

# Research on the Public Policy of Vehicle Restriction under Traffic Control

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**Abstract**—In recent years, with the improvement of China's urbanization level, the number of urban motor vehicles has grown rapidly. As residents' daily commuting necessities, cars cause a lot of exhaust emissions and urban traffic congestion. In the "Fourteenth Five Year Plan" of China, it is proposed to strive to reach the peak of carbon dioxide emissions by 2030 and achieve carbon neutrality by 2060. Urban transport accounts for a high proportion of carbon emission sources. It is an important driving force for the realization of China's carbon peak strategy. Some cities have introduced and implemented the policy of "car restriction" to solve the related urban problems by reducing the use of cars. This paper analyzes the implementation of the "automobile restriction" policy, evaluates the relevant effects of the automobile restriction policy, and discusses how to better optimize the "automobile restriction" policy in the process of urban governance.

**Keywords**—Carbon emission, traffic jam, vehicle restriction, policy evaluation.

## I. INTRODUCTION

IN recent years, China's urbanization process has shown a straight upward trend, with the rapid growth of urban population, the continuous improvement of residents' living standards and the utilization efficiency of various public infrastructure, and the increasing ownership and use of cars. At the same time, the use of cars has brought about urban environmental problems, and automobile exhaust emissions have aggravated urban air pollution. In order to alleviate the problems of urban pollution and urban congestion, many cities have taken the measure of "car restriction" when dealing with these problems, which has a certain impact on the daily commuting needs of some residents and the operation of the transportation system. The impact of the car restriction policy on urban governance and the impact of such policies on personal interests and social interests. Based on the analysis of the "car restriction" policy, the paper analyzes the relevant effects of the car restriction policy and discusses how to optimize the "car restriction" policy. This paper explores how to better use this public policy to solve the problem of urban governance.

## II. OVERVIEW OF "AUTOMOBILE TRAFFIC RESTRICTION" POLICY

### A. The Purpose of the "Automobile Restriction" Policy

The main purpose of vehicle restriction is to solve the problem of traffic congestion and urban air pollution.

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With the increase of car ownership in some cities, the growth rate of roads is far slower than that of motor vehicles, resulting in insufficient road throughput. Especially in the rush hour of urban working days, urban road congestion is serious.

Urban air pollution is serious, especially compared with the poor air quality in northern cities in winter, a large number of vehicle exhaust emissions are one of the causes of pollution. In order to deal with smog pollution, improve air quality and do a good job in air pollution prevention, some cities have restricted the number of motor vehicles.

Analysis on the Growth Trend of China's Automobile Ownership  
Unit: 10000 vehicles

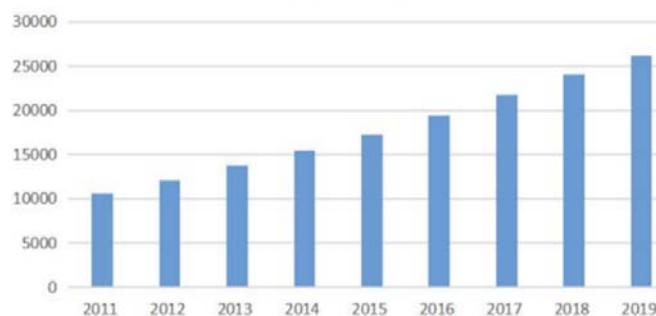


Fig. 1 Trend chart of car ownership from 2011 to 2019 [12]

### B. Formulation of "Automobile Traffic Restriction" Policy

The restriction of cars in China began in Beijing. From August 17 to 20, 2007, the policy of tail number restriction of motor vehicles was implemented on a trial basis, providing a scientific basis for the Olympic restriction. After the 2008 Olympic Games, Beijing issued the Notice of the People's Government of Beijing on the Implementation of Traffic Management Measures (JZF [2008] No. 39) on September 28, officially becoming the first city in China to control traffic congestion by adopting tail number restrictions [1]. Later, in order to solve the problem of urban traffic and urban air pollution, some cities also began to implement the car limit policy, including in Shanghai, Guangzhou, Hangzhou, Zhengzhou, Shijiazhuang, Jinan, Lanzhou, etc. The implementation of the car limit policy has lasted for 14 years.

### C. Implementation of the Policy of "Automobile Restriction"

There are many ways to implement vehicle restrictions, including the tail number restriction system. Currently, there are two main ways to implement vehicle restrictions: single or double number restriction and workday restriction.

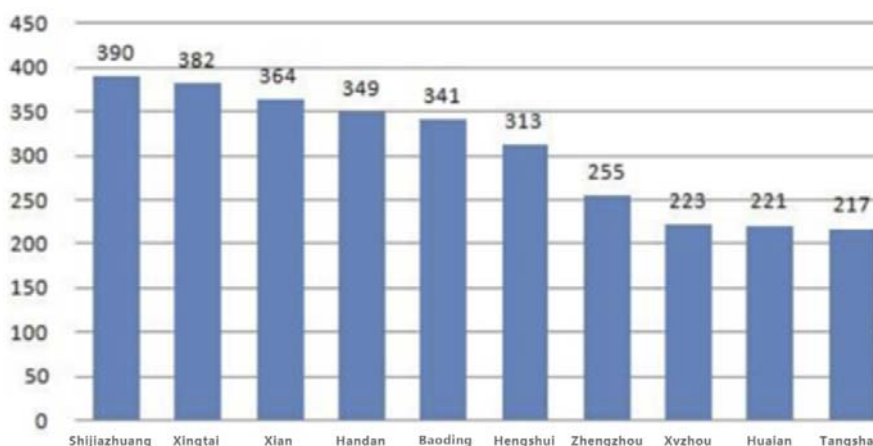


Fig. 2 Top 10 cities with the highest average AQI in November 2019 [13]

- Single and double number restriction: delimit the restricted area, specify the restricted time, and divide it into odd number and even number according to the tail number of the car license plate. Corresponding to the date, the single number date can only be used by the private car with the tail number of the car license plate as the single number, and the double number date can only be used by the private car with the tail number of the car license plate as the double number.
- Travel restriction on weekdays: delimit the restricted area and time. According to the tail number of the car license plate, it is divided into five groups: 4 and 9, 5 and 0, 1 and 6, 2 and 7, 3 and 8, which correspond to the weekdays Monday to Friday in turn. Travel on one of the weekdays corresponding to the tail number group of the parking spaces is restricted.

The limit of driving restriction on weekdays is relatively low, and generally the minimum number of vehicles is about 20% of the total number of vehicles. The traffic restriction for single and double number vehicles is relatively strong, and the traffic restriction is about 50% of the total number of vehicles. It is usually implemented during the period when the urban air pollution is very serious and important meetings and events are held.

TABLE I  
 BUSINESS DAY LIMIT RULES

Travel time limit	Restricted last number	Restricted period
Monday	4 and 9	
Tuesday	5 and 0	
Wednesday	1 and 6	Daily (7:00-20:00)
Thursday	2 and 7	
Friday	3 and 8	
Saturday	Unlimited	/
Sunday	Unlimited	/

#### D. The Implementation Characteristics of the "Automobile Traffic Restriction" Policy

The car restriction policy has been widely implemented in many cities in China for many years, with the following characteristics:

- The scope of cities involved is relatively wide: mainly including two types of cities aimed at improving traffic and improving air pollution. Large and medium-sized cities have relatively congested traffic, such as Beijing, Tianjin, Hangzhou, Chengdu, Changchun, etc. Its city scale is relatively large, and the number of daily commuters is relatively large; Cities with high PM2.5 air quality index and poor urban air quality level usually implement traffic restriction policies for the purpose of air pollution control, such as Shijiazhuang, Xingtai, Tangshan, Handan, Jinan, Zhengzhou, Xinxiang, Pingdingshan, etc.
- A large number of travelers are affected: for the first tier and second tier cities, the large number of daily commuters and long commute distance will affect the daily work of some urban residents, thus affecting urban traffic to a certain extent.
- The implementation lasts for a long time: the urban traffic restriction policy aimed at solving congestion usually lasts for a whole year, while the urban traffic restriction policy aimed at reducing urban pollution usually focuses on the four months in winter. At present, the policy tends to be normalized.

### III. EVALUATION OF THE EFFECT OF "VEHICLE RESTRICTION"

#### A. Governance Problems Solved by "Automobile Traffic Restriction"

##### a. Alleviating Traffic Congestion

The car number limit reduces the number of car trips, resulting in off peak trips or an increase in the use of public transport, thus reducing the carrying capacity of roads in urban peak hours, dynamically balancing the supply and demand of the road network, relatively improving the urban congestion in some periods, and improving the road smoothness.

##### b. Mitigating Air Pollution

According to the statistics of relevant data, the vehicle restriction policy has brought a certain degree of environmental benefits to the control of air quality (Fig. 3) Mobile source emissions are the main source of nitrogen oxides, and private

cars are part of mobile sources. Motor vehicle pollution is the primary source of PM<sub>2.5</sub>. Reducing the use of vehicles will reduce the emission of greenhouse gases and pollutants, and significantly reduce the concentration of nitrogen oxides in the air. The number of days with good air quality in some cities in the north has increased and blue sky appears. The air quality indicators have improved significantly in the short term [2].



Fig. 3 Statistics of monthly comprehensive AQI of Zhengzhou City

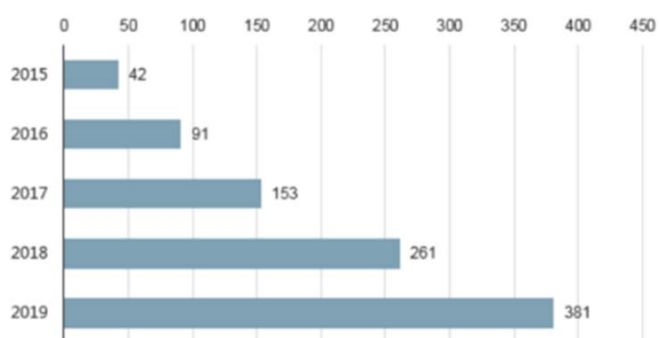


Fig. 4 Trend of new energy vehicle ownership in 2015-2019

### c. Promoting the Use of New Energy

In the Implementation Plan for Promoting the Updating and Upgrading of Key Consumer Goods and Smooth Resource Recycling (2019-2020), which was studied and formulated by the National Development and Reform Commission, it was excluded that no local authority should impose restrictions on the traffic and purchase of new energy vehicles. The relaxation of the restrictions on new energy vehicles and the subsidy support for the purchase of new energy vehicles have promoted the growth of the new energy vehicle market [3]. This will help to promote the use of new energy in cities, and to a certain extent, it can also reduce the pollution of automobile exhaust to cities.

### B. A Series of Impacts Caused by "Vehicle Restriction"

#### a. Effect of the Credibility of the Government

Every year, the implementation of the traffic restriction policy in each city will cause heated discussion among citizens, which inevitably causes some citizens to be relatively dissatisfied and relatively roast. The game between the traffic control policy and the right to use citizens' personal goods has also become the focus of discussion, and the restriction policy

has been opposed by some people. However, some local governments only start from themselves when implementing the restriction policy, resulting in the citizens' perception of this as strong, abusive and arbitrary public power. Doubts about the legal nature of public policy also arise from the differences between local governments and citizens in their value judgments, and continue to accumulate [4]. Improper implementation of policies will affect the credibility of the government.

#### b. Abnormal Growth of the Number of Vehicles

In response to the urban car restriction policy, some citizens will choose to buy a car with a different tail number when they have economic conditions, thus increasing the number of cars in one household. Moreover, the subsidy policy for new energy vehicles and the policy of no restriction on traffic have promoted the purchasing power of new energy vehicles, so it has led to the growth of vehicle ownership. The increase in the use of vehicles has no effect on the purpose of the "restriction on traffic" policy to solve traffic congestion. Instead, it has increased the urban traffic volume, not slowed down the problem of urban congestion.

#### c. Possible Negative Environmental Benefits

In order to cope with the urban car restriction policy, some citizens will choose to purchase a second-hand car on the basis of their own car, which not only responds to the number restriction policy, but also saves personal costs. This has led to an increase in the purchasing power of second-hand cars in cities. However, due to the long service life of second-hand cars, although they have passed the corresponding vehicle inspection, they are more likely to cause excessive exhaust gas, thus aggravating the urban air pollution caused by automobile exhaust. The scrapping of second-hand cars will also have a corresponding impact on urban resources and environment. Therefore, the corresponding negative environmental benefits are generated.

#### d. Travel Problems Caused by Some Citizens

The urban traffic restriction policy and imperfect public transport policy will cause personal problems in necessary travel time, which will affect personal travel costs, including economic costs and time costs [5]. Inconvenient public transportation will lead to longer commute time for individuals, bringing greater inconvenience. As for the purchase of the second vehicle and other expenses incurred in response to the traffic restriction policy, the economic cost of individuals has increased, affecting the personal interests of citizens.

## IV. A COMPREHENSIVE ANALYSIS OF THE "AUTOMOBILE TRAFFIC RESTRICTION" POLICY

### A. The Timeliness of the Restriction Policy

The traffic restriction policy can alleviate the problem of traffic congestion to a certain extent. The main time period for traffic relief is the rush hour on weekdays. For workers with long commuting distance, due to the high cost of public transport time, they are more likely to choose private cars when

they are not restricted, while they will choose carpooling, taxi and other travel modes on restricted working days, which has a relatively low impact on the guidance of public transport and the operation and evolution of the urban transport system. For the control of urban air pollution, the traffic restriction policy can bring short-term air control effect and make short-term optimization of air quality.

#### *B. Legality of the Restriction Policy*

Public interests involve public order, public welfare, public facilities, etc. With the development of social economy, the congestion caused by the proliferation of automobiles and the air pollution caused by automobile exhaust affect the public interest in society to a certain extent. The Road Traffic Safety Law of China stipulates that according to the actual situation of roads and traffic flows, the public security organs and traffic management departments have the right to take measures to divert, restrict and prohibit the passage of motor vehicles, non-motor vehicles and pedestrians. The Law on the Prevention and Control of Air Pollution incorporates the response to heavy pollution weather into the emergency management system, and the corresponding emergency plan should be launched according to the early warning level of heavy pollution weather. The emergency measures include restricted vehicles [6].

When personal interests conflict with the realization of public interests, citizens' property can be expropriated and expropriated in accordance with the provisions of the law [7]. However, the normalization of the implementation of automobile use restrictions needs to rethink whether it is reasonable and whether it can effectively safeguard the public interest for a long time.

#### *C. Effectiveness of Traffic Restriction Policy*

##### *a. Government*

For a city, car purchase restriction is a response and effort to the problems of traffic congestion and pollution. From the perspective of the government, the principle of public interest needs to be taken into account in policy formulation. The most simple and effective way to control car ownership is to restrict car travel or car purchase restrictions extended from travel, which is also the fastest way to alleviate traffic congestion and air pollution.

##### *b. Market*

The car restriction policy or car purchase restriction policy reduces the use opportunities of cars relatively because it weakens the driving rights and purchase opportunities of car buyers. For automobile manufacturers and dealers, the purchase and traffic restriction policy for cars has weakened the purchasing power of the automobile market, resulting in the lack of vitality of the automobile market.

##### *c. Individuals*

For some car users, the restriction of travel conditions has resulted in the loss of personal time costs and economic costs. For the non-restricted objects, the traffic and air quality improvement brought by the vehicle restriction make them the beneficiaries of social interests.

## V. COUNTERMEASURES FOR THE OPTIMIZATION OF THE "AUTOMOBILE TRAFFIC RESTRICTION" POLICY

### *A. Optimizing the Formulation Process of Traffic Restriction Policy*

The formulation of public policy is the primary link of the implementation of public policy. In the automobile restriction policy, there will inevitably be problems such as lax policy formulation procedure, lack of public participation, and unclear legal basis [8]. Among them, improving public participation and clarifying the legal basis are important conditions to promote the rationality of public policies. At present, citizen participation in the car restriction policy is low, and the lack of some mechanisms is obvious.

As a public policy, the automobile restriction administration is an important manifestation of ensuring public participation. Therefore, in the process of formulating the restriction policy, the government must establish a platform for public participation, encourage public participation, collect different views and opinions, create a democratic and consultative atmosphere, ensure the public's right to speak, so as to reflect the interests of all groups in society, make choices and balance. Instead of pursuing a policy without public consultation, the government directly announces and enforces it.

Therefore, we must ensure public participation in the process of implementing the restriction policy, so as to better integrate social interests and personal interests, and realize the integration and distribution of interests of all parties under the restriction policy.

### *B. Improving the Compensation Mechanism under the Policy*

The urban management is as delicate as embroidery. The car traffic restriction policy is not as simple as "one restriction". Instead, it is necessary to improve the establishment of compensation mechanism while implementing the traffic restriction policy. At present, some cities in China have implemented certain compensation policies during the traffic restriction period. For example, in Beijing, the corresponding taxes and fees have been reduced, and in Zhengzhou, Xinxiang, Kaifeng and other cities in Henan Province, public transport subsidies have been implemented. However, public transport free measures cover a wide range. The compensation is not targeted at the people, which may cause the shortage of public transport resources.

On the whole, the implementation of the urban motor vehicle restriction compensation system is less in cities and the implementation policy is relatively simple. The compensation measures are not institutionalized. The lack of procedural provisions on compensation leads to the confusion of administrative compensation procedures in reality, which makes the rights and interests of obligees unable to be adequately compensated [9]. Therefore, the restriction policy should strengthen the establishment and implementation of the compensation system while affecting the right of motor vehicle owners to pass, so that the rights of motor vehicle owners can be effectively compensated.

Therefore, the compensation methods of traffic restriction policies need to be optimized in a diversified way and

strengthened in a systematic way to guide citizens' travel methods and environmental awareness.

### C. Coordinating the Relationship and Interests of All Parties

The essence of public policy is the authoritative distribution of the interests of the whole society by the government. The distribution of interests by the government is a dynamic process. The basis of its distribution is the choice and integration of interests by the government. The key to distribution is the implementation of interests [10]. It is a rather complex dynamic process from interest selection to interest integration, and from interest distribution to interest implementation.

The government should play a leading role in coordinating the interests of citizens. The "automobile restriction" policy needs to give full play to its public policy attributes, improve the communication and contact between citizens and the public sector, fully understand the citizens' attitude and suggestions on the restriction policy, understand the citizens' demands under the implementation of the "restriction policy", and maximize the satisfaction of residents' needs. As the leading party, the government should have long-term and effective communication with citizens.

Similarly, the implementation of policies is also a process. If the pace of implementation is too fast, even regardless of the feelings of most people, the pressure of urban environmental governance and traffic improvement is transferred to the citizens, then the implementation of policies will become very "tight". Therefore, it is necessary to popularize its social benefits, so as to guide the attitude of citizens and enhance their understanding and trust in policies. It is not only formulated and implemented by the government, but also blindly obeyed and fulfilled by the citizens. Therefore, the implementation of the restriction policy must focus on the process, coordinate the relationship and balance the interests of all parties.

### D. Multi Part Cooperation and Cooperation

To solve the problem of urban traffic and urban atmospheric environment, it requires not only a traffic restriction policy, but the comprehensive coordination and cooperation of multiple departments, which includes urban planning, urban traffic management, urban environmental protection and other departments. So, when formulating this public policy, each department needs to unleash its potential, strengthen cooperation, and analyze the emergence of problems from various professional fields, as well as whether the limit policy is effective for the problems to be solved.

We can optimize the public transport system and environment. The accessibility and convenience of public transport in some areas are relatively weak, which cannot meet the inconvenience caused by traffic restrictions. Therefore, the government must also improve the public transport needs of the city while implementing vehicle traffic restrictions. When the construction of urban public transport system reaches a certain degree of convenience, the control measures for the total number of cars will be more effective [11]. The application of new technologies will also achieve certain results in urban traffic control and environmental governance.

Therefore, the traffic restriction policy can only alleviate these problems in a short time. In order to fundamentally solve the traffic and pollution problems, we need to start from the urban planning and construction, and achieve the sustainable development of urban traffic and environment in the long run.

## VI. CONCLUSION

The "automobile restriction" policy can alleviate the urban air pollution problem to a certain extent, but for the personal and social impact of the "automobile restriction" policy, corresponding strategies and means must be proposed to solve the problem. The main body of the "automobile restriction" policy is the government, and the service object is the masses, so it is necessary to coordinate the interests of all parties, from personal gains and losses to public social benefits, The government needs to make efforts to balance its interests, maximize the affordability of individuals and minimize the impact, so as to give play to the tools of public policy and emphasize its public policy attributes. The continuous adjustment and optimization of the traffic restriction policy is to solve the problems of traffic congestion, traffic organization, air pollution, the legitimacy of the policy, the rights and interests of citizens and other comprehensive problems. Therefore, the consideration of traffic restriction policy should start from citizens and gradually return to a state of citizens.

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