

# Car Ownership Control in Chinese Mega Cities: Shanghai, Beijing and Guangzhou

FENG Suwei and LI Qiang

## Abstract

*Three mega cities in China – Shanghai, Beijing, and Guangzhou – have implemented a unique quota policy to control car ownership growth. In this paper, we explore how special characteristics of China’s rapid urbanisation and motorisation contribute to the formulation of this unique policy. These cities, however, have adopted different policy designs. Auction, lottery and a hybrid of these two mechanisms are used in Shanghai, Beijing and Guangzhou respectively. We analyse the design, evolution and effectiveness of these policy measures. We also discuss how these measures can fit with an integrated transportation demand management policy.*

## Introduction

China has gone through rapid urbanisation and motorisation in recent decades. The current urbanisation rate stands at 51% in 2011, a dramatic increase from 18% in 1978. Ownership of vehicles has also increased significantly. In 2011, about 55 in every 1,000 people owned a private vehicle, while only a negligible 0.27 persons in every 1,000 people in 1985.<sup>1</sup> These great changes created many traffic problems especially for large cities in China. Moreover, the high density, complex and dynamic urban environment in these cities pose additional challenges to policy makers. Easy solutions, which duplicate policies adopted by cities in other countries, are not viable. In response, policy makers in these cities have developed their own solutions. One example is the car ownership control policy implemented sequentially by Shanghai, Beijing and Guangzhou. This policy directly restricts the number of registered automobiles. We believe that their unique experience can cast some light on the future evolution of best practices of transportation demand management worldwide.

These Chinese mega cities share some common reasons in their decision to control car ownership.

### *Rapid Development of the Automobile Industry and Unprecedented Motorisation*

Since China joined the World Trade Organization (WTO) in 2001, its automobile industry has expanded significantly. The output has risen from 2 million vehicles in 2000 to 18 million in 2010, which puts China as one of the world’s largest automobile manufacturers. During the Eleventh Five-year Plan period (2006-2010), the sale of automobiles increased by 25% annually, and the output in China accounted for 23.5% of worldwide output. As the automobile industry expanded at an unprecedented pace, private ownership of automobiles also increased significantly. *Figure 1* shows the dramatic increase in the number of registered automobiles in Beijing, Shanghai and Guangzhou. Rapid motorisation also created many social, economic and environmental problems, posing serious challenges to the sustainable development of large Chinese cities.

The output has risen from 2 million vehicles in 2000 to 18 million in 2010, which puts China as one of the world's largest automobile manufacturers. During the Eleventh Five-year Plan period (2006-2010), the sale of automobiles increased by 25% annually, and the output in China accounted for 23.5% of worldwide output.

### *Urbanisation in China is Characterised by High Density Development and Concentration of Public Services in Central Areas of these Mega Cities*

One special characteristic of China's motorisation is its overlap and interaction with China's great modernisation and urbanisation in recent years (Guo et al. 2011). During the Eleventh Five-year Plan period (2006-2010), population in large cities increased 3.5% annually. Rapid urban development continuously pushed the city boundary beyond the limits set by the city's master plan. Such expansion put huge pressure on the transportation networks. Additionally, uneven distribution of public services, such as education,

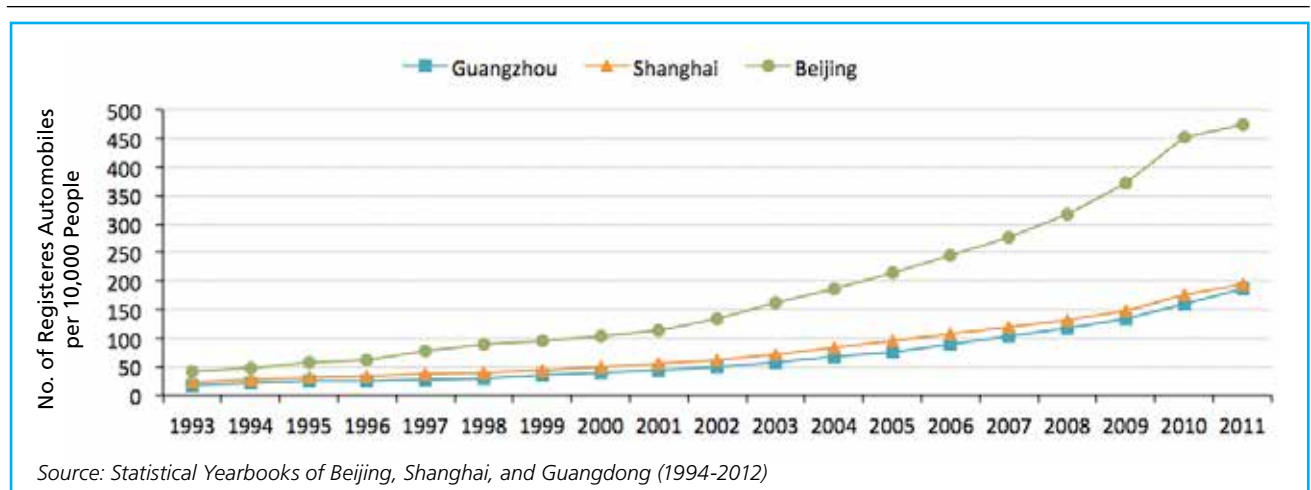
health, housing and transportation within these cities aggravated the problem.

Since reforms in the Hukou<sup>2</sup> system and the educational system were not in tandem with urban development, these public services are more accessible and are of higher quality in the traditional central districts. This uneven distribution obstructs the smooth decentralisation of the population, which in turn creates hurdles for urban development and severe traffic congestion in central cities. To alleviate these problems, maintain economic vitality, and achieve long-term sustainability, a necessary step is to control the demand for automobiles at its source.

### *Car Ownership Control is an Integral Part of the Integrated and Comprehensive Transportation Management Policy*

Many large cities have come to realise that an integrated and comprehensive transport management strategy is needed to combat traffic problems. Since 2005, a national public-transit-priority strategy has been put forward. Many cities invested heavily in building public transit infrastructure, and upgraded policies to encourage people to take buses and subways.

Figure 1. The number of registered automobiles (in 10,000's) of Beijing, Shanghai and Guangzhou



Many large cities have come to realise that an integrated and comprehensive transport management strategy is needed to combat traffic problems. Since 2005, a national public-transit-priority strategy has been put forward. Many cities invested heavily in building public transit infrastructure, and upgraded policies to encourage people to take buses and subways.

For example, through a series of administrative and financial measures, Beijing put forward a plan to achieve a 50% target modal share of public transit among all commuting trips in central areas of the city by 2015 (Beijing People's Municipal Government, 2010). However, the competition from private automobiles is still strong due to the constraints faced by the public transit system. Policy makers hence must apply instruments that "pull" individuals to public transit and instruments that "push" individuals away from their cars. In this sense, car ownership control that channels and restricts demand for automobiles fits perfectly in a comprehensive transport management plan that prioritises public transit (*Figure 2*).

Shanghai was the first to implement a policy to control car ownership through an auction process. This policy

*Figure 2. Chang'an Avenue, Beijing*



started in 1986 but was in full force only in early 2000. After Shanghai, Beijing adopted a lottery mechanism in allocating a quota among automobile users in 2011. In 2012, Guangzhou unexpectedly announced that it would test run a mixture of lottery and auction mechanisms to control the total number newly registered automobiles.

In the following sections, we will expand on the various mechanisms in greater detail.

### **Auction of Private Car Licences in Shanghai**

The first and most famous city in China that regulates car ownership is Shanghai. In 1986, Shanghai instituted a bidding mechanism (with a reservation price) in allocating licences to automobile owners.

The bidding mechanism has undergone several major changes since then. The policy was also modified when national and local economic planning and policy changed. For example, the automobile industry was promoted in 1994 as the pillar industry by the national government to boost economic growth. As one of the manufacturing centres for automobiles, Shanghai adopted temporary policies to stimulate car sales of local manufacturers by issuing low cost licences at that time. In 2000, the bidding mechanism changed from one with reservation price to one without reservation price. In 2003, the bidding mechanism was homogenised between imported vehicles and domestic vehicles.

In 2008, the auction procedure was modified and the on the spot bidding auction was replaced by an open auction through telephone and the Internet. People continue to pay the amount that they bid. This more transparent mechanism allows people to modify their bids to reduce the possibility of "winner's curse" and unwise aggressive bidding behaviour. This mechanism has remained in place till now.

In 2008, the auction procedure was modified and the on the spot bidding auction was replaced by an open auction through telephone and the Internet. People continue to pay the amount that they bid. This more transparent mechanism allows people to modify their bids to reduce the possibility of “winner’s curse” and unwise aggressive bidding behaviour. This mechanism has remained in place till now.

The Urban Transportation and Port Management Bureau of Shanghai designates Shanghai International Auction Company to implement the auction. The auction opens to the public once a month. In recent years, the quota fluctuated between 8,000 and 9,000 monthly, and rarely exceeded 10,000. The whole auction procedure takes about 90 minutes, with the first 60 minutes as the initial bidding period and the last 30 minutes as the modification period. In the second stage, bidders can modify their bids by bidding higher/lower ( $\pm\text{¥}^3300$ ) than the lowest price in the system. They can modify their bids once or twice during this period. Eventually,

those who bid higher or whose bids arrive earlier get the rights of ownership<sup>4</sup>. Figure 3 shows the transaction prices and the quota for various years.

As vehicle registration fees in other provinces are much lower, many people choose to register their vehicles elsewhere to avoid the auction process. To discourage local residents from doing so, the Shanghai government stipulates that during peak hours (7:30-9:30am and 4:30-6:30pm), vehicles with non-local licence plates cannot enter the elevated roads or the intra-city expressway system. With this restriction in place, the auction can effectively control the annual growth of private cars. Meanwhile, revenues from the auction have been spent on the improvement of ring roads and the development of public transit system. These two measures are combined to buy time to develop the public transit system so that it can keep pace with rapid urban expansion.

Shanghai’s experience has been a valuable contribution to the practice of transport management for other Chinese cities. However, critics are numerous. Many question the lawfulness of such a policy because it is

Figure 3. The quota, average price and bidders for Shanghai licence plates (2002/01-2013/06)



in conflict with the 2003 National Law on Road Safety which puts no restriction on car ownership. Others are doubtful of its effectiveness because many local residents can avoid paying the auction price by not registering their cars in Shanghai. Many also consider such a policy as inequitable because it favours wealthier individuals at the expense of those in need, especially as the price has increased to about ¥80,000 recently.

With this restriction in place, the auction can effectively control the annual growth of private cars. Meanwhile, revenues from the auction have been spent on the improvement of ring roads and the development of public transit system. These two measures are combined to buy time to develop the public transit system so that it can keep pace with rapid urban expansion.

### Lottery of Automobile Licences in Beijing

In 2011, vehicle ownership in Beijing was at the rate of about 0.229 per person, ranking highest among all 31 provinces and province-level administrative units in China. Rapid motorisation fostered a dominant car culture among Beijingers. Many people even prefer owning a car to buying a house. The rapid growth of motor vehicles has been dramatic. Since 2000, annual increase of motor vehicles has reached 251,000. Even though Beijing had attained a total stock of 4 million motor vehicles by the end of 2010, the growth of automobile ownership has shown no signs of tapering off.

The 2008 Olympic Games provided a valuable testing ground for implementing innovative transport management measures (Wang et al. 2008). It was around this time that the driving restriction based on licence plate numbers was put into place. During the

Olympics, the right to drive alternated according to whether the plate number was an odd or even number. After the Olympics, the policy was modified to factor in the last digit of the plate number, and each car had to be off the road at least one day per week. It also put an end to the policy of non-intervention in the purchase of automobiles in Beijing. By the end of 2010, the Beijing government decided to implement a quantity control policy (effective January 2011) to further reduce the pressure on the road networks. Instead of auctioning the right to own a car, the Beijing government decided to run a lottery.

The ownership control measure is one of the many tools that Beijing has used to combat congestion. Its integrated transport policy covers four areas: planning, construction, management and restriction (Beijing People's Municipal Government, 2010). The lottery is one of the restriction measures. This policy has three key elements:

1. The quota for annual vehicle growth and its structure are set according to an analysis of road capacity, environmental sustainability and projected demand;
2. Currently, monthly quota is set at 20,000, with 88% to individuals, 10% to companies and other organisations, and the remaining 2% to operators of transportation services;
3. Companies and individuals go through separate lottery processes to get their rights to own. This right is non-transferable and effective for six months. It lapses if the individual or company fails to register a car before the deadline. Companies and individuals who already own a car licence can renew their licence on a new car if the old car is sold or scrapped. This right also lapses within six months<sup>5</sup>.



As expected, the lottery reduced the number of newly registered vehicles. In 2010, the number of newly registered vehicles was 810,000. This number decreased to 174,000 in 2011. By February 2012, the stock of automobiles in Beijing reached 5.017 million. Without the lottery, this number would have been hit 11 months earlier. Official statistics show that vehicle speed in the central city increased by 13%. Therefore, this quantity control policy bought precious time in alleviating central-city congestions.

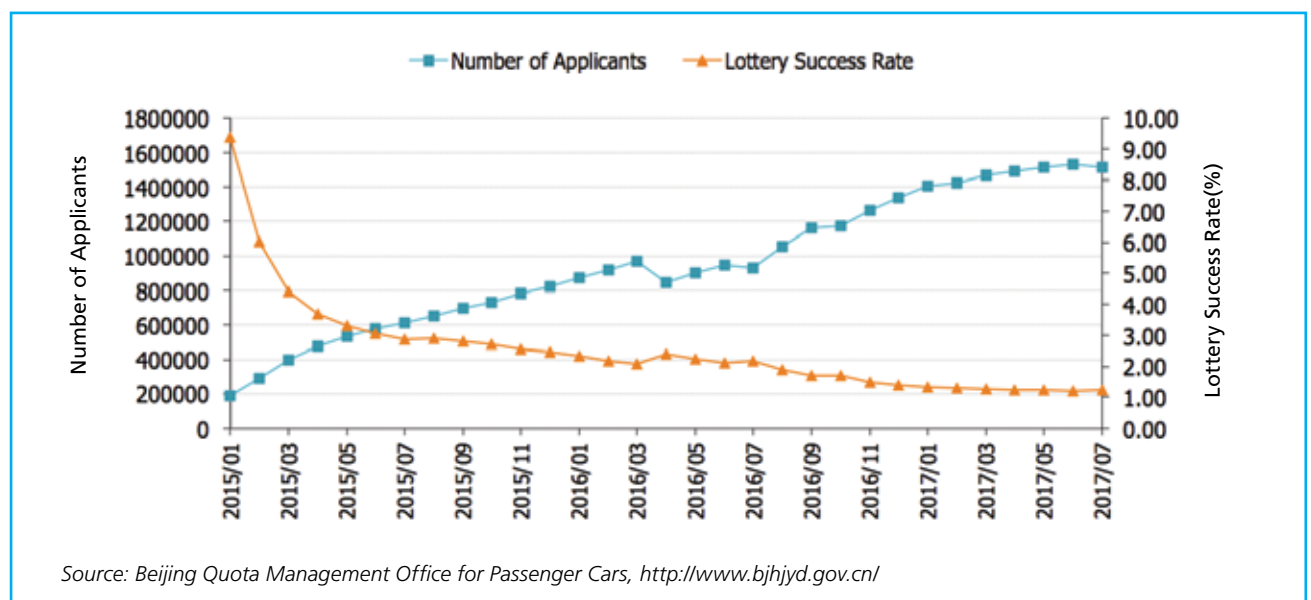
Beijing also started restricting the road rights of vehicles with non-local licences. During peak hours, non-local vehicles are banned from entering road networks within the 5th ring. Meanwhile, Beijing's generous subsidy to transit fares and construction of BRT pulled many people away from their cars. These measures all facilitated the smooth implementation of Beijing's integrated transport management plan.

However, a lottery based system, though more equitable, is bound to create pent-up demand because

the unmet demand will accumulate over time. The number of participants over the last two years has increased steadily. In October 2012, the number of applicants became 1.17 million, and only 1.69% of them were successful. Until July 2013, there are still 1.515 million applicants waiting to get their ownership rights, which is an increase of 588,000 from July 2012. *Figure 4* shows the historical quota and lottery success rate for the lottery of ownership rights in Beijing.

Beijing also started restricting the road rights of vehicles with non-local licences. During peak hours, non-local vehicles are banned from entering road networks within the 5th ring. Meanwhile, Beijing's generous subsidy to transit fares and construction of BRT pulled many people away from their cars. These measures all facilitated the smooth implementation of Beijing's integrated transport management plan.

Figure 4. The quota and lottery success rate in Beijing (2011/01-2013/07)



## Hybrid Ownership Control Policy in Guangzhou

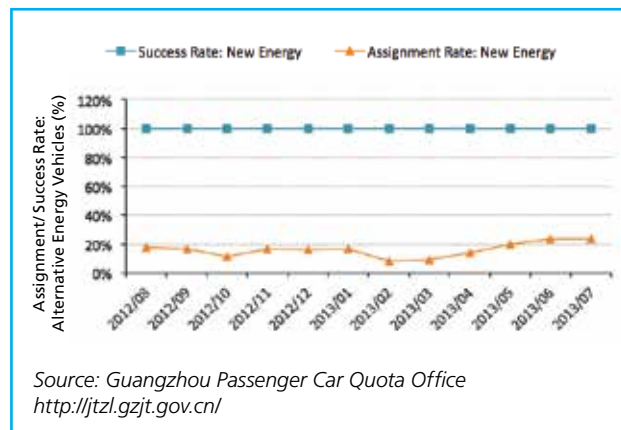
On 30 June, 2012, Guangzhou announced that it would control the number of newly registered cars starting from 1 July 2012. All passenger vehicles newly registered by individuals, private companies and government agencies are subject to the new restriction. The quota will be allocated using a mixed system that combines a lottery and an auction. Initially, it was announced as a test run for one year. On 1 July 2013, the Guangzhou government announced that the policy became a long term regulation, effective until July 2018.

The annual quota is set at 120,000, or 10,000 per month. There are three categories: a lottery for alternative energy vehicles, a lottery for regular vehicles and an auction for regular vehicles. In the auction, the reserve price is ¥10,000. Each month the allotted quotas for these categories are approximately 1,000, 5,000, and 4,000 respectively. From the quota of each category, 88% goes to individuals, and the remaining 12% is assigned to companies, organisations and government agencies.

Figures 5, 6 and 7 show the success rates and assignment rates for the three categories associated with individual participants. The results for companies and organisations are similar and hence not reported here. Success rate is defined as the proportion of eligible applicants that receive the licence. Assignment rate is defined as the proportion of the quota that is assigned to the applicants. If the quota restriction is binding, the assignment rate should equal 100%.

Figure 5 shows the results for alternative energy vehicles. The quota is not fully utilised, indicated by an assignment rate below 20%. As a result, all eligible applicants receive the quota. When it comes to the lottery (Figure 6), success rate is extremely low and the quota

Figure 5. Assignment and success rates: Alternative energy vehicles



is fully utilised. Success rate has continuously declined from 9% in August 2012 to 3% in July 2013. For auctions (Figure 7), the assignment rate was below 100% until April 2013, which means those who participated in the auction could get the quota by paying the minimum price of ¥10,000. After April 2013, the number of eligible bidders exceeded the quota, and people had to bid above ¥10,000 in order to get one licence. Success rate before April 2013 was below 100% because some bidders regretted their bids and did not pay.

Figure 6. Assignment and success rates: Lottery for regular vehicles

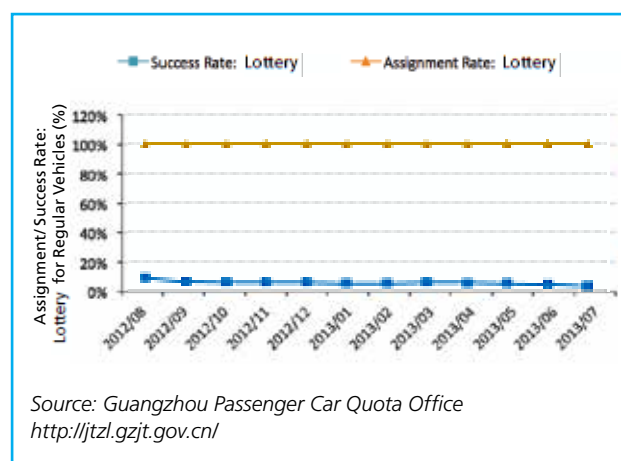
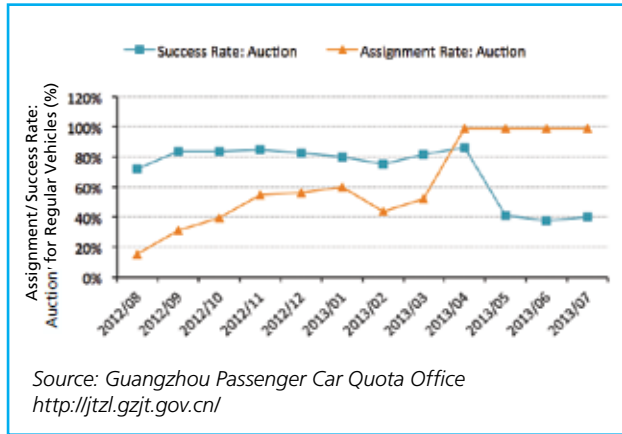


Figure 7. Assignment and success rates:  
Auction for regular vehicles



Based on information released by the Guangzhou government, the total revenue from August to December 2012 was ¥204.88 million. The total number of successful bids was 17,243, and hence the average bidding price was around ¥12,000. The government started to release information on auction revenue monthly from May 2013. The average prices of a licence were ¥12,530, ¥15,220, and ¥19,671 in May, June and July 2013 respectively. As the waiting list in the lottery lengthens and the number of participants in the auction category increases, the bidding price is expected to increase further.

One special feature of the Guangzhou regulation is the time limit on the registration rights for all vehicles. For vehicles registered before 30 June 2012, owners can re-register their old licences on new vehicles for as many times as possible in the 10-year period after 1 July 2012. For those vehicles registered after 1 July 2012, the 10-year period for re-registration is calculated from the date they first register their vehicles. For those who do not re-register during the 10-year period, they are allowed to execute this immediately after the 10-year period. In approximately 10 years' time, everyone has to go through the same application process to get

licences. This puts everyone on equal footing in terms of the right to drive.

The new regulation also restricts the road rights of those vehicles registered elsewhere. This aims to prevent residents of Guangzhou from registering their vehicles elsewhere. Details have not been released yet. The proposal, with a hearing held on 19 April 2013, includes two basic components: (1) passenger vehicles with non-local licences are restricted from entering central areas during peak hours on working days; (2) passenger vehicles with non-local licences are not allowed to use elevated roads and other main roads.

These restrictions are highly controversial and have created a lot of negative media coverage.

One special feature of the Guangzhou regulation is the time limit on the registration rights for all vehicles... In approximately 10 years' time, everyone has to go through the same application process to get licences. This puts everyone on equal footing in terms of the right to drive.

## Conclusion

Efforts in Shanghai, Beijing and Guangzhou to directly control ownership of automobiles have presented many challenges and opportunities in combating urban traffic problems in Chinese cities. Although three cities adopt different quota allocation mechanisms, their policy objectives are clear and similar. They all aim to control traffic congestion and pollution, while promoting public transit through a series of integrated and comprehensive transportation demand management instruments.

However, the priorities in their policy design are quite



different. Beijing puts more emphasis on equity, while Shanghai seems to focus on efficiency (Figure 8). Guangzhou combines the merits and shortcomings of both Shanghai and Beijing, yet it adds its own touch by putting a time limit on the licences of all vehicles.

The diverse policy designs and experiences in policy implementation not only prove the feasibility of quantity control measures, but also provide blueprints for other cities to work on. A harmonious balance between urban development, motorisation, and interests of the automobile industry is an achievable goal if more Chinese cities can follow the lead of Beijing, Shanghai and Guangzhou in devising their own integrated transport management strategy.

To make quantity control work, policy makers have to strike a balance between road rights of local versus non-

local licences, as well as both monetary and opportunity costs, in getting a local licence. Putting restriction on non-local licences without incurring retaliation from other cities is likely to be one of the considerations of policy makers as well.

Figure 8. Pedestrian Crossing at Shanghai



## Notes

- <sup>1</sup> Source: China Statistical Year Books, 2012
- <sup>2</sup> Hukou is a household registration record in China to officially identify a person as a resident of an area. A person seeking to relocate is required by law to apply through the relevant bureaucracies.
- <sup>3</sup> ¥ = Chinese Yuan Renminbi (RMB). The average exchange rate in 2012 was US\$1.00 = ¥6.3093

## References

- Beijing People's Municipal Government. 2010. *Interim Regulation on Quantity Control of Small Passenger Vehicles in Beijing* No. 227 Directive, <http://www.bjjtgl.gov.cn/publish/portal0/tab63/info21958.htm>
- Beijing People's Municipal Government. 2010. *Opinions on Works to Advance Scientific Development of the Capital City's Transportation Further and Alleviate Traffic Congestion More Vigorously* No. 42 Directive, <http://www.bjjtgl.gov.cn/publish/portal0/tab41/info21957.htm>
- China Statistical Year Books. 2012.
- Guangzhou People's Municipal Government. 2013. *Regulation on Quantity Control of Small and Medium Passenger Vehicles*

- <sup>4</sup> In July 2013, the Shanghai government announced that it would modify the procedure by reducing the time of the auction from 1.5 hours to 1 hour. The auction system will also automatically notify the bidder that the price is "excessive" (compared with the previous three-month moving average price) to discourage unwise bidding behavior.
- <sup>5</sup> This means that buyers cannot buy a used car and its licence as a bundle. Additionally, those whose cars are stolen have to enter the lottery to renew their licences.

*in Guangzhou* No. 28 Directive, [http://jtzl.gzjt.gov.cn/index/gbl/2013627/1372324215481\\_1.html](http://jtzl.gzjt.gov.cn/index/gbl/2013627/1372324215481_1.html).

Guo, J. F., Y. Liu and L. Yu. 2011. *Traffic Congestion in Large Metropolitan Area in China. Urban Transport of China* (in Chinese) Vol.9, No. 2.

Statistical Yearbooks of Beijing, Shanghai, and Guangdong. 1994-2012.

Wang, S. L., J. C. Chen, J. F. Guo and C. Y. Li. 2008. Application and Evaluation of Traffic Demand Management Policies during Beijing Olympic Games. *Journal of Transportation Systems Engineering and Information Technology (in Chinese)*, Vol. 8, No. 6.



Feng Suwei is an Associate Professor in the School of Public Economics and Administration at Shanghai University of Finance and Economics, China. Her research fields are public regulation, transport economics, and transport policy. Her recent interests include the performance evaluation of vehicle ownership regulation of Chinese cities and job-housing balance in a network of urban areas. She has published more than 40 papers and 1 book in recent years. In 2012, two of the papers (co-authored with Ma Zuqi) won the 2nd 'Tsien Hsueshen Urban Science Gold Award' (Excellent Paper Award) awarded by China Urbanology Network. Dr Feng obtained her PhD from Shanghai Institute of Applied Mechanics and Mathematics, Shanghai University, in 1998. Her PhD dissertation is on traffic flow theory, one of the first dissertations in this area in China.



Li Qiang is an Assistant Professor at Department of Real Estate, National University of Singapore. Before moving to Singapore, he was an Assistant Professor in the School of Public Economics and Administration at Shanghai University of Finance and Economics, China, from 2008 to 2012. His research fields are urban economics, transport economics, and real estate. His current interests are vehicle ownership control and urban structure, optimal city size, and the size distribution of cities. His works have been published in academic journals in urban economics and real estate. Dr Li obtained his PhD in urban economics and real estate from Sauder School of Business at the University of British Columbia, Canada.