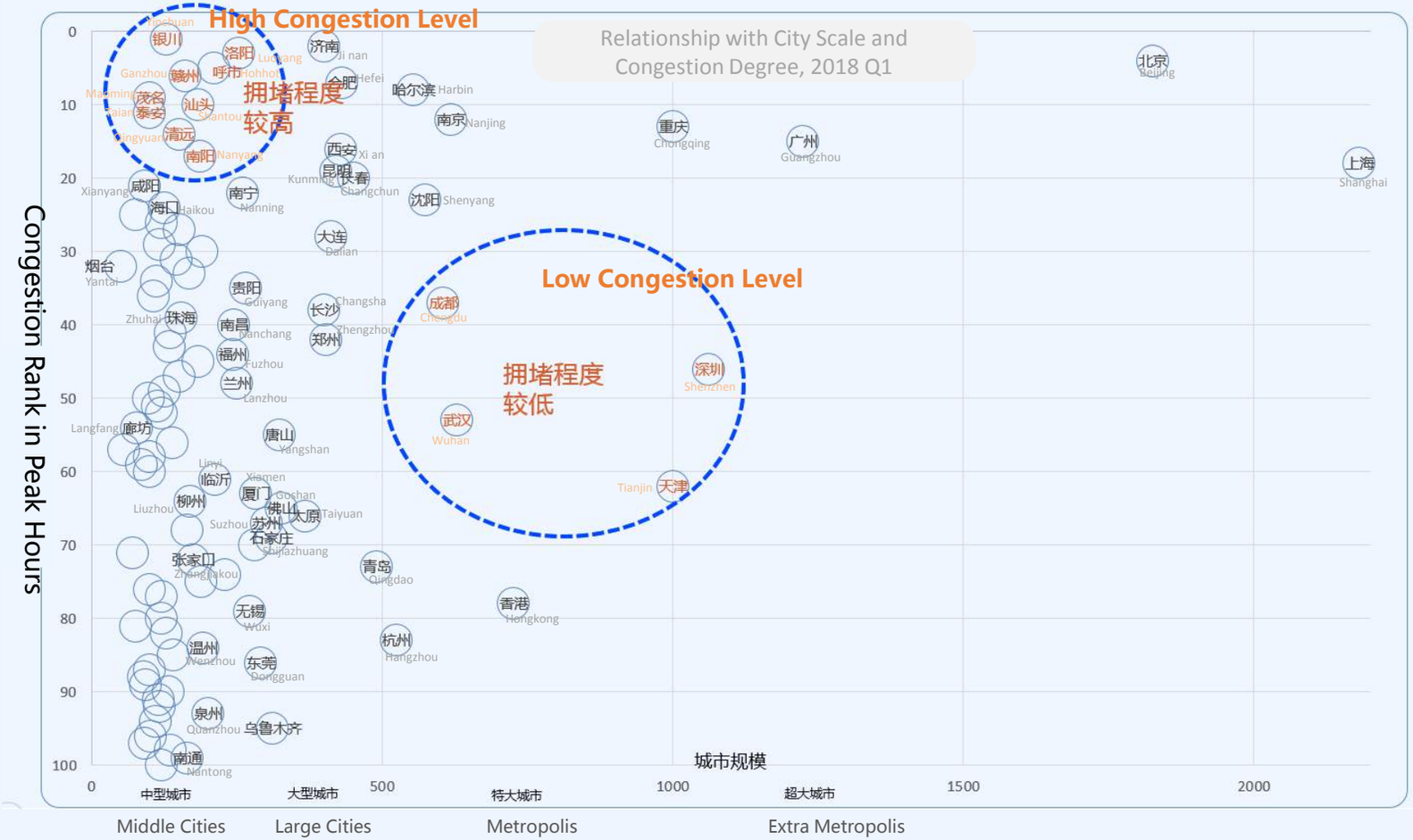
According to the city scale, 100 cities has been ranked according their congestion degree, in order for enough dimension of reference. According to the result, in 2018, Q1, Beijing ranked first among extra metropolis and metropolis, with congestion delay index of 1.935 in peak hours, and the following top congested cities were Harbin and Nanjing. In terms of the top 10 congestion city for large and middle cities, Yinchuan ranked first, and this was followed by Jinan, Luoyang and Hohhot.





Relationship with City Scale and Congestion Degree —— Congestion in Large and Middle City Has Overpassed the Congestion of Extra Metropolis and Metropolis

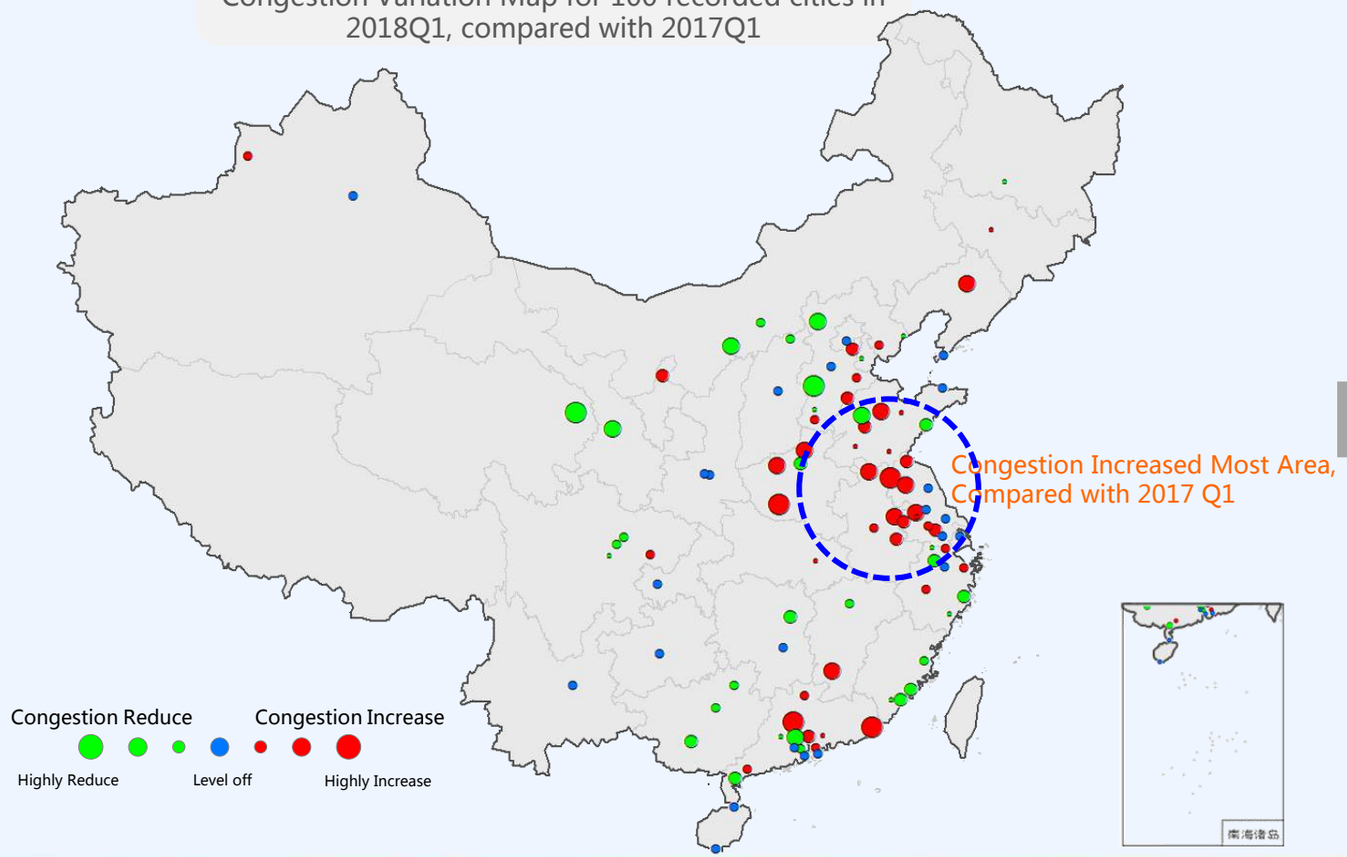
In 2018 Q1, according to the relationship between city scale and congestion degree, from recorded 100 cities, the results show the congestion rank of large cities and middle cities have increased dramatically, but the congestion rank of the first-tier cities and the provincial capitals have reduced. The congestion rank of the large cities has exceeded that of metropolis and extra metropolis. Further analysis revealed that the congestion degree for some cities, such as Yinchuan, Luoyang, Hohhot and Ganzhou, was relatively high but with low city scale; on the other hand, the cities, such as Chengdu, Wuhan, Shenzhen and Tianjin, were with large city scale but low congestion degree. Such change of congestion rank might be related with the cross-city travel behaviors (travelling out and travelling in).



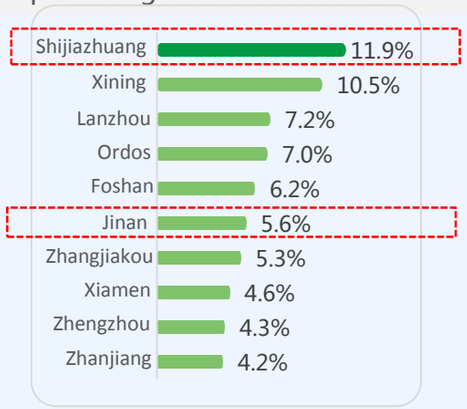
60% of Cities Has Decreased or Leveled off Their Congestion Level, Compared to 2017 Q1

In 2018 Q1, in recorded 100 cities, there were 43 cities with their congestion delay index increase, compared with 2017 Q1. Among them, the most congested city was Nanyang, with congestion degree increasing by 12.8%, Nanyang was followed by Suqian and Shantou. From the location of top 10 congested cities, most of them were in the province of Anhui, Jiangsu and Henan. For all recorded cities, there were 23 cities with their congestion delay index almost leveling off, 34 cities with their congestion delay index reducing. The largest reduction was in Shijiazhuang in Hebei Province, reduced by 11.9%. Besides, the most congested city Jinan in 2017 Q1 has reduced its congestion degree by 5.6%, hitting 6th in the congestion reduction list.

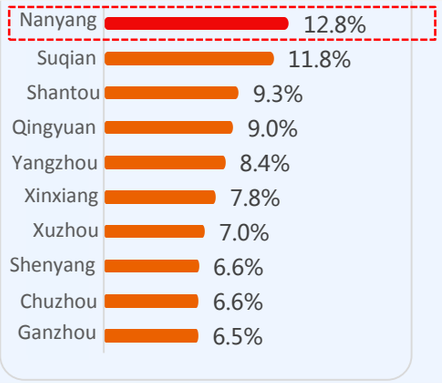
Congestion Variation Map for 100 recorded cities in 2018Q1, compared with 2017Q1



Top 10 Congestion Reduction Cities



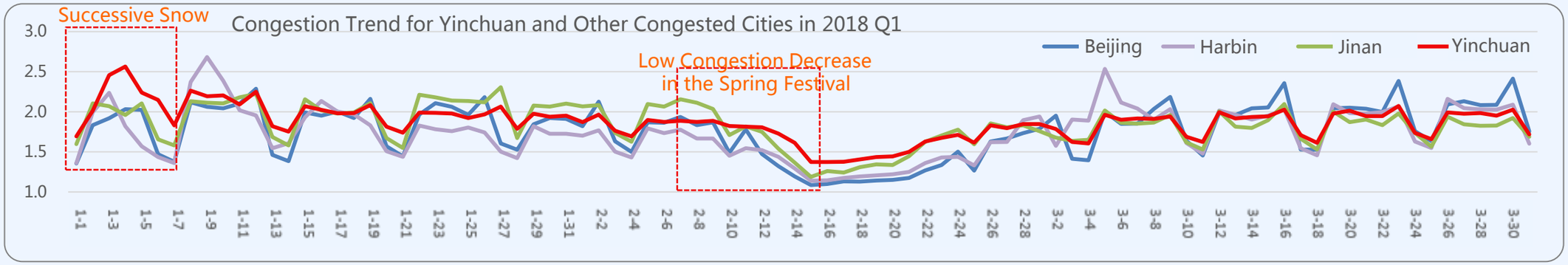
Top 10 Congestion Increase Cities



Congestion Analysis —— Yinchuan

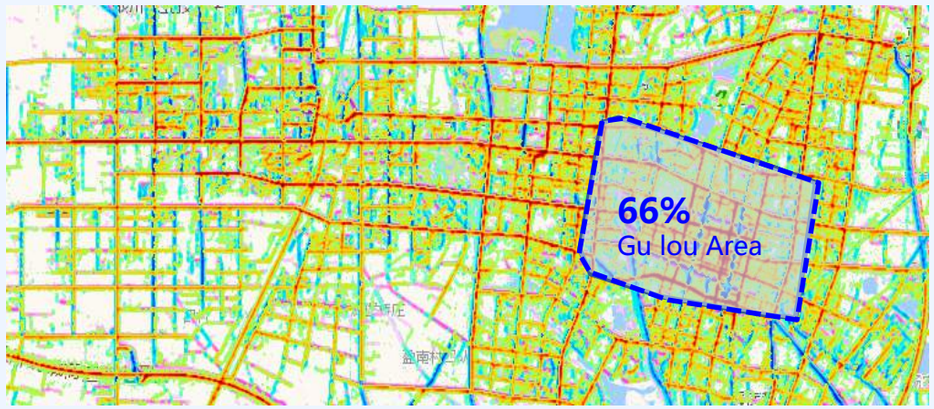
Congestion Reasons: Snow weather has increased congestion & Low congestion has decrease in the Spring Festival

Yinchuan was the most congested city in the peak hours of 2018 Q1. When compared to the day-to-day congestion level of Yinchuan with other congested cities in 2018 Q1, 2 congestion patterns can be found. One is the successive snow for one week, making the congestion delay index increased dramatically and becoming the most congested city; the other is low congestion decrease for Yinchuan during the Spring Festival, making Yinchuan as the most congested city in 2018 Q1.



Travel Characteristics：66% of travel was located in the area of Gu Lou

According to the travel data in 2018Q1, nearly 66% of travel was concentrated on Gu lou Area and its surrounding areas, which was one reason for the congestion aggravation. For this congested area, the congestion delay index of the Fenghuang South Street with the direction from north to south was 4, with average driving speed of 11.76km/h. The graph below is the heat map of vehicle flow of Yinchuan, the deeper the color is, the more concentrated the travel is located.



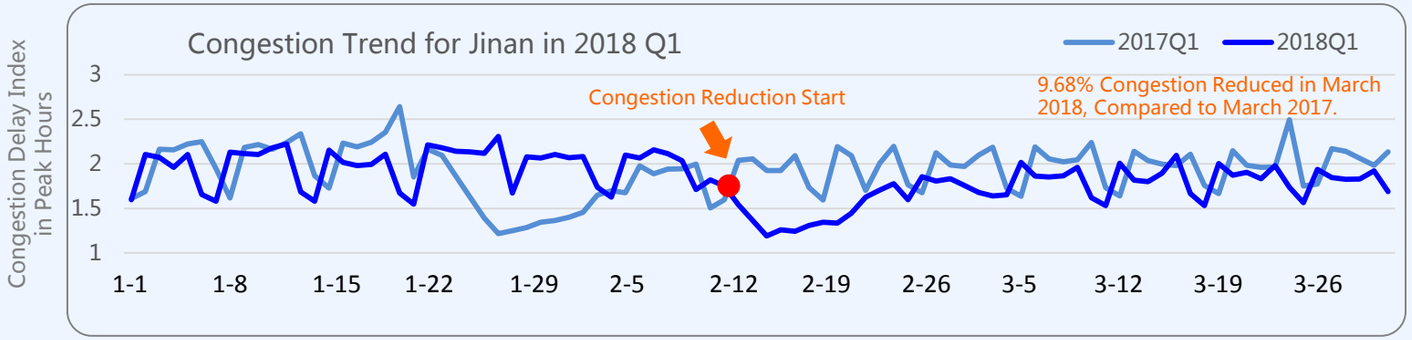
TOP 10 Congested Road in Peak Hours for Gulou Area

Rank	Road Name	Road Direction	Congestion Delay Index in Peak Hours	Speed in Peak Hours (km/h)
1	Fenghuang South Street	Changcheng East Road — Nanxun West Street	4	11.76
2	Tianping Street	Beijing East Road — Helanshan North Road	2.15	19.27
3	Minzu South Street	Zhiping Road — Nanxun East Street	2.07	20.14
4	Fenghuang North Street	South — north	2	21.83
5	Minzu North Street	Beijing East Road — Helanshan East Road	1.98	22.59
6	Sanlin Lane	Songbo Lane — Nanxun West Street	1.98	16.3
7	Tianping Street	Helanshan East Road — Beijing East Road	1.97	20.54
8	Yinsheng Road	Nanxun West Street — Qingqiang Street	1.96	21.99
9	Fenghuang North Street	North — south	1.92	22.58
10	Yuhuang ge North Street	Yizhi Lane — Beijing East Road	1.92	18.02

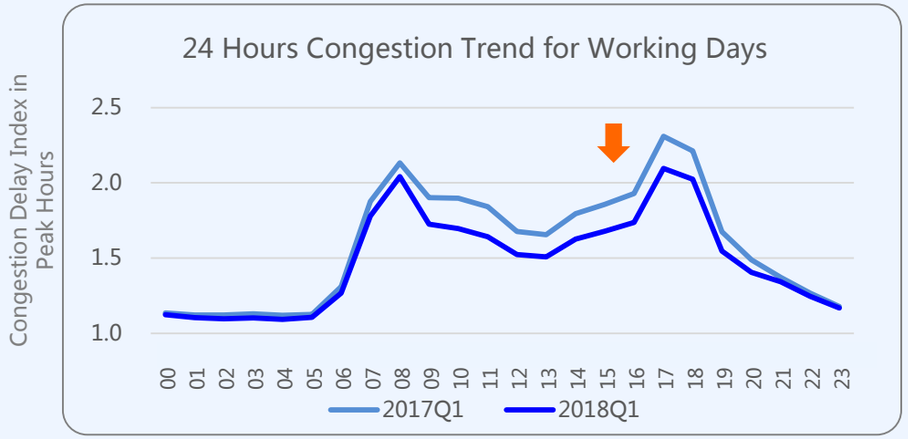
Congestion Analysis —— Jinan (I)

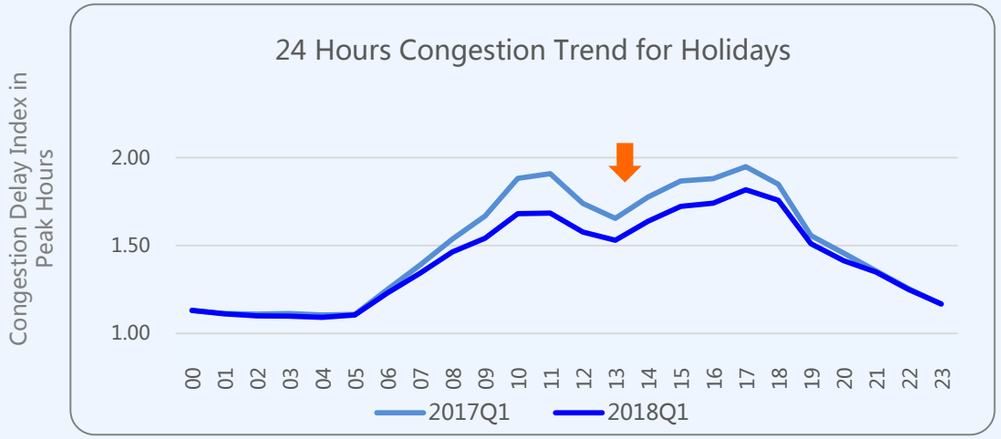
The most frequently congested city Jinan clearly reduce its congestion degree in 2018, Q1

Compare with 2017 Q1, in 2018 Q1, Jinan, as the most congested city in last few years, has reduced its congestion with the congestion delay index by 5.6%. Unlike 2017, on Feb. 12 (the eve of 2018 Spring Festival), there was a reduction for its congestion degree, and no dramatic increase of congestion can be found after the 2018 Spring Festival. In this periods, there was few days with severe congestion (congestion delay index>2), with only steady and smooth congestion degree variation. During the peak hours in March, the congestion delay index of Jinan has clearly reduced by 9.68%.



From 24 hours congestion trend in 2018 Q1, the all-day overall congestion degree for both working days and holidays has clearly improved, with better improvements on the evening peak of working days and the morning peak of holidays respectively.





Congestion Analysis —— Jinan (II)

Road locations of increased congestion and reduced congestion in central parts of Jinan.

In 2018 Q1, the congestion in central parts of Jinan has clearly reduced. The congestion level of some main road including Jinan Jingshi Road, Second Ring East Road, Shandong University Road (From north to south direction), Lishan Road and Jingqi Road, has clearly reduced. On the contrast, some low congested road in last several years has been with high obvious congestion in 2018 Q1, and such roads were mainly next to or connected to the road with reduced congestion.

Location of the road with clearly reduced congestion in Jinan.

Length of these road is over 500 meters, and congestion reduction is more than 5%.

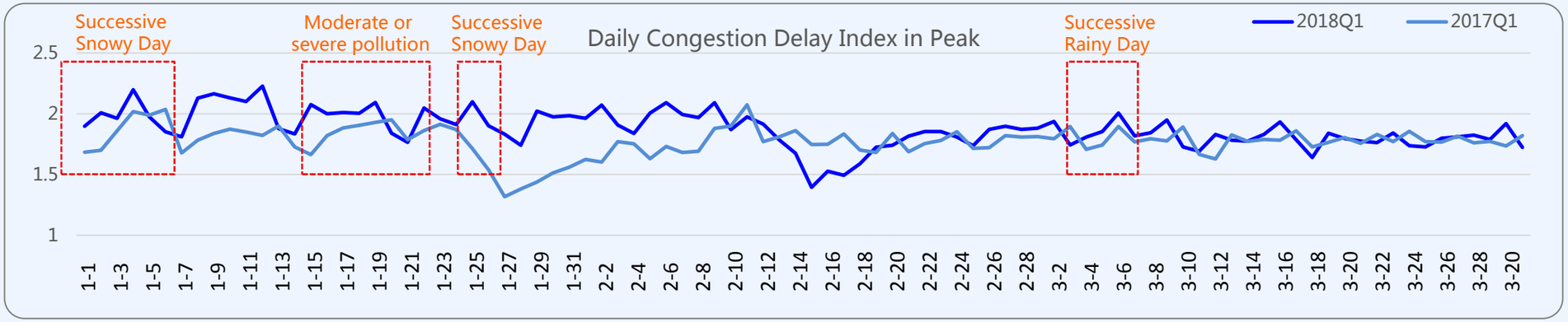
Location of the road with increased congestion in 2018 Q1, but with little congestion before

Road with the congestion delay index less than 1.8 in 2017, but with congestion increase higher than 5%.

Congestion Analysis —— Luoyang

Congestion Reason：Bad Weather makes Luoyang with Excessive High Congestion in January

Compared with 2017 Q1, clear and dramatic increase of congestion can be found during the periods from Jan.1st to the eve of Spring Festival in 2018 Q1. In January, what made congestion has increased were mainly due to the successive snow weather and haze weather. The congestion degree has increased 9.63%, compared with the degree in eve of 2017 Spring Festival, and this increase might related to the concentrated purchasing for the Spring Festival and large activities.



Travel Characteristics：Most Congested Roads in Luoyang Located in the Shopping Areas of Wanda Plaza in Xigong District and Wangfujing Department Store

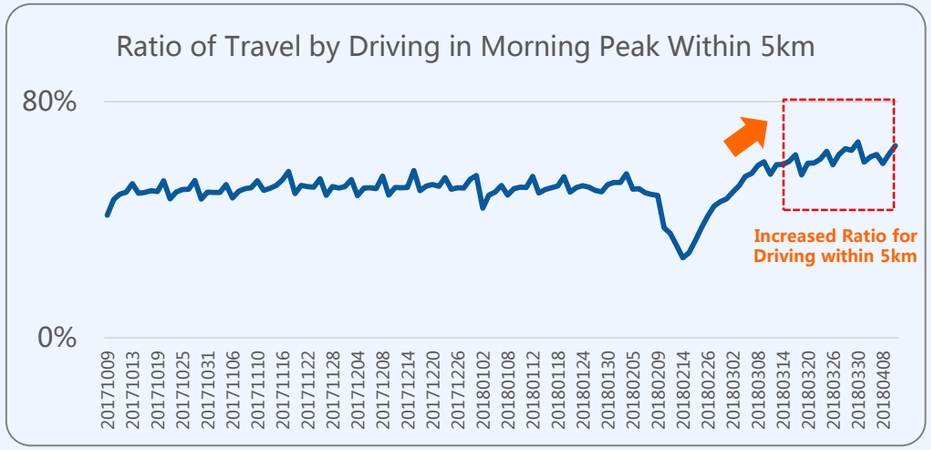
TOP10 Congested Road during Peak Hours

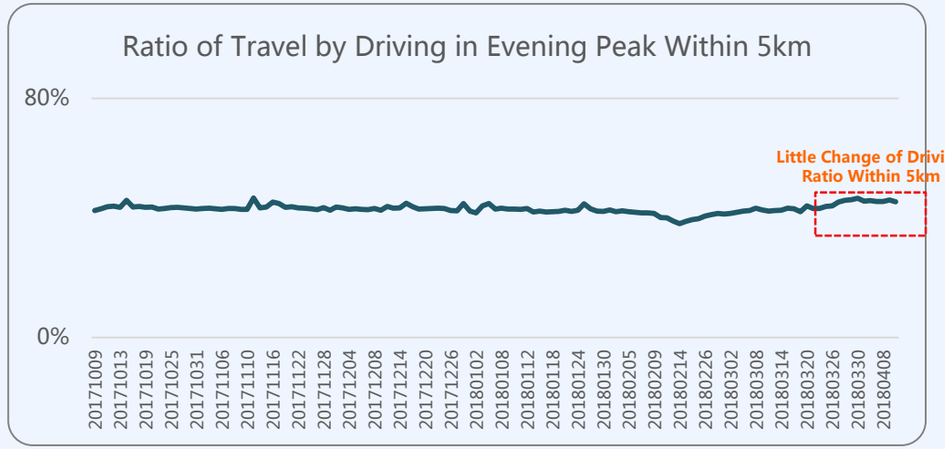
Rank	Road Name	Road Direction	Congestion Delay Index in Peak	Speed in Peak Hours (km/h)
1	Jiandong Road	North — south	3.02	11.3
2	Wangcheng Avenue	Shachang West Road — Binghe South Road	3.01	13.82
3	Shachang South Road	Shachang East Road — Shachang South Road	2.8	13.88
4	Fanglin Road	Binhe South Road — Tang Gong West Road	2.76	13.4
5	Jiandong Road	Lichun Road — the intersection of Zhongzhou West road and Jiandong Road	2.72	13.23
6	Side Road of Jiudu Road	East — West	2.67	19.75
7	Liaoning Road	Kaixuan West Road — Nanchang Road	2.56	15.97
8	Huashan Road	Huashan North Road — Zhongzhou West Road	2.53	17.86
9	West City Loop	From North — South	2.39	15.56
10	Side Road of Wangcheng Avenue	From South — North	2.31	16.69

Congestion Analysis —— Shanghai

The ratio of driving travel in Shanghai has obviously increased within the distance of 5 km travel, in morning peak during the middle and late of March.

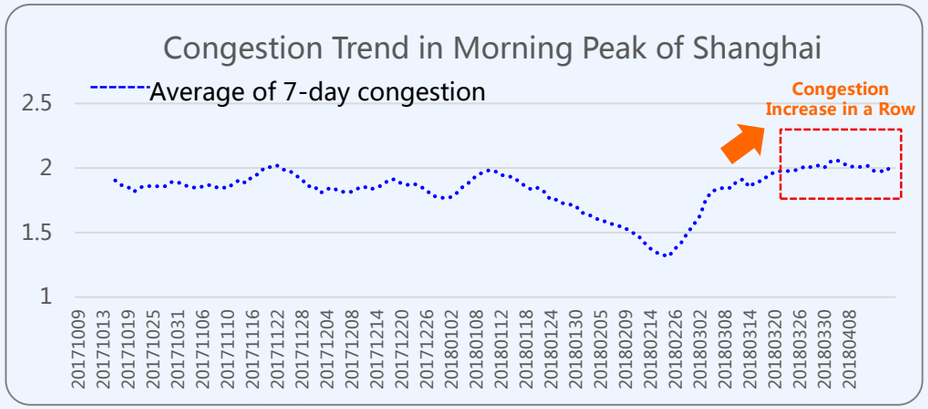
According to the data from Oct.1st in 2017 to Apr. 10th in 2018, the ratio of travel for driving users that using navigation service within 5km has increased dramatically by 10% in morning peak, but the travel ratio of evening peak has increased marginally about only 2%.

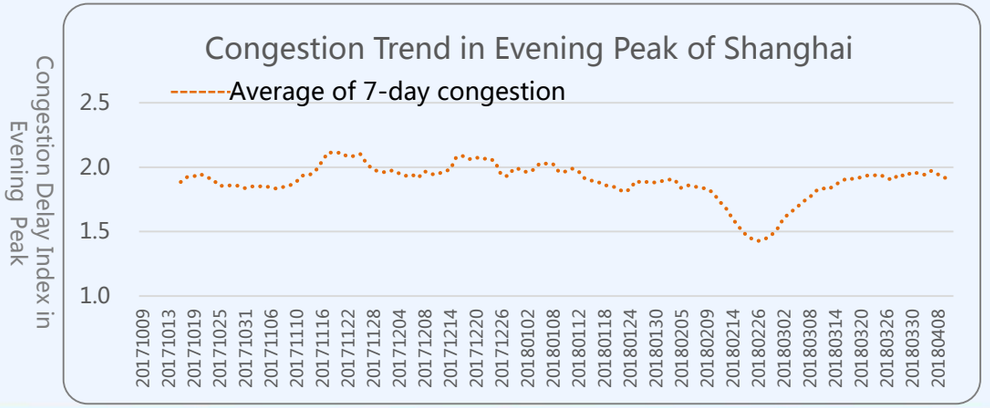




Congestion in Shanghai has slightly increased in the morning peak, during the middle and late of March.

According to the congestion trend from Oct.1st in 2017 to Apr.10th in 2018, since the middle and late of March, the congestion in Shanghai has continually increased in morning peak and evening peak. The average congestion delay index of morning peak in 2018 Q1 was higher than the index of morning peak in 2017 at 8.1%.

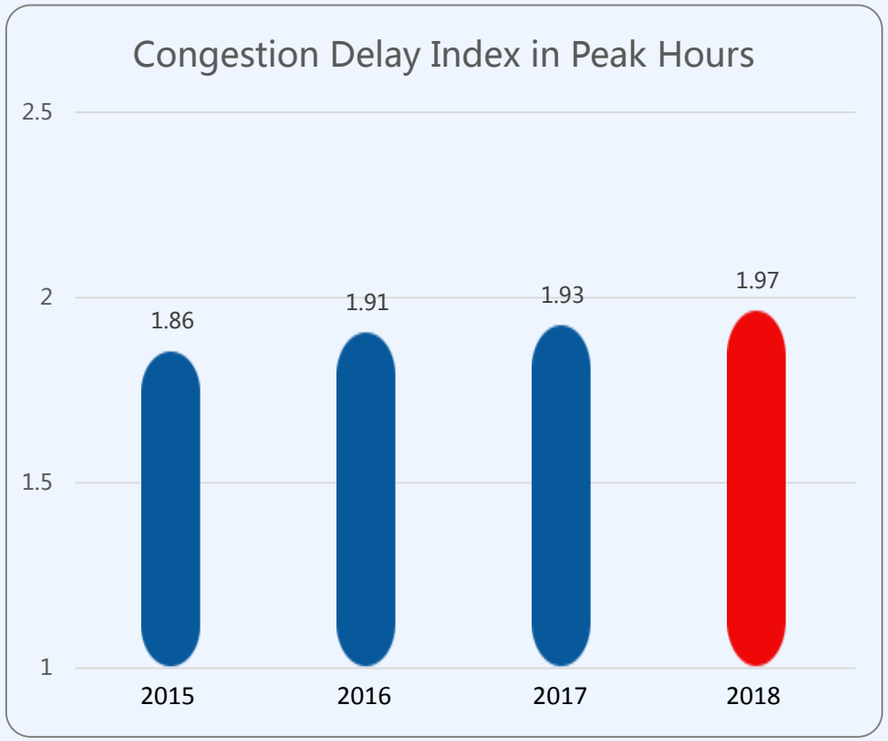


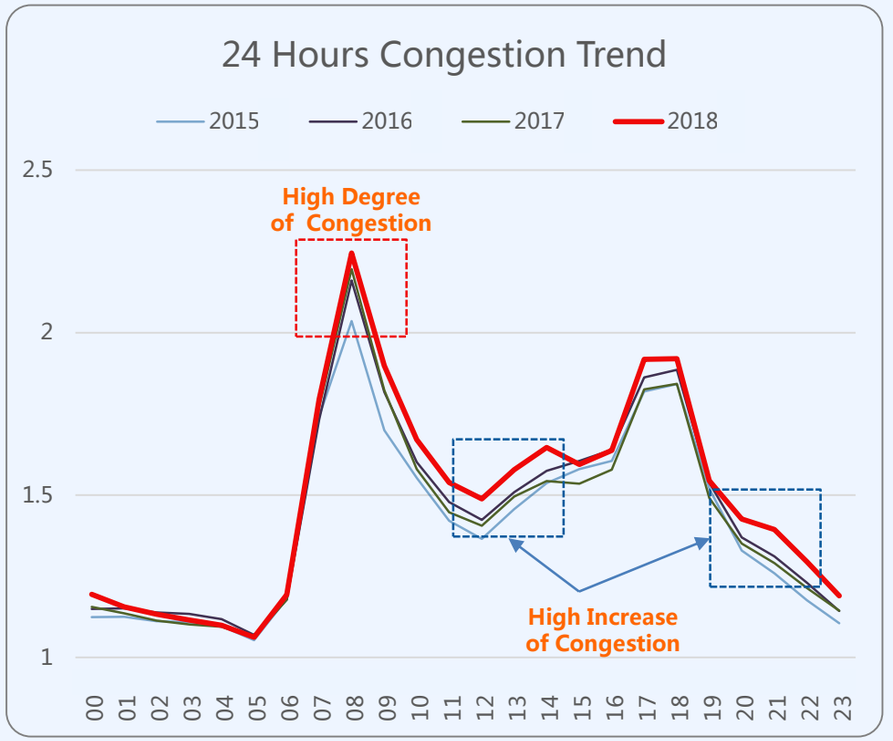


Congestion Analysis —— Shanghai

The congestion in Shanghai was the highest during the periods from the middle and late of March to April 10th , compared with the same time in last 4 years.

By examining and analyzing the increased ratio of travel within five kilometers, what can be found is that the congestion in peak has increased in recent years, with peak congestion delay index hitting at 1.97 in 2018 Q1. From the 24 hours congestion delay index trend, what can be found is that the morning peak was the most congested period. The index has increased in recent four years during the periods from March. 21st to April 10th, with the highest increase on night and the time periods of 6:00~22:00(non-peak)

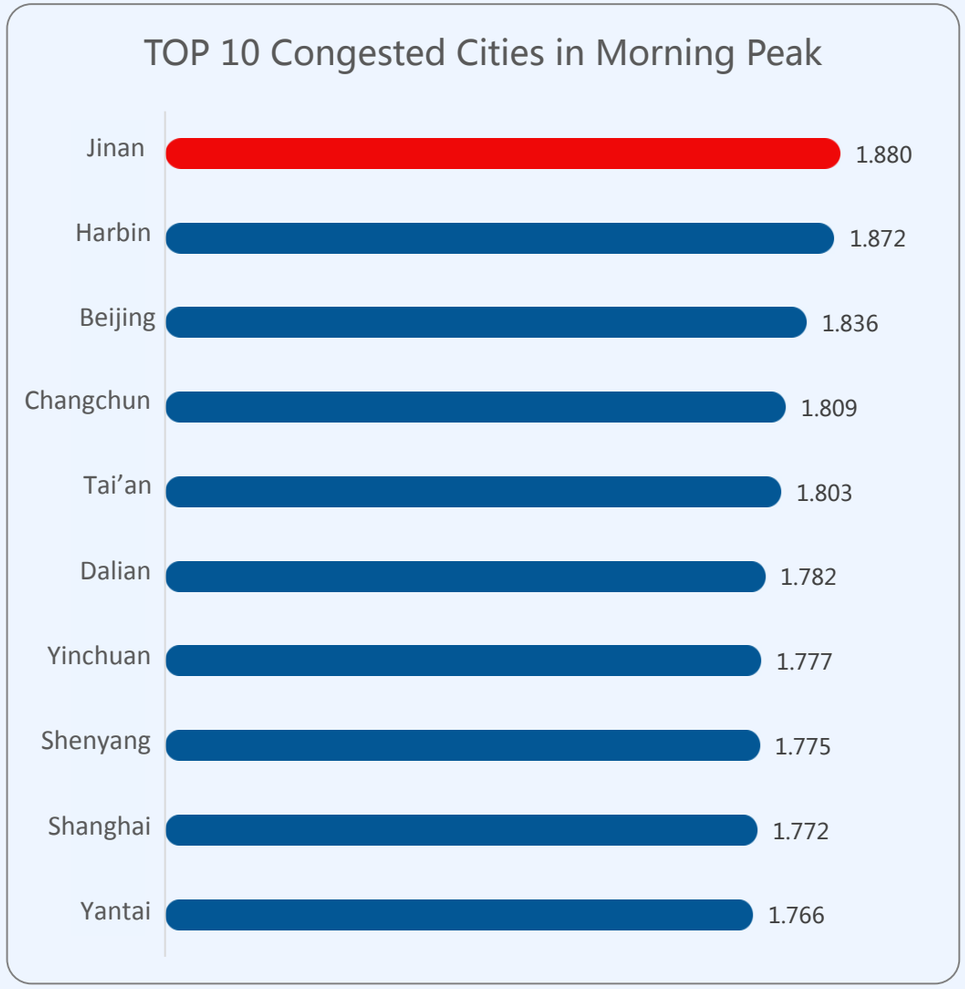


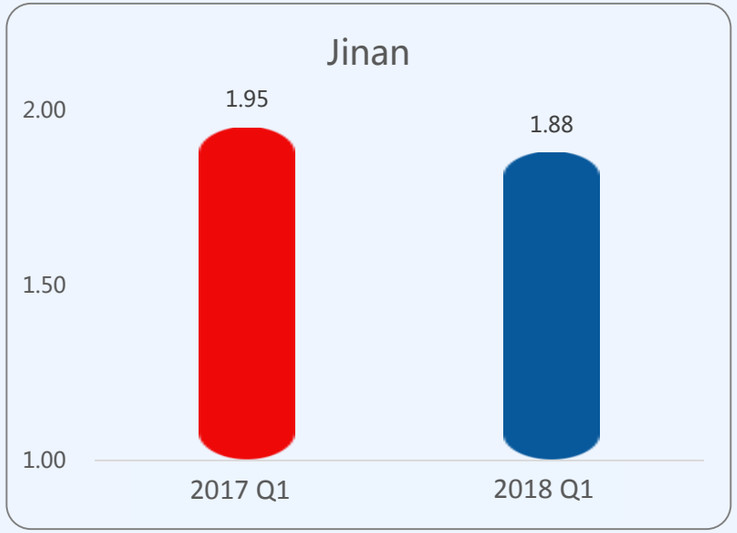


Time Range：March 21st -Aprial 10th , Working days

City Label —— Jinan, The Most Congested Morning Peak

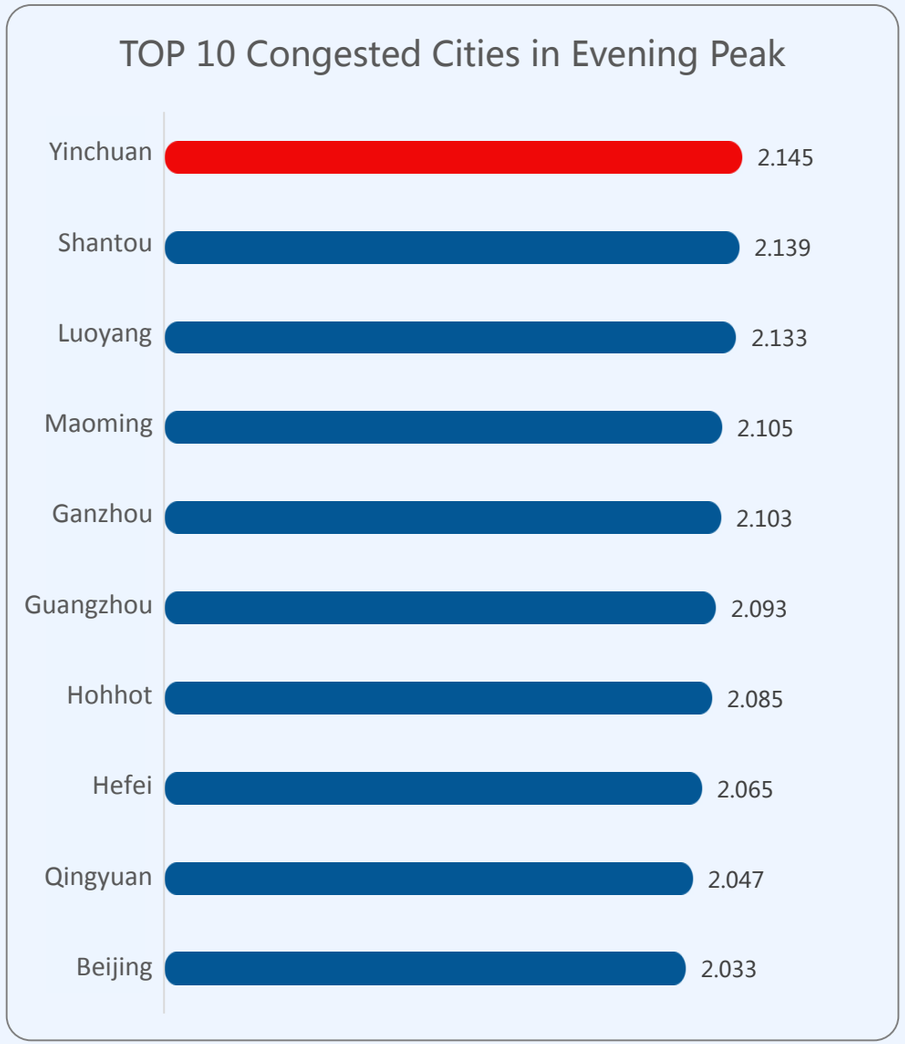
Jinan was the most congested city during morning peak in 2018 Q1, and the top three congested cities in the list were all old congested cities. From the location, most congested cities in morning peak were northern cities in China, and only Shanghai, belonging to southern cities in china, is in the list. Although Jinan ranks the first, its congestion delay index reduced by 3.6%.

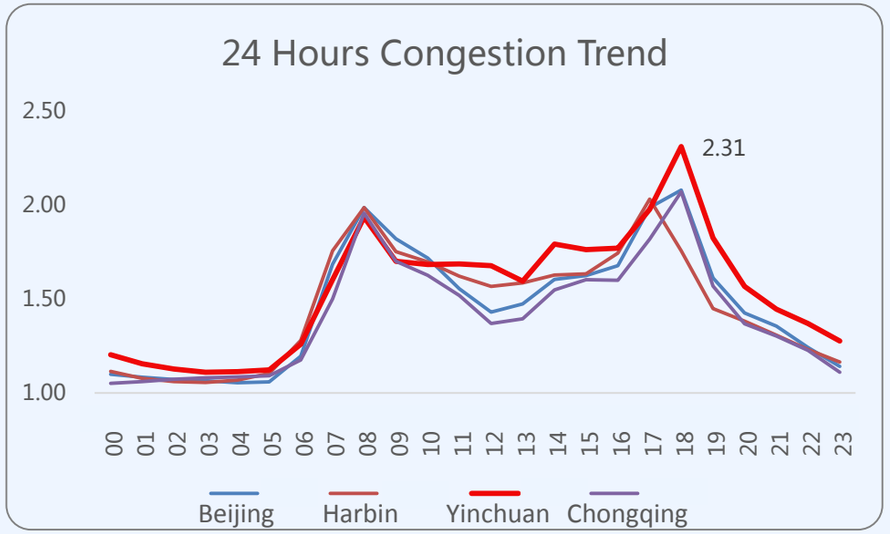




City Label —— Yinchuan, The Most Congested Evening Peak

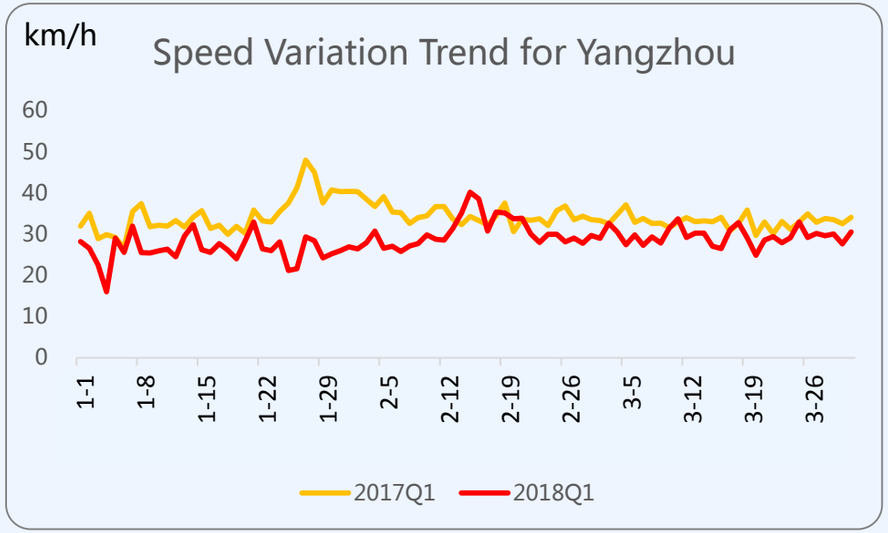
Yinchuan was the most congested evening peak in 2018Q1, with congestion delay index in evening peak at 2.145 , the highest index at 2.31. From the top 10 congested cities in evening peak, the top 3 were large and middle cities, whereas the traditional congested city during evening peak - Guangzhou just ranked at sixth.





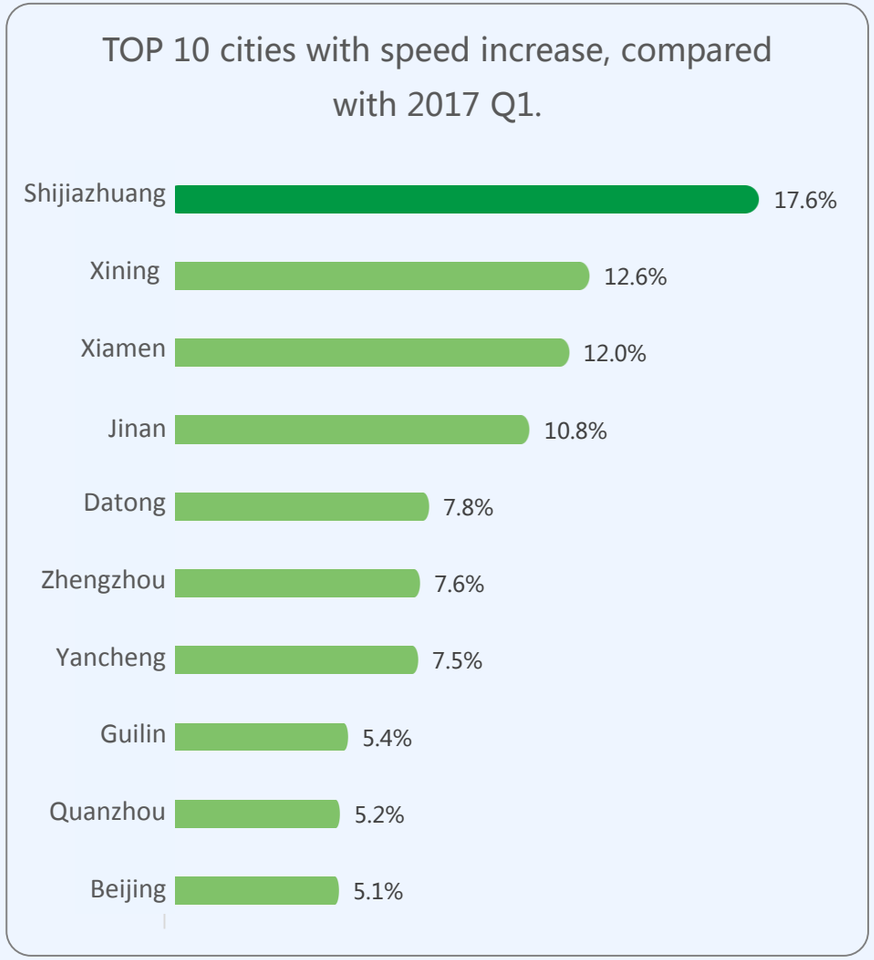
City Label —— Yangzhou, The Highest Speed Reduction, Compared with 2017 Q1

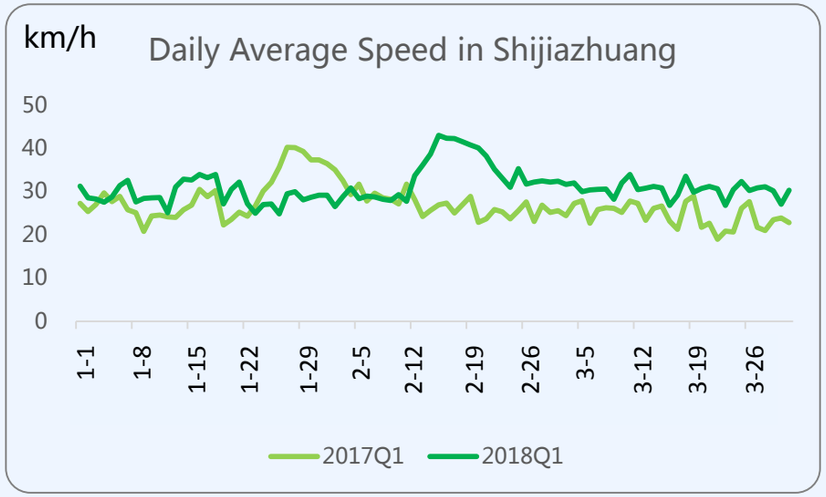
Most cities with large speed reduction were also with their number of driving users increasing in 2018 Q1, another reason for this might due to the bad weather of rain and snow in many cities in January.



City Label —— Shijiazhuang, The Highest Speed Increase, Compared with 2017 Q1

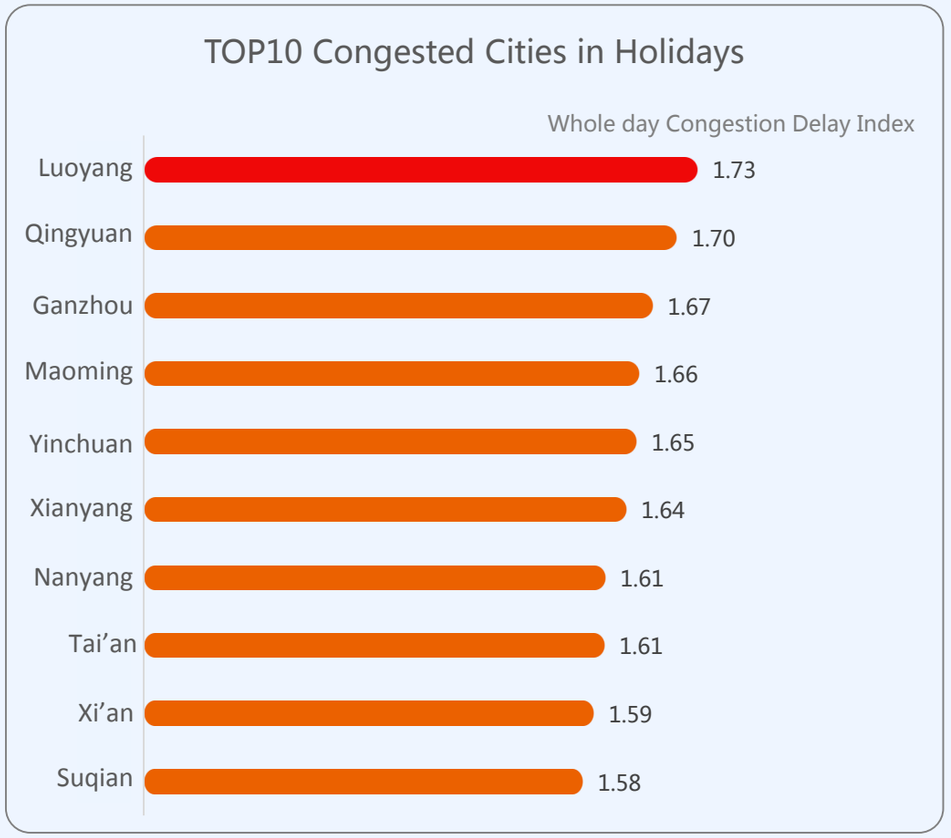
For cities in top 10 lists with the speed increased, compared with 2017 Q1, the congestion of Shijiazhuang and Jinan reduced obviously, making a better vehicle driving in cities. Ranked in second, the speed increase for Xining largely due to the vehicle running limitation of road driving in central areas.





City Label —— Luoyang, the Most Congested City in Holidays

Luoyang was with the highest congestion delay index in holidays. In Luoyang, the first season is the time that peony has flowered, so there is high demand of travel going out, which increased the degree of road congestion. Among all congested areas, the core travel and business locations suffered high level of congestion were Jianxi District, Xigong District and Old city District.



Location of Congested Road in Luoyang on Weekend

Congestion Rank for Selected 100 Cities (1~25)

Rank	Rank Change	Change Rate	City Name	Congestion Delay Index (Peak)	Peak Average Speed (km/h)	All-day Congestion Delay Index	All-day Average Speed	Congestion Delay Index in Morning Peak	Average Speed in Morning Peak	Congestion Delay Index in Evening Peak	Average Speed in Evening Peak	Congestion Delay Index in Non-Peak	Average Speed in Non-Peak
1	↑ 5	5.1%	Yinchuan	1.966	21.41	1.740	24.20	1.777	23.75	2.145	19.58	1.663	25.32
2	↓ -1	-5.6%	Jinan	1.954	23.59	1.653	27.94	1.880	24.56	2.028	22.71	1.552	29.78
3	↑ 8	6.5%	Luoyang	1.941	21.35	1.768	23.44	1.733	23.97	2.133	19.37	1.710	24.25
4	↓ -1	0.5%	Beijing	1.935	24.52	1.641	28.93	1.836	25.86	2.033	23.31	1.542	30.78
5	↓ -3	-2.6%	Hohhot	1.920	24.30	1.670	27.94	1.744	26.81	2.085	22.32	1.586	29.44
6	↑ 11	6.5%	Ganzhou	1.917	21.27	1.756	23.20	1.713	23.88	2.103	19.31	1.702	23.93
7	↑ 3	3.0%	Hefei	1.896	23.37	1.609	27.57	1.723	25.76	2.065	21.42	1.512	29.35
8	↓ -4	-1.5%	Harbin	1.883	23.35	1.640	26.84	1.872	23.52	1.894	23.19	1.559	28.26
9	↑ 10	4.0%	Maoming	1.862	20.21	1.727	21.80	1.609	23.43	2.105	17.85	1.681	22.40
10	↑ 35	9.3%	Shantou	1.849	20.27	1.641	22.81	1.530	24.66	2.139	17.42	1.572	23.80
11	↑ 21	5.7%	Tai'an	1.845	21.47	1.632	24.29	1.803	21.99	1.887	20.99	1.559	25.43
12	↑ 19	5.4%	Nanjing	1.845	23.77	1.585	27.69	1.748	25.12	1.940	22.57	1.498	29.32
13	↓ -6	-1.3%	Chongqing	1.838	25.89	1.572	30.28	1.730	27.53	1.945	24.45	1.483	32.09
14	↑ 34	9.0%	Qingyuan	1.833	23.20	1.658	25.63	1.606	26.61	2.047	20.67	1.600	26.57
15	↑ 5	2.1%	Guangzhou	1.826	24.91	1.643	27.69	1.556	29.25	2.093	21.71	1.581	28.76
16	↓ -1	-0.2%	Xi'an	1.802	25.39	1.623	28.21	1.648	27.82	1.953	23.38	1.563	29.30
17	↑ 57	12.8%	Nanyang	1.799	21.98	1.671	23.66	1.615	24.51	1.974	20.01	1.628	24.29
18	↓ -2	-0.2%	Shanghai	1.798	24.46	1.548	28.42	1.772	24.84	1.823	24.08	1.464	30.05
19	↓ -5	-0.8%	Kunming	1.797	24.86	1.624	27.53	1.589	28.22	1.995	22.31	1.566	28.55
20	↑ 15	2.6%	Changchun	1.784	24.45	1.537	28.38	1.809	24.12	1.759	24.79	1.455	30.00
21	↑ 2	0.2%	Xianyang	1.783	23.21	1.640	25.23	1.625	25.47	1.933	21.39	1.592	25.99
22	↓ -13	-3.5%	Nanning	1.779	23.20	1.606	25.69	1.539	26.97	2.008	20.45	1.548	26.64
23	↑ 27	6.6%	Shenyang	1.776	24.43	1.530	28.37	1.775	24.45	1.777	24.41	1.447	29.99
24	↓ -2	-1.0%	Haikou	1.767	21.79	1.581	24.34	1.525	25.35	1.996	19.20	1.519	25.33
25	↑ 57	11.8%	Suqian	1.765	24.78	1.612	27.11	1.670	26.25	1.850	23.59	1.561	28.00

Possible reason for newly congestion listed cities:

1. Travel into cities during the Spring Festival, and hence, increased the high popularity of travel took by vehicle.

2、Bad Weather.

Congestion Rank for Selected 100 Cities (26~50)

Rank	Rank Change	Change Rate	City Name	Congestion Delay Index (Peak)	Peak Average Speed (km/h)	All-day Congestion Delay Index	All-day Average Speed	Congestion Delay Index in Morning Peak	Average Speed in Morning Peak	Congestion Delay Index in Evening Peak	Average Speed in Evening Peak	Congestion Delay Index in Non-Peak	Average Speed in Non-Peak
26	↑ 17	3.7%	Nanchong	1.763	22.46	1.644	24.09	1.593	24.93	1.924	20.52	1.604	24.70
27	↓ -14	-3.1%	Datong	1.763	25.65	1.609	28.13	1.645	27.51	1.878	24.06	1.556	29.09
28	↓ -1	-0.2%	Dalian	1.759	26.89	1.492	31.75	1.782	26.59	1.737	27.20	1.402	33.81
29	↑ 36	8.4%	Yangzhou	1.759	26.99	1.540	30.89	1.647	28.92	1.867	25.37	1.466	32.47
30	↑ 11	2.3%	Huizhou	1.754	23.63	1.525	27.18	1.567	26.51	1.936	21.37	1.448	28.62
31	↓ -1	-0.1%	Yantai	1.750	26.32	1.511	30.53	1.766	26.09	1.734	26.56	1.429	32.29
32	↓ -6	-1.0%	Sanya	1.745	22.30	1.664	23.38	1.457	26.76	2.026	19.17	1.637	23.77
33	↑ 26	6.2%	Zibo	1.745	26.08	1.539	29.61	1.681	27.10	1.807	25.14	1.469	31.04
34	↓ -5	-0.9%	Hengyang	1.738	24.68	1.612	26.61	1.549	27.80	1.913	22.36	1.570	27.32
35	↑ 4	0.5%	Guiyang	1.732	27.10	1.523	30.83	1.534	30.66	1.926	24.31	1.452	32.33
36	↑ 34	7.8%	Xinxiang	1.732	24.28	1.602	26.26	1.592	26.45	1.866	22.51	1.558	27.01
37	↓ -12	-1.9%	Chengdu	1.731	26.66	1.565	29.48	1.573	29.38	1.887	24.41	1.510	30.56
38	↓ -17	-3.5%	Changsha	1.723	24.63	1.522	27.89	1.544	27.51	1.900	22.31	1.454	29.19
39	↓ -1	-0.2%	Zhuhai	1.723	27.92	1.464	32.85	1.560	30.84	1.884	25.53	1.378	34.91
40	↓ -16	-2.4%	Nanchang	1.722	25.63	1.532	28.81	1.596	27.74	1.843	23.88	1.469	30.06
41	↑ 16	4.3%	Lianyungang	1.717	24.44	1.567	26.81	1.602	26.21	1.826	22.96	1.515	27.73
42	↓ -24	-4.3%	Zhengzhou	1.714	29.05	1.560	31.96	1.579	31.63	1.846	26.91	1.508	33.07
43	↑ 6	2.2%	Jining	1.705	27.92	1.537	31.00	1.606	29.69	1.802	26.39	1.479	32.21
44	↓ -11	-2.3%	Fuzhou	1.703	26.84	1.496	30.57	1.565	29.28	1.840	24.80	1.426	32.07
45	↑ 32	7.0%	Xuzhou	1.698	26.80	1.534	29.68	1.624	28.09	1.770	25.66	1.479	30.80
46	↑ 12	3.3%	Shenzhen	1.698	27.83	1.532	30.83	1.541	30.79	1.853	25.41	1.477	31.98
47	↓ -13	-2.7%	Jinyang	1.694	29.59	1.537	32.63	1.585	31.76	1.797	27.78	1.484	33.80
48	↓ -36	-7.2%	Lanzhou	1.691	25.29	1.580	27.08	1.580	27.09	1.795	23.79	1.543	27.74
49	↓ -44	-10.5%	Xining	1.690	28.30	1.578	30.35	1.565	30.71	1.807	26.34	1.540	31.11
50	↑ 11	3.1%	Jinhua	1.690	23.11	1.555	25.11	1.591	24.62	1.783	21.84	1.509	25.86

Congestion Rank for Selected 100 Cities (51~75)

Rank	Rank Change	Change Rate	City Name	Congestion Delay Index (Peak)	Peak Average Speed (km/h)	All-day Congestion Delay Index	All-day Average Speed	Congestion Delay Index in Morning Peak	Average Speed in Morning Peak	Congestion Delay Index in Evening Peak	Average Speed in Evening Peak	Congestion Delay Index in Non-Peak	Average Speed in Non-Peak
51	↓ -9	-2.1%	Qinghuangdao	1.678	28.63	1.502	32.04	1.631	29.47	1.724	27.87	1.442	33.39
52	↑ 19	4.5%	Dezhou	1.677	26.66	1.533	29.19	1.587	28.22	1.764	25.30	1.484	30.18
53	↑ 2	1.6%	Wuhan	1.676	27.80	1.454	32.06	1.537	30.34	1.814	25.66	1.380	33.79
54	↑ 19	4.7%	Langfang	1.675	29.24	1.466	33.43	1.609	30.48	1.740	28.11	1.395	35.13
55	↑ 12	3.7%	Tangshan	1.674	27.43	1.505	30.53	1.604	28.67	1.743	26.32	1.448	31.75
56	↑ 27	6.0%	Huai'an	1.668	25.89	1.501	28.79	1.555	27.84	1.776	24.25	1.444	29.93
57	↑ 15	3.5%	Cangzhou	1.661	27.95	1.516	30.65	1.624	28.61	1.698	27.33	1.466	31.69
58	↓ -21	-4.2%	Zhanjiang	1.660	23.20	1.511	25.49	1.443	26.72	1.871	20.56	1.461	26.37
59	↑ 30	6.6%	Chuzhou	1.659	25.42	1.530	27.59	1.554	27.19	1.758	23.94	1.486	28.42
60	↑ 9	3.1%	Jiangxing	1.659	24.74	1.468	27.98	1.613	25.51	1.703	24.04	1.403	29.27
61	↑ 2	1.5%	Linyi	1.658	27.28	1.474	30.71	1.559	29.07	1.756	25.72	1.412	32.08
62	↓ -15	-1.6%	Tianjing	1.657	28.94	1.440	33.31	1.645	29.21	1.669	28.68	1.368	35.09
63	↓ -27	-4.6%	Xiamen	1.654	28.08	1.430	32.47	1.482	31.36	1.825	25.43	1.355	34.27
64	↓ -20	-2.6%	Liuzhou	1.651	24.18	1.516	26.34	1.500	26.67	1.797	22.17	1.471	27.15
65	↓ -37	-6.2%	Foshan	1.651	26.28	1.462	29.68	1.471	29.57	1.825	23.70	1.399	31.02
66	↓ -15	-0.9%	Taiyuan	1.649	30.19	1.475	33.82	1.545	32.30	1.751	28.37	1.416	35.25
67	↓ -5	0.8%	Suzhou	1.648	29.63	1.418	34.47	1.627	30.08	1.669	29.19	1.341	36.47
68	↑ 12	3.6%	Handan	1.641	26.59	1.543	28.30	1.543	28.33	1.735	25.08	1.509	28.93
69	↓ -61	-11.9%	Shijiazhuang	1.640	29.61	1.460	33.30	1.562	31.13	1.718	28.24	1.399	34.75
70	↓ -4	1.0%	Baoding	1.634	30.27	1.486	33.33	1.575	31.45	1.692	29.20	1.437	34.51
71	↓ -19	-1.9%	Zhangzhou	1.627	26.27	1.534	27.83	1.422	30.26	1.816	23.40	1.502	28.39
72	↓ -32	-5.3%	Zhangjiakou	1.627	31.39	1.514	33.73	1.554	32.93	1.696	30.03	1.476	34.61
73	↓ -27	-3.7%	Qingdao	1.620	29.62	1.414	33.95	1.594	30.10	1.645	29.16	1.346	35.70
74	↑ 10	3.2%	Ningbo	1.616	26.24	1.416	29.95	1.555	27.28	1.676	25.27	1.349	31.44
75	↑ 11	3.2%	Changzhou	1.615	30.79	1.427	34.88	1.566	31.83	1.662	29.84	1.364	36.51

Congestion Rank for Selected 100 Cities (76~100)

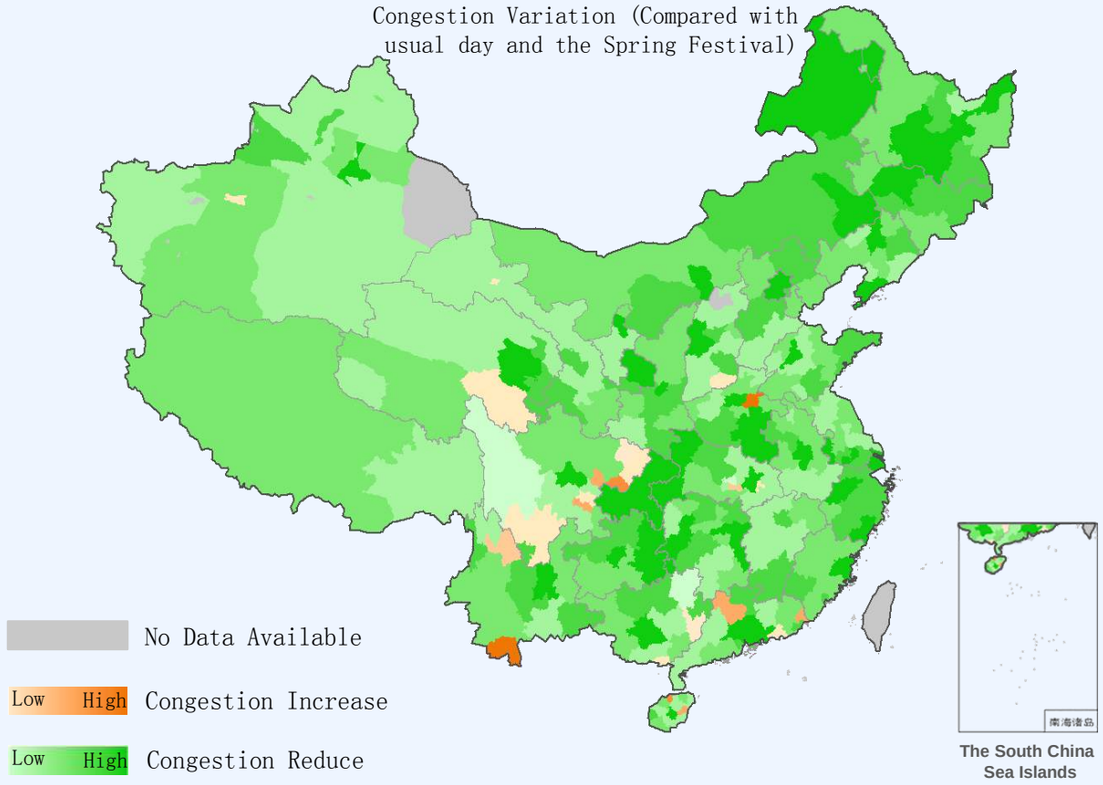
Rank	Rank Change	Change Rate	City Name	Congestion Delay Index (Peak)	Peak Average Speed (km/h)	All-day Congestion Delay Index	All-day Average Speed	Congestion Delay Index in Morning Peak	Average Speed in Morning Peak	Congestion Delay Index in Evening Peak	Average Speed in Evening Peak	Congestion Delay Index in Non-Peak	Average Speed in Non-Peak
76	↑ 12	3.3%	Shaoguan	1.612	27.53	1.450	30.60	1.443	30.82	1.769	25.03	1.396	31.79
77	↓ -23	-2.6%	Guilin	1.609	31.35	1.487	33.94	1.447	35.07	1.762	28.46	1.447	34.91
78	↓ -3	0.7%	Xianggang	1.599	38.16	1.517	40.12	1.505	40.88	1.689	35.85	1.490	40.83
79	↑ 13	4.3%	Wuxi	1.594	29.92	1.401	34.08	1.515	31.51	1.672	28.49	1.336	35.74
80	↓ -16	-2.4%	Zhongshan	1.592	29.89	1.429	33.32	1.476	32.31	1.706	27.82	1.375	34.66
81	↓ -21	-3.2%	Deyang	1.588	33.72	1.484	36.16	1.526	35.26	1.646	32.37	1.448	37.07
82	↑ 3	1.5%	Weifang	1.588	30.71	1.443	33.85	1.531	31.86	1.644	29.65	1.394	35.07
83	↓ -27	-3.8%	Hangzhou	1.586	25.73	1.498	27.25	1.540	26.53	1.631	24.98	1.468	27.80
84	↓ -16	-2.0%	Wenzhou	1.580	27.30	1.456	29.65	1.469	29.45	1.688	25.49	1.414	30.53
85	↓ -7	-0.8%	Shaoxing	1.573	28.87	1.415	32.13	1.521	29.91	1.624	27.91	1.361	33.40
86	↑ 8	4.5%	Dongguan	1.570	31.99	1.413	35.56	1.412	35.60	1.726	29.06	1.361	36.94
87	↓ -8	-1.5%	Zhaoqing	1.560	28.96	1.414	31.97	1.426	31.78	1.688	26.68	1.365	33.13
88	↑ 5	1.7%	Zhenjiang	1.551	29.39	1.415	32.22	1.484	30.82	1.613	28.16	1.369	33.29
89	↓ -8	-2.1%	Xingtai	1.546	30.86	1.465	32.57	1.458	32.77	1.632	29.21	1.438	33.20
90	-	-0.2%	Jiangmen	1.543	31.42	1.393	34.79	1.430	34.08	1.649	29.24	1.344	36.09
91	↓ -38	-7.0%	Ordos	1.539	36.25	1.478	37.72	1.451	38.87	1.610	34.37	1.458	38.24
92	↑ 5	5.4%	Wuhu	1.537	27.72	1.428	29.85	1.492	28.61	1.579	26.91	1.391	30.64
93	↓ -17	-3.3%	Quanzhou	1.536	30.65	1.408	33.44	1.374	34.33	1.696	27.73	1.365	34.49
94	↓ -7	-1.9%	Huzhou	1.532	29.16	1.401	31.88	1.511	29.65	1.552	28.69	1.357	32.92
95	-	-0.8%	Urumchi	1.483	31.39	1.609	28.64	1.236	38.62	1.674	27.27	1.648	27.87
96	↓ -5	-3.5%	Taizhou	1.481	30.03	1.388	32.08	1.427	31.25	1.535	28.93	1.356	32.83
97	↑ 2	4.0%	Yili	1.477	27.64	1.550	26.28	1.232	33.39	1.584	25.68	1.570	25.94
98	↓ -2	-1.0%	Yancheng	1.471	34.85	1.371	37.44	1.378	37.43	1.559	32.70	1.337	38.41
99	↓ -1	-0.5%	Nantong	1.429	36.85	1.304	40.44	1.373	38.46	1.483	35.40	1.262	41.81
100	-	-0.6%	Taizhou	1.370	38.47	1.300	40.58	1.323	40.02	1.414	37.09	1.277	41.34

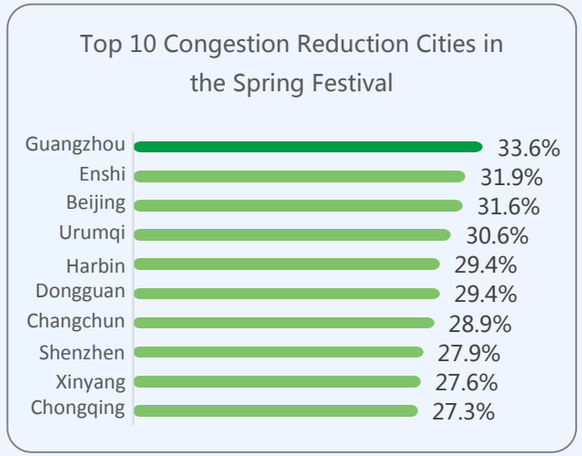
Travel Characteristics in the Spring Festival

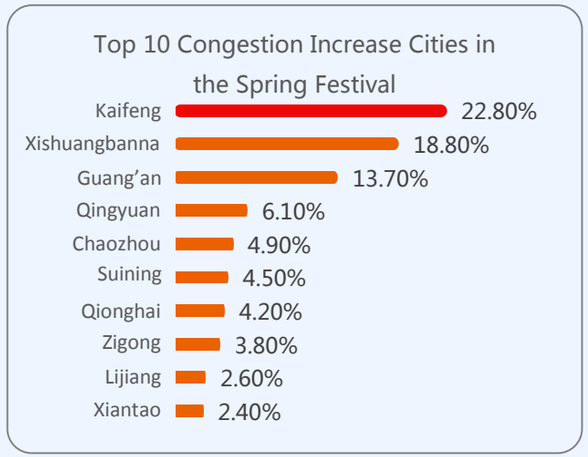
02

Congestion Reduced for Over 94% of Cities in the Spring Festival

Selecting the congestion delay index in 7 days of the Spring Festival to reflect the congestion degree in the Spring Festival. What can be found is shown as congestion variation map below (total 361 cities). From the data, the first-tier cities and some provincial capitals , including Guangzhou, Beijing, Urumqi, Shenzhen and Chongqing, had their congestion reduced dramatically. Among them, Guangzhou were with the largest reduction on its congestion delay index by 33.6%. Meanwhile, some cities had their congestion slightly increased, during the Spring Festival, including cities of Kaifeng in Henan Province, Xishuangbanna in Yunnan Province, Guang’ an in Sichuan Province, Qingyuan in Guangdong Province.



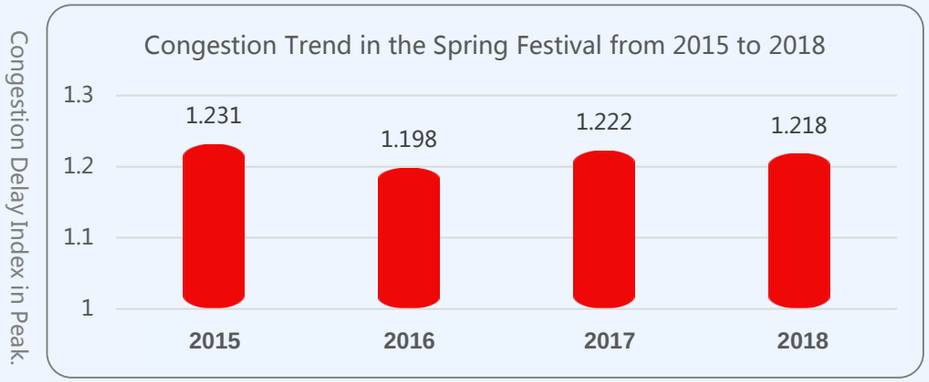


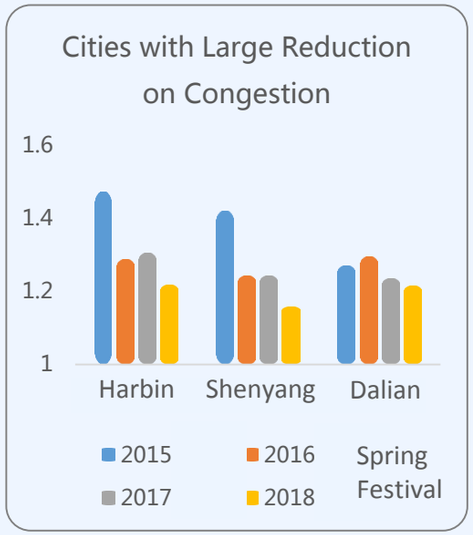


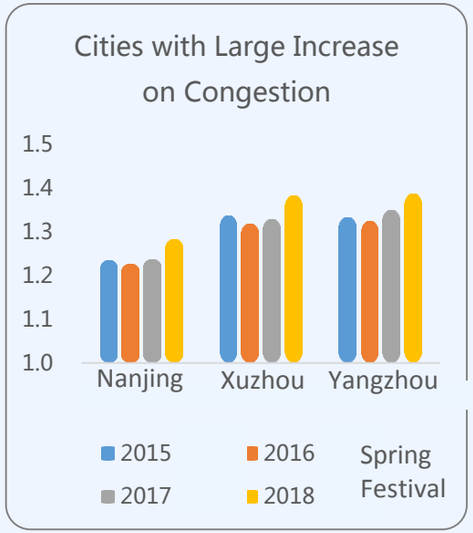
Note: The Spring Festival Time (Feb.15~Feb.21, All-day Congestion Delay Index), The usual day Time(Jan.4~ Jan.28, All-day Congestion Delay Index)

Cities in the Pearl River Delta and the Yangtze River Delta Had Their Congestion Increased and the Congestion of Northeast City Gradually Reduced, in Last 4 years

Compared to the congestion trend in 45 main cities in last 4 years' Spring Festival, the result reveals that the overall congestion trend was stable and with little change. Meanwhile, after the examination of city congestion vibration and trend, what can be found is that cities with the congestion delay index increasing were mainly located in the Pearl River Delta and Yangtze River Delta region. Among them, the largest congestion increased cities were Yangzhou, Xuzhou and Nanjing in 2018 Q1. On the contrast, the largest congestion reduced cities were Harbin, Shenyang and Dalian in northeast region.

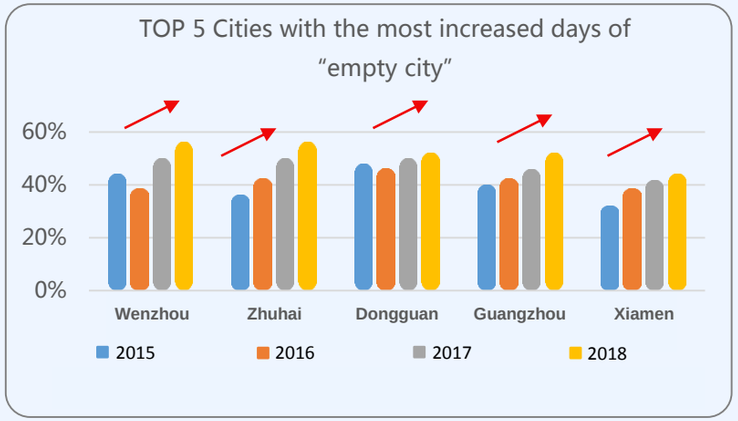


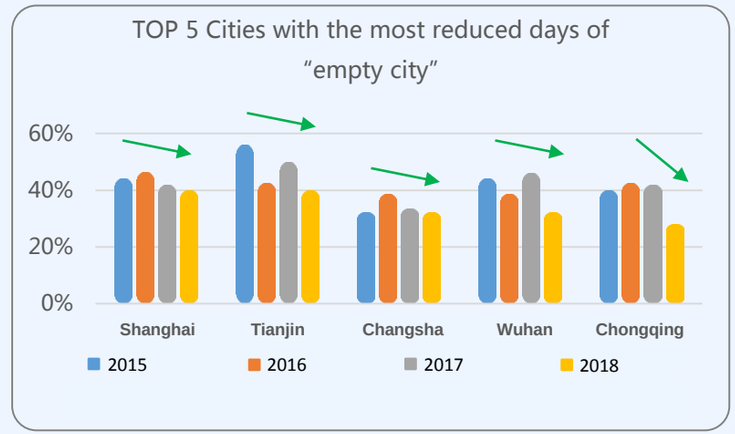




The Numbers of Days of "Empty City" in Some Centrally-Administered Municipality and Provincial Capital Has Reduced, but in Some Eastern Coastal Cities Has Increased.

Among 45 main cities, compared the difference of congestion trend on the average congestion delay index in 2018 Spring Festival with the index in last 4 years' Spring Festival respectively, if the result is lower than the average index of 2018 Spring Festival, that day is called the day of "empty city", which is used to show the situation of traffic during the Spring Festival. According to the results, among 45 cities, the number of days belonging to "empty city" has increased gradually year to year for the cities of Wenzhou, Zhuhai, Dongguan, Guangzhou and Xiamen; on the contrast, the numbers of "empty city" has reduced, for the centrally-administered municipalities and provincial capitals including Shanghai, Tianjin, Changsha, Wuhan and Chongqing.

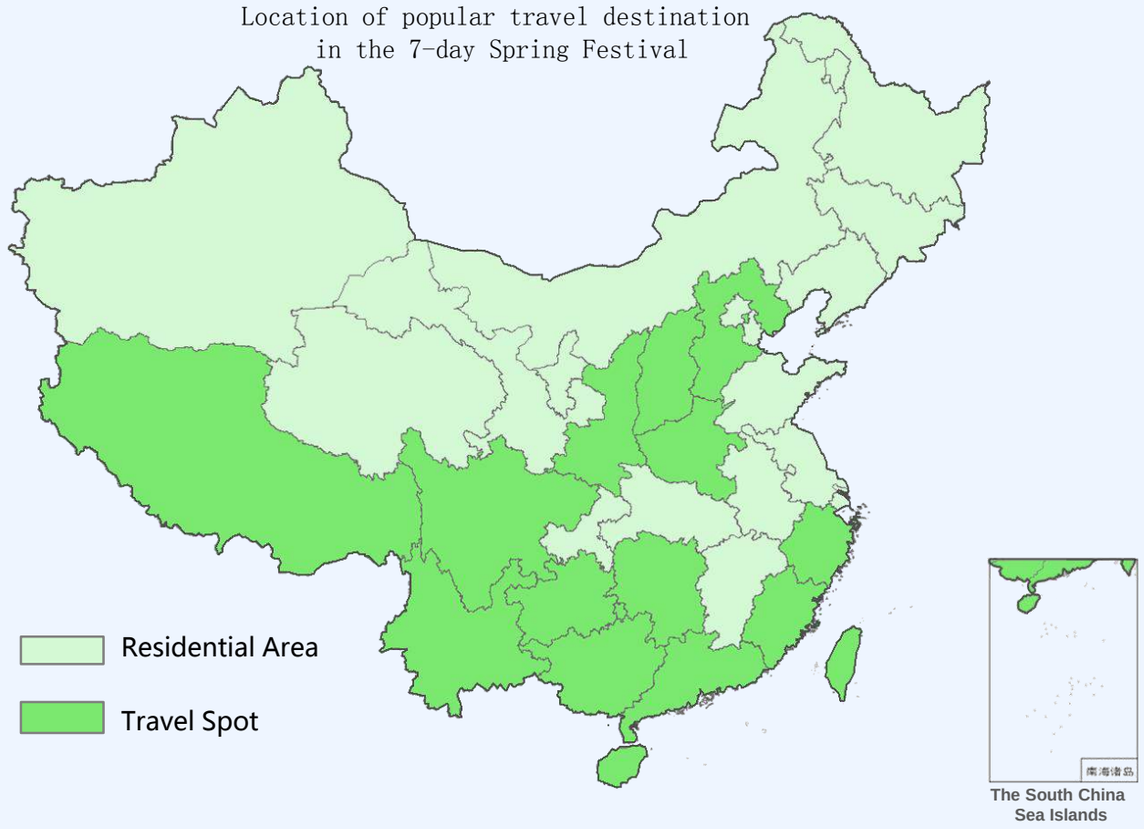


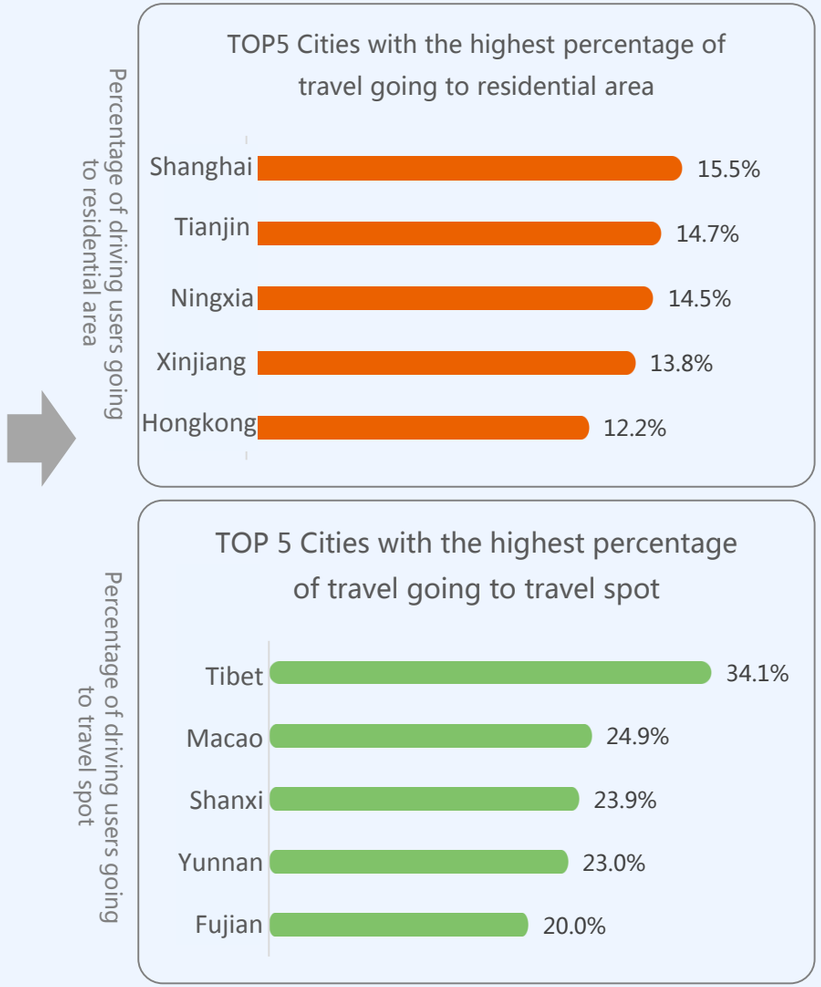


Note: the Ratio of "empty city" days is calculated by the ratio of the days in the Spring Festival that their congestion delay index lower than the average congestion delay index, and the higher ratio means the longer times needed to recovery to normal traffic situation.

Popular Purpose of Driving Tour During the 7-day Spring Festival Are Travel and Visit

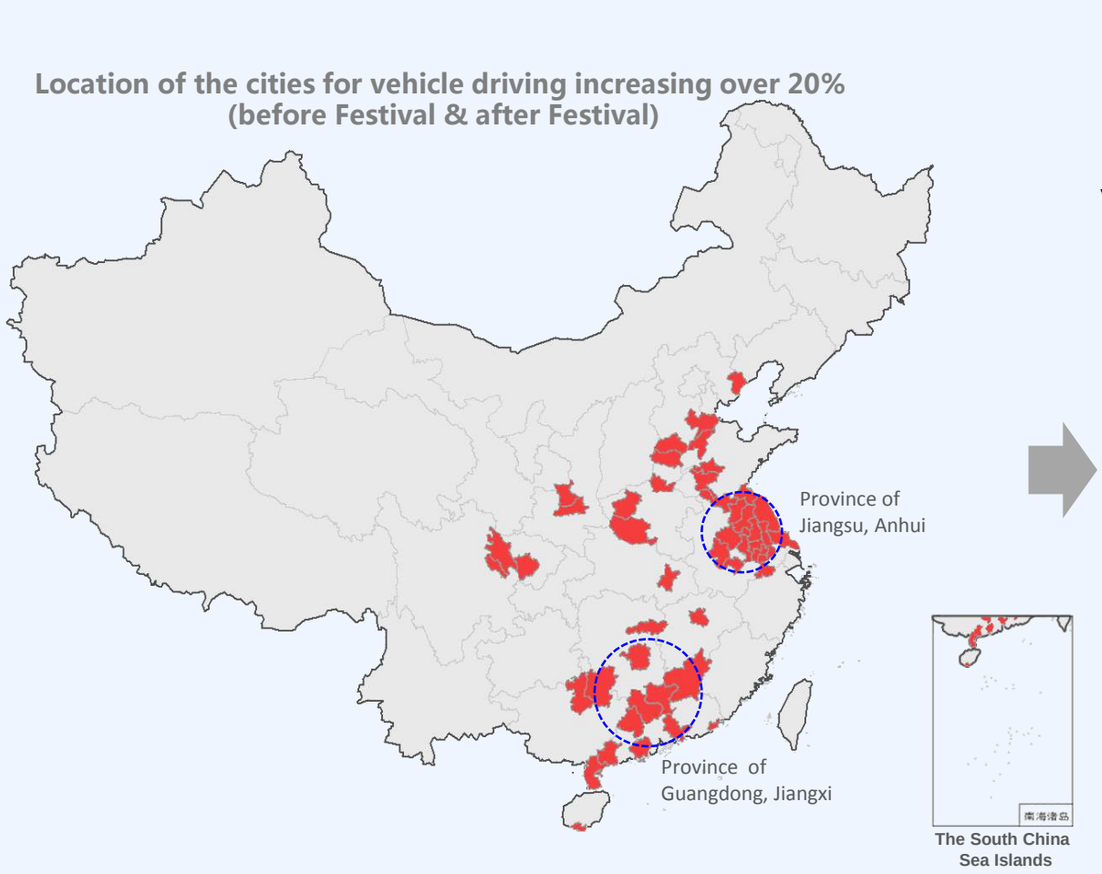
From the destination data from 7-day purpose of driving tour in 2018 Spring Festival, the destination of going to residential areas and tourist attractions occupied the highest ratio of travel. For the location pattern, during the Spring Festival, people of the South prefer to travel out, but people of the North prefer to visit. The top 5 cities that the highest percentage of people there prefer to going to residential area and having a visit were Shanghai, Tianjin, Ningxia, Xinjiang and Hongkong, where as the top 5 cities that the highest percentage of people in China prefer to travel into were Tibet, Macao, Shanxi, Yunnan and Fujian.

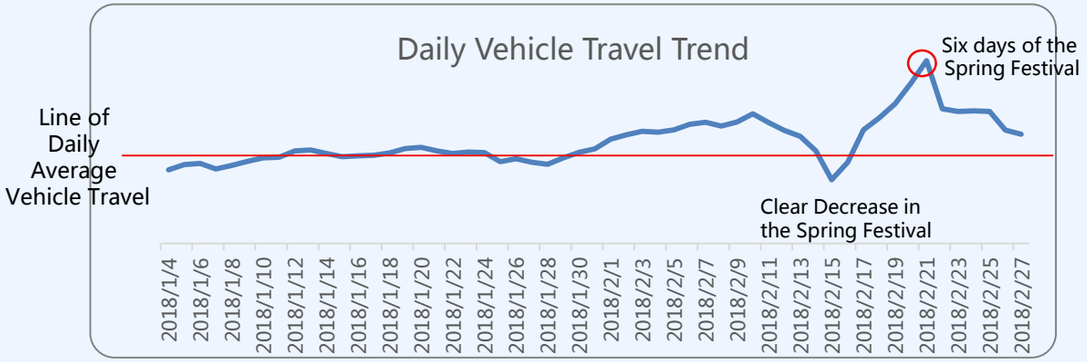


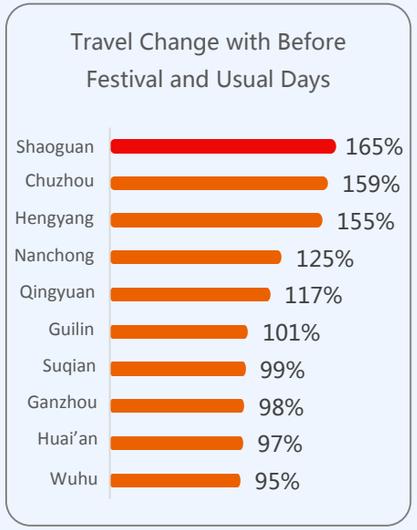


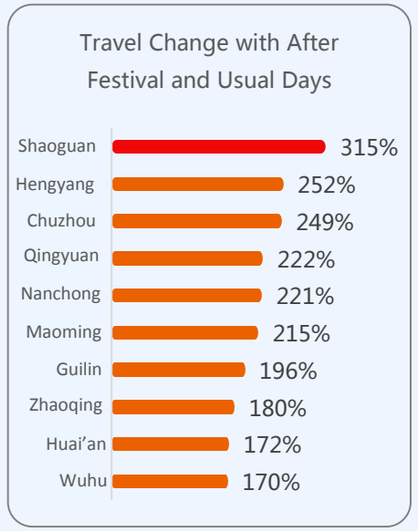
Demand of Passing Through Cities Increased Dramatically in the Spring Festival

For cities that vehicle driving has obviously increased before festival and after festival, the locations of most were in the southern part, with the province of Jiangsu, Anhui, Guangdong and Jiangxi dramatically increasing on the average driving travel. From the cities in top 10 lists during the time between before the Festival and after the Festival, 8 cities were almost with same increasing percentage. Among them, most cities were middle and small cities, belonging to third and fourth-tier cities, just next to the first-tier cities. Congestion has increased in these cities, but these cities were not the destination of travel. Besides, cities like Shaoguan and Chuzhou has dramatically increased the demand of travel than their normal travel demand.



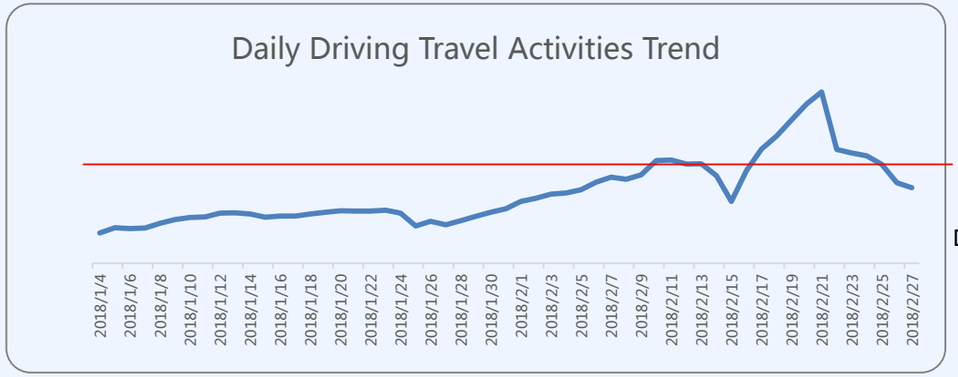


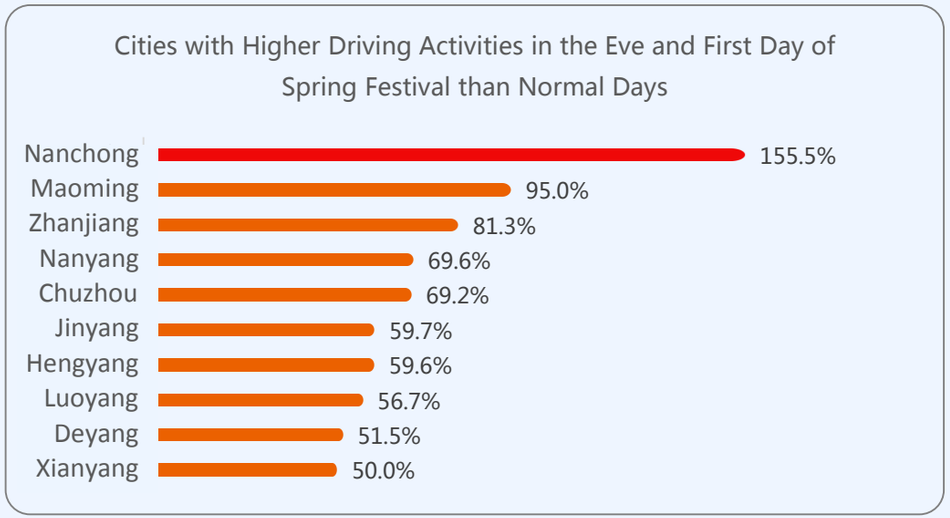




Most Cities with High Driving Travel Activities Were Located in the Provinces of Sichuan, Henan and Guangdong in the Eve and First Day of the Spring Festival, 2018 Q1.

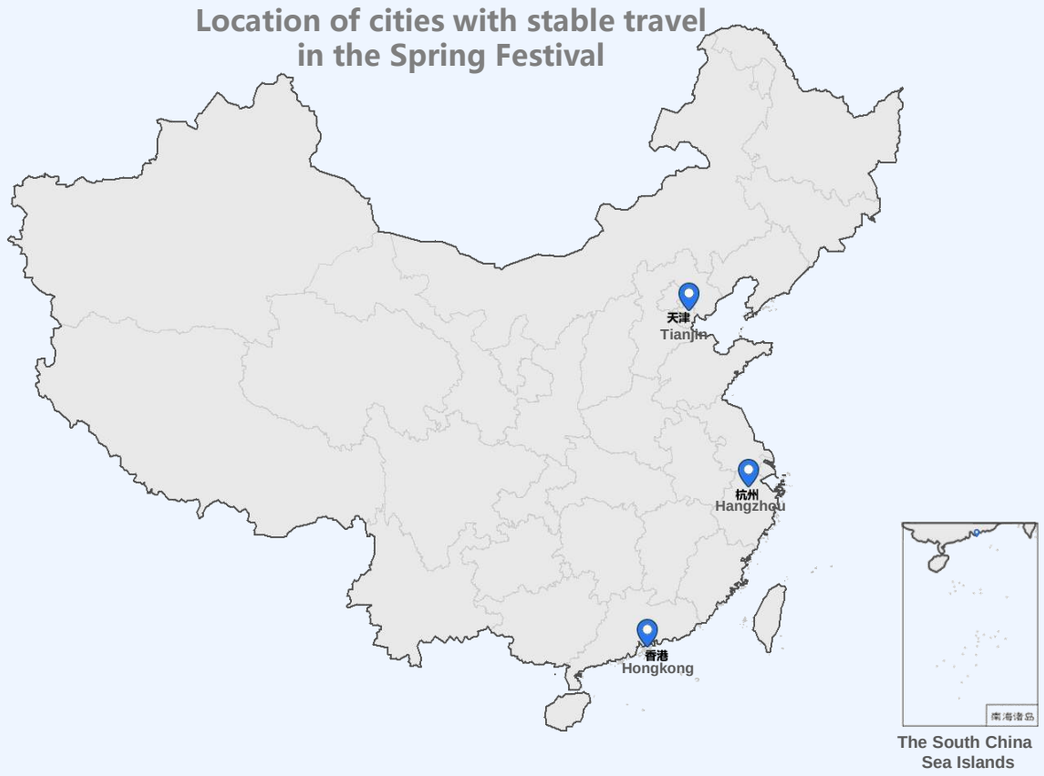
Compared the travel activities of driving travel in the Eve and the First Day of Spring Festival with daily driving travel activities respectively, what can be found is that the city of Nanchong in Sichuan Province ranked the first in the list below, with dramatically increased driving travel activities at 155.5%; Maoming and Zhanjiang in Guangdong Province ranked the third and fourth respectively in the list below. The driving travel in both cities were obviously higher in the Spring Festival periods , than their daily driving travel distance.

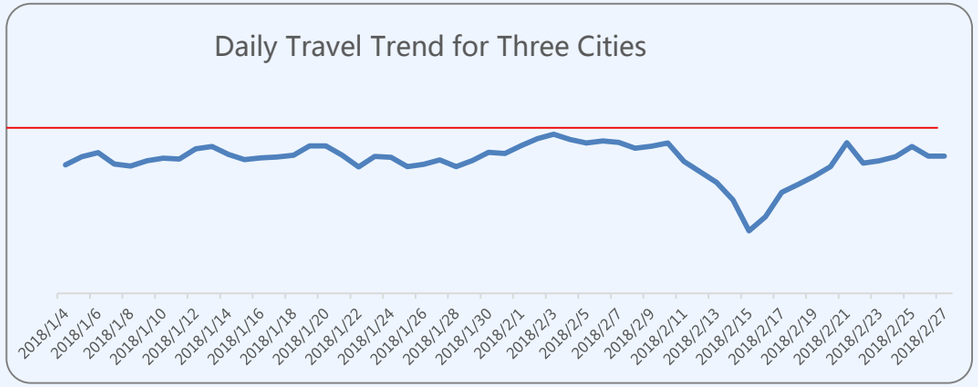


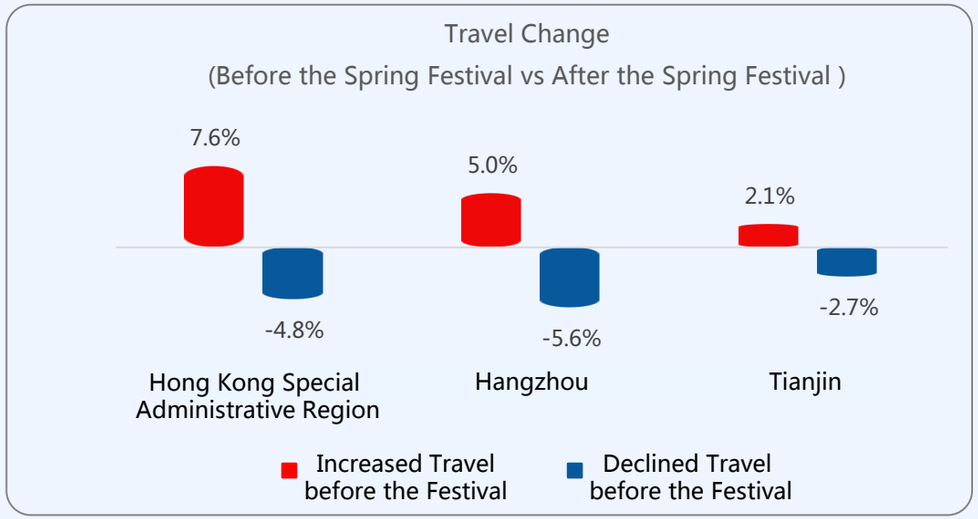


Cities with Stable Travel Activities in the Spring Festival

From users' travel in three time periods, namely, before the Spring Festival(SF), in the middle of SF and after SF, little changes happened for travel in Hongkong, Hangzhou and Tianjin. In other words, this also proves that there were less times of travel on these cities, neither going out of cities nor going into these cities. Across-travel were inactive in these cities, and traffic kept stable for these cities.







03

Cooperative Research Results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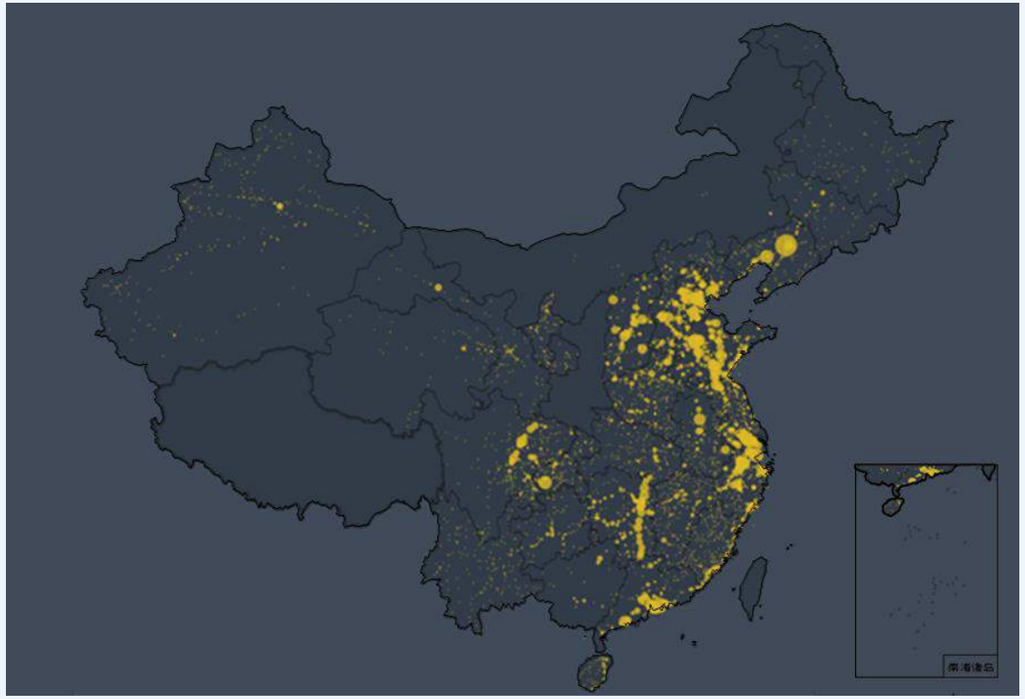
Transport Planning and Research Institute
Ministry of Transport

Freight Traffic Volume of Whole Country Has Increased, with the Highest Volume in the Region of Beijing ,Tianjin ,Hebei and Lu

In this quarter, the data collected from 4000 automatic survey stations on the national trunk road were taken as the analysis object, and the changes in the traffic volume and channel (focusing on the Changjiang Economic Belt and Lianhuo Expressway) were analyzed, as well as the changes in the first quarter of the passenger traffic volume and the volume distribution during the Spring Festival. The result shown as below:

The freight traffic volume has increased in the first quarter. Among them, the freight traffic volume in the regions of Beijing, Tianjin, Hebei and Lu was the highest, but with 1.2% lower of growth rate, compared with the rate in the fourth quarter of 2017. Freight traffic volume in the Yangtze River Delta, Hunan Province, Eastern Sichuan and Guangdong was also quite large. The freight traffic volume along the Yangtze River has steadily increased, with a growth in upstream and a decrease in downstream. The freight traffic volume of Lianhuo expressway has steadily increased.

Heat Map of Freight Traffic Volume in 2018 Q1



Traffic Volume Passenger Vehicle in Whole Country Has Increased, with the Highest Volume in the Region of Yangtze River Delta

Traffic volume of passenger vehicles has also increased in 2018 Q1. In 2018 Q1, the traffic volume of passenger vehicle in the Yangtze River Delta was the highest, as well the Spring Festival. The traffic volume of passenger vehicle in Hunan Province, the regions of Beijing, Tianjin, Hebei and parts of areas in Guangdong were also quite large.

Heat Map of Traffic Volume for Passenger Vehicles in the 2018 Spring Festival

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清華大學 DAIMLER
Tsinghua-Daimler Joint Research Center for Sustainable Transportation

Joint Laboratory for Future Transport and Urban Computing

Signal Evaluation Standard

This study was jointly published by the AutoNavi, the Tsinghua University-Daimler Sustainable Transport Research Center, and the Joint Laboratory of Future Traffic and Urban Computing.

Single intersection evaluation index

Evaluation index

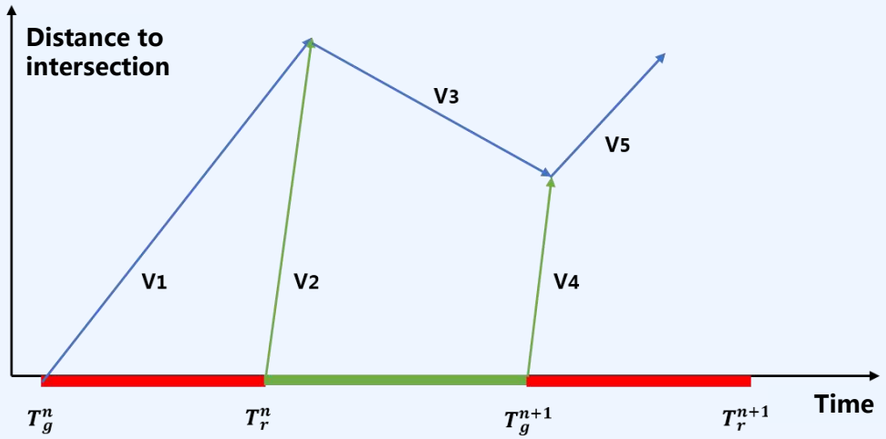
- NVPTI : number of vehicles passing through intersections
- VDTI : Vehicle delays through intersections (compared with free flow speed)
- VDCTF : The average distance from the center of the intersection at the first stop before the vehicle passing through the intersection（0 if there is no stop）
- ANP : The average number of parking stops within a certain distance before the traffic（like 1km）Judging parking by driving speed
- RPT : The ratio of the number of parking to the total vehicle

Balance indicator

- SDD：Standard deviation of delay time at intersections of different directions，Used to indicate the effect of different turn signals on vehicle transit time
- SDAFQ：The standard deviation of the average first queue length of vehicles with different steering directions，Used to indicate the traffic demand of different directions

Signal Evaluation Calculation Model (I)

Evaluation Computation Model - Shockwave Model



Theory Diagram of Shockwave Model

V1——Queuing cumulative shock wave velocity

V2——Queuing Dissipation Shock Wave Velocity

V3——Queuing compression shock wave speed

V4——Residual queuing cumulative shock wave velocity

V5——Queuing the cumulative shock wave velocity in the next cycle

Based on the AutoNavi traffic big data, the traffic shock wave theory can be used to accurately identify the dynamic changes of vehicle queuing, and to analyze the formation-dissipation process of intersection vehicles.

Basic thought : Based on the AutoNavi trajectory data, identify the key points of the changes in the vehicle operating status, and select effective key points related to parking, based on the shock wave theory. The formation and dissipation of parking queues at intersections are calculated, and the queue length of dynamic intersections is obtained.

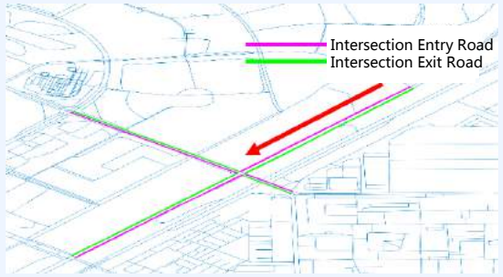
As left figure shows,

The blue line represents the dynamic queue length change. The blue line slope can change with time (Queuing cumulative shock wave speed)

Key point selection based on trajectory motion status ⇨ Key point based shock wave fitting ⇨ Dynamic Queue Length Calculation Based on Shock Wave

Signal Evaluation Calculation Model (II)

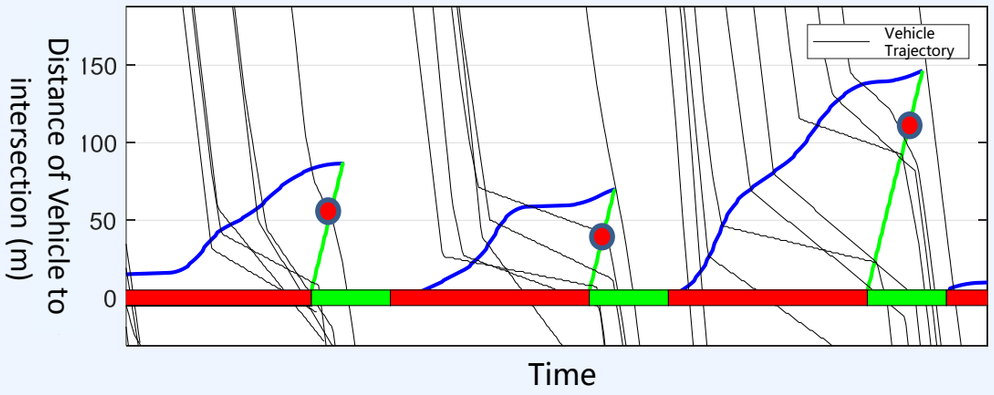
Evaluation Computation Model - Shockwave Model



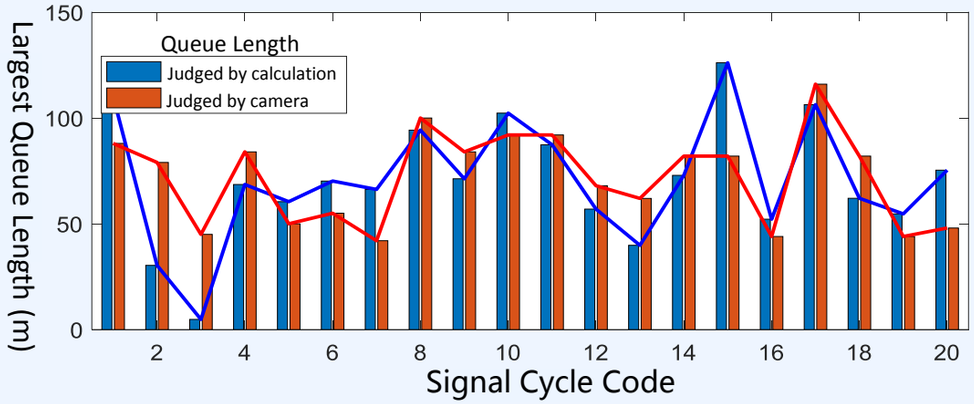
Queue length calculation results verification:

To obtain accurate vehicle queue length data, analysis of video queuing data at intersections between 9:30 and 11:00 on weekdays of the selected intersection was conducted. Track-based queue length data was calculated based on trajectory data during the same time period at the intersection. Then finish validation work through comparison. (Validated signal period was only with a queue length greater than 50 meters) .

Through validation, average error of queue length during verification period is 15.8m, the accuracy is about 77.3% (1-relative error MAPE)



Trajectory data and its queue length calculation process

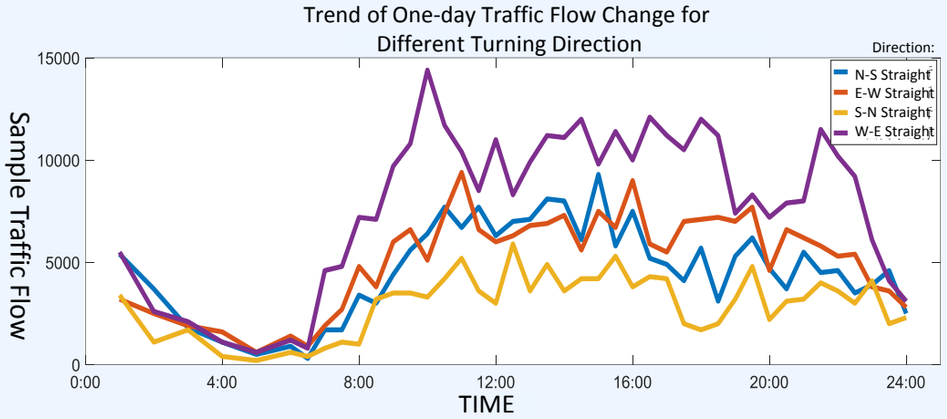


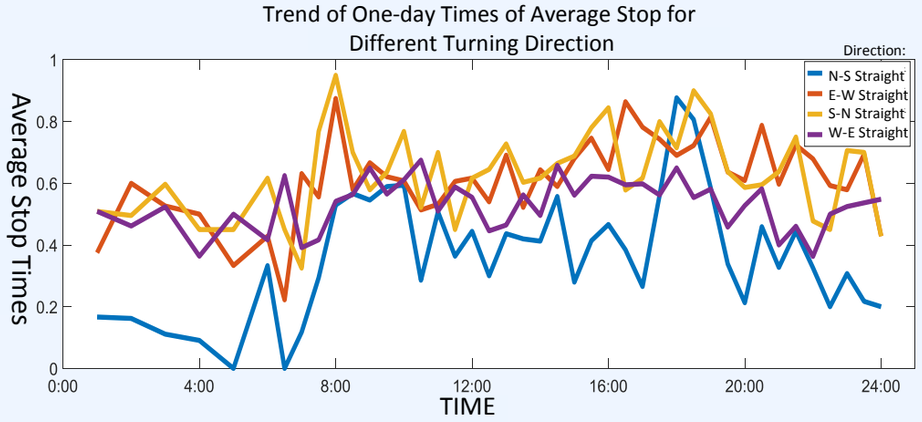
Video Evaluation Queue Length - Trajectory Estimated Queue Length Comparison Diagram

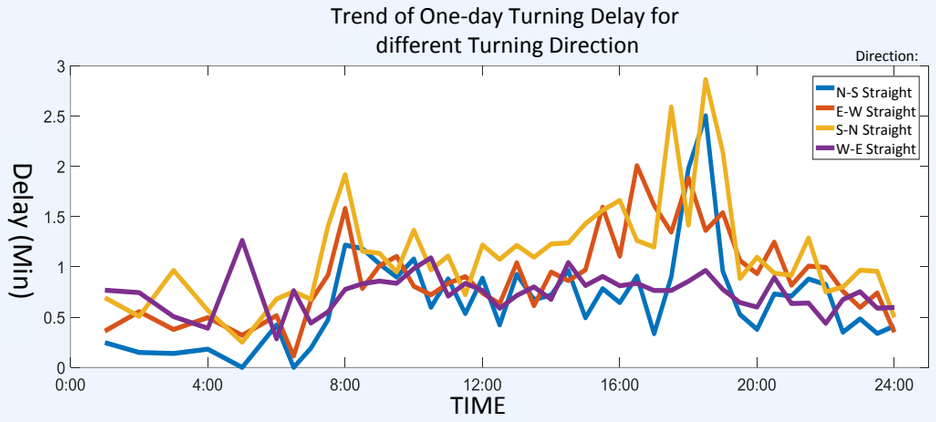
Signal Evaluation

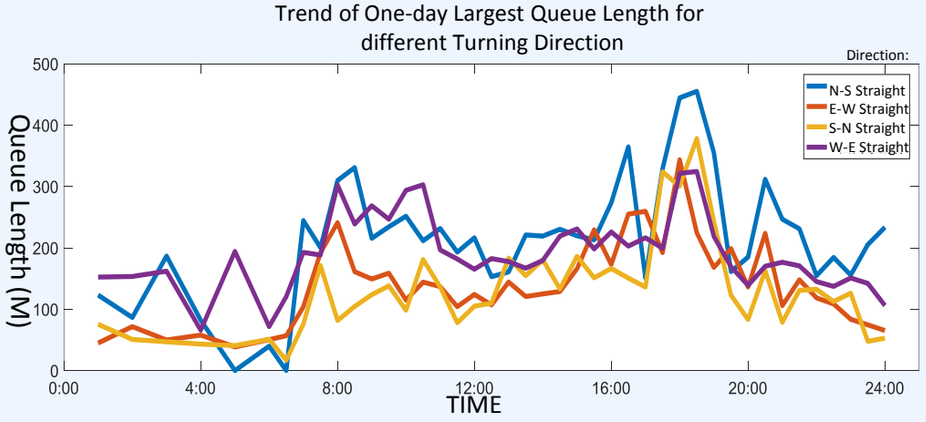
Single Intersection Evaluation Index Change Trend

Location of Zhongguancun No.1 Street









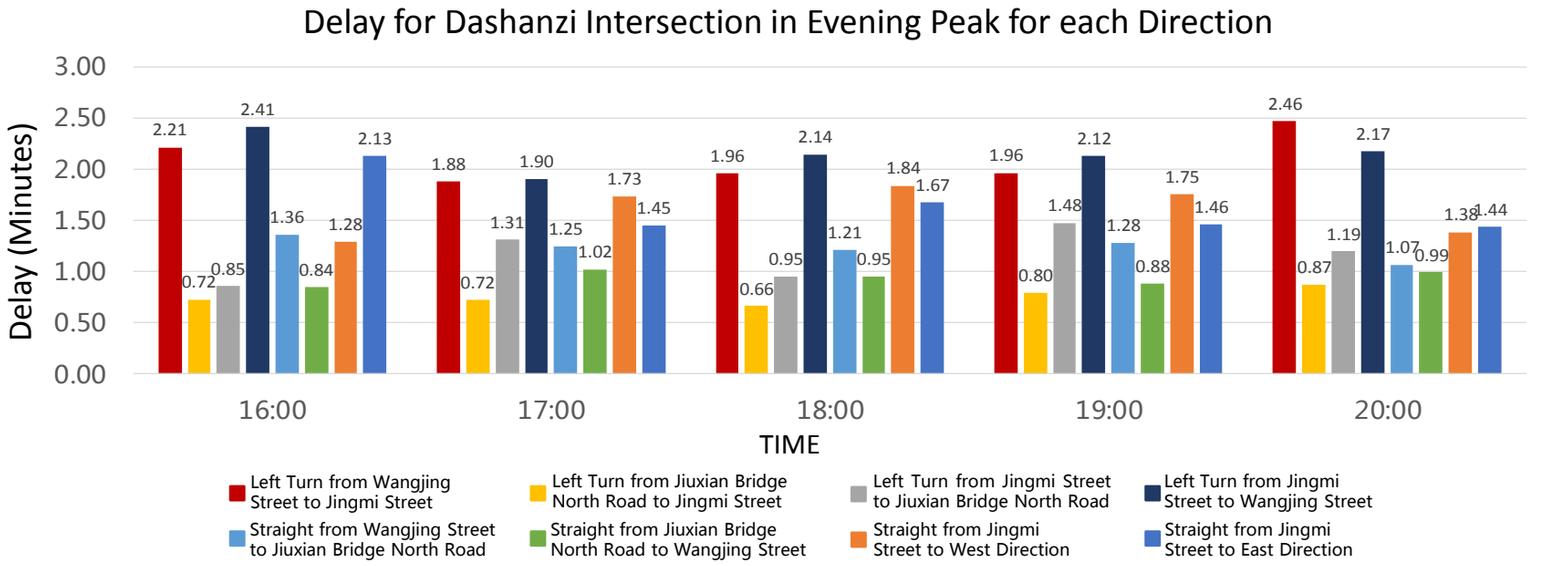
Take the intersection of First Zhongguancun Street as an example, it is possible to calculate the indicators for different directions of the intersection. Indicators display, the evening peak of Zhongguancun First Bridge is from 6pm to 7pm, and this is the most congested time-period. Compared with this, however, the morning peak of 8 am is relatively better.

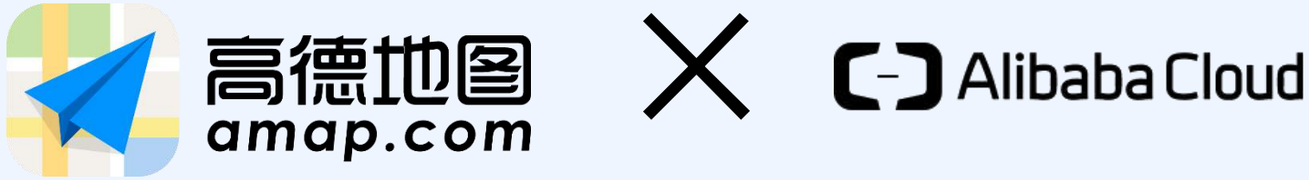
Single Intersection Delay Balance Index

Single intersection delay balance index

To evaluate the effect of different turning signals on vehicle transit time, the index of single intersection equilibrium has been introduced, namely the "Delay Standard Deviation". Based on AutoNavi traffic big data, from vehicle behavior, the trajectory data of each turn can be distinguished, and the traffic delay time of each turning can be calculated and analyzed. Then, by calculating the standard deviation of traffic delay for different turning of each intersections, the equilibrium of each intersections can be obtained. Through analysis on different equilibrium of intersections , what can be found is that Dashanzi intersection shows the worst equilibrium during evening peek, the longest evening peek traffic delay are at the left turning of Wangjing Street and Jingmi Road respectively, and the second worst are Straight in both directions of Jingmi Road. The equilibrium of other intersections are not quite serious.

Location of Dashanzi Intersection

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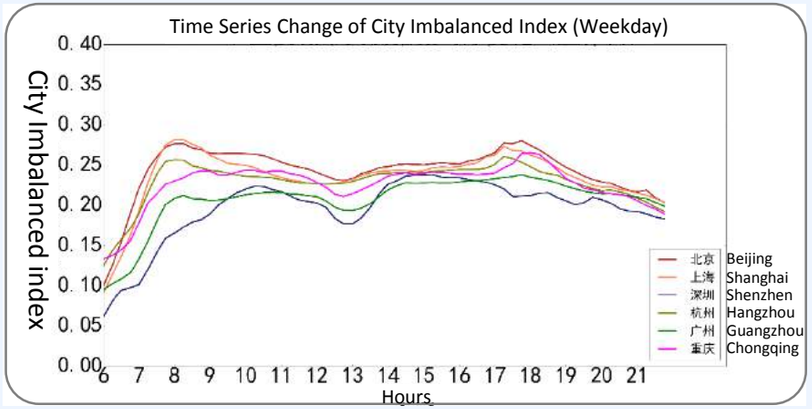
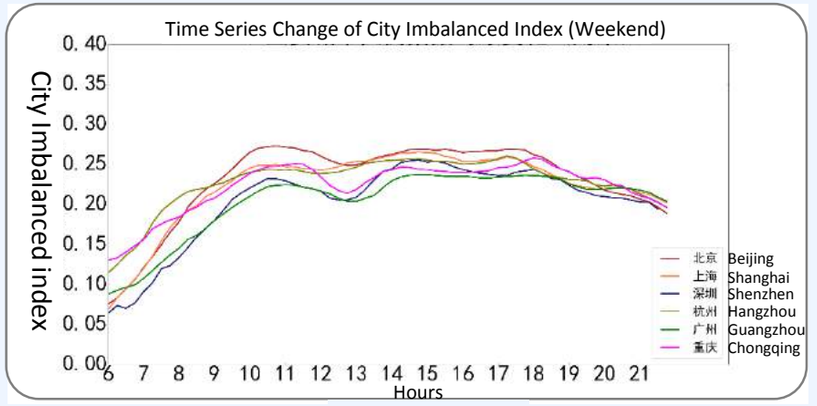
2018Q1 Beijing signal intersections show the highest imbalance, while Shenzhen is the lowest.

2018 Q1 Analysis of Supply and Demand Regulation Capacity of Signal in Main Cities

The ability of supply and demand regulation for intersections is measured by the imbalance index. The imbalance index is calculated by the difference between the intersectional import state and the theoretical equilibrium state. When the intersection is balanced, the imbalance index is 0. The higher the imbalance index is, the more imbalanced state the intersection is under, and the lower control ability of signal lights is on the demand of intersections for all directions. In our research, 6 cities has been selected as evaluation targets, including Beijing, Shanghai, Guangzhou, Shenzhen, Hangzhou and Chongqing, so as to analyze the control capability of signal lights in T-junctions and intersections of main areas of most main cities during 2018,Q1.





Overall analysis:

- It is expected to see the imbalance index comes to a peak at 8am on weekdays in most cities, and also comes from 5pm to 6pm in another peak as well; the lowest imbalance index are from 12:30 to 13:30.

Comparison analysis between different cities :

- Shenzhen has the lowest overall imbalance index on weekdays, the smallest imbalance index at the intersection. The supply and demand in all directions of each signalized intersection are comparable good.
- The imbalance index of Beijing is higher than that of other cities during two time periods , namely from 7 am to 6 pm on weekdays and from 9 am to 6pm on weekend. This shows the biggest imbalance index at intersections, which proves the balance between supply and demand in all directions need to be optimized.

Appendix A

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.
Nitrogen oxides (NOx)	Collective name for nitrogen oxides from automobile exhausts.
Popular places going by vehicles	Collect all POI from the users of AutoNavi, 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.

AutoNaviMap

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