Research on the Safety Governance of Overload and Overrun Transportation on Urban Expressways Based on Big Data Analysis—Taking Huai'an City as an Example

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Abstract. With the rapid development of traffic, urban expressways are becoming more and more popular. However, the problem of overload and overrun on expressways that followed has been repeatedly banned, seriously affecting transportation safety. This article takes the urban expressway in Huai'an as an example, collects big data, analyzes the data with SPSS software, and combines the real case of the viaduct collapse in Wuxi to provide governance strategies for expressway overload and over-run control and improve transportation safety.

1. INTRODUCTION
In 2016, my country successively promulgated the "Special Action Plan for Remediation of Illegal and Overloading Behaviors of Highway Trucks", the "Regulations on the Management of Overrun Transportation Vehicles on Highways", and the "Work Plan for Vehicles and Transportation Vehicles Management", forming three governmental orders to severely crack down on overrun. The overloaded "921 New Deal". And on October 10, 2019, three years later under the most stringent "921 New Deal" in history, a viaduct collapsed in Wuxi City, Jiangsu Province. The final cause officially announced was overload and overrun. It can be seen that the problem of overload and overrun seriously endangers the stability and safety of road engineering, and urban expressways are the highest-level roads in urban roads, so it is particularly important to study the traffic safety of urban expressways under overload and overrun situations.

Urban expressways bring great convenience to urban traffic and alleviate the problem of traffic congestion. However, there are few domestic and foreign scholars on the impact of overload and overrun on urban expressways on traffic safety. On the problem of overload and overrun on urban expressways, there are not many relevant studies at this stage, but it has similar characteristics to the problem of overloading and overrun in road transportation. Therefore, based on understanding the problem of overload and overrun, starting from the research of overload and overrun on highway transportation, we analyze its impact on traffic safety.

Hao Wu [1] et al. established a freight-based overload preference evaluation model. In the selection of indicators, the equal weight adjustment weight model and the adjustment weight decision model based on the analytic hierarchy process are used to evaluate the overload preference of freight drivers. Qi Shi Mohamed Abdel-Aty [2], using big data to monitor the real-time traffic operation and safety of urban expressways, analyze traffic accidents on urban expressways, and propose improvement measures.
Mariana Boss et al. [3] used existing dynamic weighing (WIM) data to identify the weight and driving mode of overloaded vehicles and optimize the efficiency of management activities through a comprehensive analysis of the regression tree model of overloaded vehicles. Zhang Aijun [4] proposed measures to control overrun and overload transportation in response to early damage to highway bridges caused by highway overrun and overload transportation, the decline in vehicle technical performance, and increase in vehicle maintenance costs. Wang Ruili [5] pointed out that the reason for overrun and overload transportation is the structural demand for industrial production and the existence of toll roads. The illegal production and transformation of automobiles make the problem of overrun and overload more serious. Huang Wei [6] analyzed the reasons for overload and limit of road transportation, explained the hazards of overload and limit, and proposed measures to control overload and limit, which can provide a reference for promoting the healthy development of the road transport market. Zhou Jie [7] used public product theory, inter-departmental cooperation theory, and other methods to put forward suggestions on improving laws and regulations, strengthening governance methods, strengthening source control, increasing publicity and public opinion guidance, etc. to strengthen vehicle overload and overload management. Guo Xin [8] innovatively used Hadoop technology to solve the problem that an illegal transportation behavior of a cross-regional vehicle was told to receive multiple penalties. It has realized the overall management of off-site law enforcement in highway over-regulation and provided a technical guarantee for the supervision of highway over-regulation and the tracing of liability for overrun violation cases.

As there are little researches on the overload and limit of the urban expressway, this paper investigates the problem of the overload and limit of the urban expressway and analyzes the case of the viaduct collapse in Wuxi. In-depth analysis of the causes of overloading and overrun problems, to propose reasonable governance strategies to reduce the impact of overloaded and overrun vehicles on traffic and improve the overall efficiency of urban expressways.

2. SURVEY AND DATA ANALYSIS OF OVERLOAD AND LIMIT ON URBAN EXPRESSWAY

2.1. Survey plan

2.1.1. Survey purpose and survey area
The purpose of the investigation is to study the impact of overloading and overrun on urban expressways on traffic safety.

The investigation area is from Yan'an Elevated to Yingbin Avenue Elevated in Huaian City.

2.1.2. Questionnaire content
a) Personal basic information
   Gender, age, family population, monthly income.
   b) The degree of understanding of the relevant regulations of overload and limit
   Do you understand the legal system for over-load and overrun governance, and whether you understand the criteria for overload and overrun transportation?
   c) The degree of understanding of the government's supervision and the situation of the transportation market
   How strong is government supervision and how is the current development of the transportation market?
   d) Whether there has been an overload and overrun experience, the reason.
   Have you ever experienced overload and overrun, what is the reason for overload and overrun?
   e) Opinions and attitudes on the over-load and overrun control of urban expressways
   Regarding the governance of the problem of overloading and overruling on urban expressways, what is lacking, and whether we support strict management of over-load and overrun transportation behaviors and the reasons.
There were a total of 215 questionnaires in this survey. SPSS software was used for data processing, summarization and statistics, and finally 196 valid data were obtained.

2.2. Data analysis

2.2.1. The characteristics of the truck driver himself

a) Gender

In the sample of the questionnaire survey, men accounted for 90.32% and women accounted for only 9.68%, reflecting a certain extent that the vast majority of truck drivers are men, which is more in line with social reality, indicating that the population of truck drivers is related to gender. As shown in Table 1.

| Gender  | Proportion |
|---------|------------|
| Male    | 90.32%     |
| Female  | 9.68%      |

b) Age

Among truck drivers, the sample between 41-50 years old is the largest, accounting for 52.69% of the total sample, followed by the sample between 31-40 years old, accounting for 36.56% of the total sample, and those under 30 and 60 years old are surveyed. The number of people in the sample is small, accounting for only 4.30% of the total, indicating that the vast majority of truck drivers are middle-aged people between 30 and 50 years old. It also reflects that most truck drivers are people with families. According to background data, it shows that truck drivers between 40-50 years old have a heavier family burden and a larger population. This is also one of the reasons for overload and overrun. The vast majority of truck drivers need to support their families, and the pressure of competition in the transportation market is high, and they can only pass through improper means to seek profit, as shown in Picture 1.

![Figure 1: The age of the truck driver](image)

Figure 1: The age of the truck driver

The family burden of truck drivers is heavy, and the economic pressure is great. Corresponding to the data results in Figure 2, it is easy to induce overloaded vehicles.

c) Family structure

According to the survey data of the family structure, as shown in Figure 2, 47% of truck drivers have five people in their homes, of which four and six people account for 25% and 21%, respectively. A family of three and more than six people accounts for less. It is 4%, 3%. It can be seen that the family burden of truck drivers is heavy, and the economic pressure is great. Corresponding to the data results in Figure 2, it is easy to induce overloaded vehicles.

![Figure 2: The family structure of the truck driver](image)

Figure 2: The family structure of the truck driver
d) Monthly income

According to the survey data, the vast majority of truck drivers have monthly incomes between 6000-7000 yuan, accounting for 35.48%, those with 5000-6000 yuan accounting for 29.03%, and the proportions of 4000-5000 yuan and more than 7000 yuan are similar, respectively, 18.61% and 16.88%. Although the monthly income of truck drivers is generally not low, the burden is heavier due to the large family population. It can be seen from Figures 1, 2, and 3 that the burden of the family and the pressure of market competition induce overload and overrun accidents. As shown in Figure 3.

![Figure 3 Monthly income](image)

2.2.2. The extent to which truck drivers are aware of the relevant regulations on overloading limits

a) Is there a legal system for overload and overrun governance?

As shown in Figure 4, it can be seen that truck drivers are aware of the legal system for overload and overrun control, but do not understand at all. It can be seen that although truck drivers know the laws and regulations related to overload and overrun, they know the law and violate the law. Insufficient perfection and inadequate punishment has allowed truck drivers to take advantage of it.

![Figure 4 Understanding the legal system of overloading and limiting governance](image)

b) Do you understand the criteria for determining overloaded transport?

It can be seen from Figure 5 that truck drivers have a basic understanding of the criteria for overload and overrun transportation, and few don’t understand it. The side reflects that the law enforcement officers are not strong enough to supervise, and truck drivers want more benefits, leading to overload and overrun. The accident happened.

![Figure 5 The degree of understanding of the criteria for determining overloaded transport](image)

2.2.3. Truck drivers have an understanding of the government's level of regulation and the transport market

a) Government supervision
According to the sample data of the survey, only 21% think that the government's supervision is very strict, and they think that the supervision is more general, accounting for almost half. It can be seen that the government's supervision is not enough and not paying enough attention to this situation, which also induces overload. One of the reasons for overrun. As shown in Figure 6.

![Figure 6 The degree of supervision by government departments](image)

b) The current development of the transportation market

According to the survey data, the vast majority of truck drivers believe that the transportation market lacks management, the industry is not regulated, and unauthorized vehicle modification is serious and vicious competition exists. Only a few people believe that the transportation market is well managed and the industry is standardized. The side reflects that due to improper supervision of the transportation market, fierce competition and vicious competition exist, which is also one of the reasons for overload and overrun accidents.

![Figure 7 Understanding the current state of the transportation market](image)

2.2.4. Overload and overrun’s experiences and causes

a) Experience

As shown in Figure 8, 70% of truck drivers have the experience of overload and overrun, and only 30% of those who do not have the experience of overload and overrun.

![Figure 8 Experience](image)

b) Causes

It can be seen from Figure 9 that the main reasons for truck drivers’ overload and overrun are heavy family burdens, high operating costs, and fierce competition in the transportation market, leading to heavy burdens and pressure on truck drivers, leading to the road of overload and overrun. It also echoes...
the previous data. It can be seen that the problem of overloading and over limiting is not only due to the personal reasons for truck drivers but also has great links with the government and enterprises (This is a multiple choice.).

2.2.5. Views and attitudes on the management of overloading of urban express roads

a) What is lacking in the management of the problem of overloading of urban express roads?

It can be seen from the sample data that it is believed that government departments need to strengthen management, law enforcement personnel enforce strict law enforcement, and laws and regulations need to strengthen management and improvement to reduce the occurrence of overload and overload accidents and protect people's lives and property. Of course, it is also very important for people to consciously abide by laws and regulations. As shown in Figure 10 (This is a multiple choice.).

b) Whether to support strict control of overloaded transport behavior

According to Table 2, the majority of truck drivers' attitudes towards strict management of superpower are supportive, accounting for 79.57%, while non-support and indifferent attitudes account for less than 12.9% and 7.53%. This shows that everyone is very supportive of supervising management. Yes, from the background data, it can be found that the unsupported and indifferent attitudes are both because the family is not burdened, or the family with lower wages is too burdened, which leads to their unsupportive attitude. It can be seen that the overwhelming majority support the control of superpower and hope that the traffic environment will be safer.

Table 2 Whether to support strict control of overloaded transport behavior

| Option                                                                 | Proportion |
|------------------------------------------------------------------------|------------|
| Support. It can make road traffic safer.                                | 79.57%     |
| Do not support it. So that the benefits are reduced, to bring a heavy burden on life. | 12.9%     |
| It doesn't matter that it doesn't have much effect on your life.        | 7.53%     |

2.3. Summary

Through the investigation of the current situation of the urban expressway in Huai'an and the analysis
and research of the data, it can be seen that the phenomenon of overload and overrun is still occurring, affecting people's life safety.

3. CASE ANALYSIS

3.1. Summary of Wuxi Viaduct Collapse
At around 6:10 in the evening on October 10, 2019, the bridge deck collapsed on the section of the bridge over Xiang Road on the Shanghai direction of National Highway 312 in Wuxi, Jiangsu. The accident caused 3 deaths and 2 injuries. The accident caused a total direct economic loss of 8.231 million yuan, including 4.8 million death compensation, 9 damaged vehicles, and 229,000 direct economic losses. Bridges The direct economic loss of damage was 3.202 million, causing significant social impact.[9]

3.2. The impact of the collapse of the Wuxi overpass

3.3.1. Analysis based on personal interest drive
The cargo transportation market itself is a product of a market economy, and freight rates should be regulated by market supply and demand. However, the current situation of the transportation industry has shown some signs of market failure. Due to the fierce competition in the transportation market and the oversupply in the transportation market, the unit price of freight deviates from the necessary labor consumed by freight. To obtain more benefits, individual transportation companies grab orders and blindly condone some unreasonable and illegal requirements of customers, making the vehicle transportation of goods develop in the direction of overload and overrun.

3.2.2. Analysis based on the terminal's lax law enforcement
Administrative law enforcement agencies are not strict in law enforcement, law enforcement personnel lack initiative, and management law enforcement lacks regularity. [10]. The overriding policy is a mere formality and does not take action. Although most transportation companies have formulated a system related to overload and overrun, the actual implementation is not strong. This makes the rules and regulations useless but has no practical effect.

3.2.3. Analysis from the perspective of inadequate supervision of freight source
The law enforcement agencies are inadequate in investigating the source companies of freight forwarders, inadequate in their investigations, inadequate in investigations of cargo throughput, illegal overload and overrun transportation, unable to accurately and timely announce to the society, and insufficient daily supervision. The supervision and investigation of logistics parks, ports, and wharves are not strong enough, and modern technology cannot be effectively used to record and record the weighing of goods, and the registration, weighing, and release of trucks and drivers are not rigorous enough.

3.3. Summary
This section analyzes the collapse of the Wuxi viaduct from different perspectives. It can be seen that the overload and overrun problem has a huge impact on people's lives and has a serious negative impact on the country's social and economic development.

4. OVERLOAD AND OVERRUN CONTROL STRATEGY ON URBAN EXPRESSWAY

4.1. Improve laws and regulations

4.1.1. Increase severe punishment system
Intensify the punishment of overloaded and overrun vehicles, formulate a complete punishment system, and ensure that the punishment is based, strong, and persuasive so that law enforcement officers can
better enforce the law and reduce the occurrence of accidents.

When the actual load of the vehicle exceeds one-third of its load, it will be fined; when the actual load of the vehicle exceeds its load between one-third and two-thirds, it will be detained. The fine is one-third of the overload. When the actual load of the vehicle exceeds two-thirds of its load, it is an illegal act. The driver’s license is revoked, the goods are confiscated, and the fines are doubled.

4.1.2. Clarify the criteria for the identification of overloaded vehicles
Because overruns and overloads have different standards in different laws, although there are current documents to unify the standards, if we want to completely cure the overload and overrun phenomenon, we must legally unify the overload standards [7]. Therefore, it is necessary to clarify the identification standards for vehicle overload and overrun, clarify the difference between overload and overrun, draw a clear distinction between the two, formulate clear standards for the governance of "two overruns", carry out national unification, and formulate laws and regulations to allow freight Enterprises and drivers have clear standards. This will not only reduce the difficulty of law enforcement personnel but also establish an image of law enforcement, which can reduce the occurrence of overload and overrun accidents.

4.2. Strengthen the supervision system on the source of illegal overloading
With the development of the economy and the faster and faster development of transportation, more and more individuals and collectives are engaged in transportation enterprises, resulting in excess transportation capacity, oversupply in the transportation market, and fierce competition in the transportation market. Operators are trying to make up for cost losses. Through the illegal modification of vehicles, widening and heightening, to be able to load more goods and obtain more benefits. Therefore, it is necessary to strengthen the supervision system for the source of illegal overloading and overloading, to reduce the occurrence of overloaded and overloaded vehicles and reduce the occurrence of traffic accidents. To play a precautionary role.

Source one: freight enterprises. The transportation department shall work with other relevant departments to check the relevant freight enterprises, update and adjust the freight source units according to the cargo throughput, report to the local government, and make them available to the public on time. At the same time, transportation and public security management departments should be the more stringent investigation and punishment of key logistics parks, port terminals, and other key enterprises strictly investigate and punish truck loading goods, weighing registration, and effectively strengthen the supervision of the source of goods, reduce the production of overloaded vehicles.

Source two: Vehicle manufacturers and manufacturers. In the production process of automobiles, the regulatory authorities should strictly manage the manufacturers of vehicles and production, once found to have violated the transformation of production standards, the use of ride-on means, the entire production chain involved in personnel are to be punished, serious cases according to illegal treatment, the closure of manufacturers.

Source three: vehicle registration, license issuance, and annual review authorities. Any vehicle driving on the road needs to be issued by the traffic control department before it can be driven on the road, and it needs to pass the annual review every year, otherwise, it is a violation vehicle. The issuing authority is strictly prohibited from issuing certificates to all modified vehicles that do not meet the standards. It is not allowed to issue certificates to vehicles that fail the annual review. Once discovered, some of the staff of the issuing authority, by accepting bribes and other means to issue certificates to the offenders, will all be revoked from their positions and will not be hired for life. If the circumstances are serious, the law enforcement agencies will deal with them.

4.3. Improve technical measures to manage vehicle overloads
4.3.1. Set up weighing system and vehicle specification standard measurement system
For example, a platform scale and vehicle specifications are set at the ramp entrance to measure whether
the weight of the vehicle meets the loading requirements of the vehicle. When the vehicle enters the ramp entrance of the expressway, the platform directly detects whether the vehicle is overloaded. If it is overloaded, the platform will issue an alarm and the information management system will Vehicles and driver information will be entered, and vehicles that violate the regulations must be parked at the emergency parking zone and wait for law enforcement officers to come and deal with it.

Under the conditions that economic and technical conditions do not allow, a weighing system can be installed at the gas station and the measurement of vehicle specifications can be carried out before the vehicle enters the expressway. Once found to be unqualified, the driver can enter the expressway It can be known to prevent vehicles from being overloaded and overrun before entering the expressway, which can also reduce the burden of supervision for law enforcement personnel, and prevent illegal behavior from entering the expressway, greatly reducing the occurrence of traffic accidents.

4.3.2. Establish a network of information management
Several law enforcement agencies are responsible for the control of overload and overrun. The government must establish a complete information management system for overrun and overrun to allow actual information sharing between several law enforcement agencies to reduce law enforcement conflicts caused by inconsistent information. Due to the complexity of the information, the inefficient use of information, and the lack of sharing, it is necessary to establish a strict networked system for information management.

First to establish a complete vehicle information system and can be shared across the country, the system information including vehicle manufacturers, license plate information, all enterprises or individuals, vehicles driver information systems, etc., when the vehicle overloading transfinite violations, can log in directly to check all the information to the vehicle, to achieve fast, accurate.

Second set up the entire sections of continuous monitoring and detecting system, the whole monitoring test, so you can avoid some not set test blocks, let the vehicles on the road detect zero dead Angle, reduce the burden of law enforcement officer site test, especially in more remote areas, but also can alleviate a shortage of law enforcement officers.

4.4. Summary
This chapter mainly proposes the governance strategies for overloading and overloading from three aspects: improving the laws and regulations, strengthening the supervision system for the source of illegal overloading and overloading, and improving the management of technical means for vehicle overloading and overloading. Through these methods, it is possible to reduce the occurrence of overload and overrun accidents, create a safe and comfortable atmosphere for the road traffic environment, and reduce casualties and economic losses.

5. CONCLUSION
In this paper, through the investigation and data analysis of the overload and overrun of the urban expressway in Huai'an City, and the in-depth analysis and research on the viaduct collapse in Wuxi City, the final control strategy is to reduce the impact of overloaded and overrun vehicles on the traffic flow. Improve the overall efficiency of urban expressways. It can reduce the proportion of overloaded and overrun vehicles in the traffic volume. It can reduce the damage to the pavement, subgrade, and road ancillary structures of urban expressways by overloaded and overrun vehicles. It can reduce traffic accidents due to overloading, improve the transportation environment, and further protect people's lives and property safety.

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