Analysis of the Causes and Countermeasures of Chengdu City Road Traffic Noise

Li Chun Chen1st,a, Bo Fang2nd,b, He Xu3nd,c, Jie Cai4th,d, Dong Li5th,e
Sichuan Zhongyi Architectural Design Institute Co.Ltd, Chengdu, China
a4337111@qq.com, b4389742@qq.com, c283380618@qq.com,
d516895450@qq.com, e962626080@qq.com

Abstract: As the pace of urbanization in Chengdu continues to accelerate, the construction of urban roads has also been strengthened. 2015 forming a dense urban road network. People often say that the city is too noisy. In fact, from a professional point of view, it is urban road noise. Therefore, under the influence of more and more people from urban road noise, it is necessary to investigate the generation and impact of urban road noise and related prevention measures. This article explains the causes and hazards of Chengdu's road noise, and puts forward opinions and suggestions on urban road noise in order to provide some research materials for the same type of urban noise prevention.

1. INTRODUCTION (HEADING 1)
With the continuous development of society, the number of motor vehicles has increased sharply, making road traffic noise pollution increasingly serious. In order to understand the current status of traffic noise, in 2015, the Ministry of Environmental Protection set 21,178 traffic noise monitoring points in various provinces across the country, covering 35,417km of road length, and built some automatic monitoring stations (Figure 1). The results of the monitoring report indicate that during 2015 the average value of noise is 67.0dB (A), the noise pollution at night is more serious, and the noise source intensity is generally higher than that in 2014. In addition to the authoritative monitoring by the state, domestic researchers also conducted monitoring and analysis of urban traffic noise. The members of Cai Ming's research team [1][2] monitored the road traffic noise in Guangzhou from 2011 to 2015 and conducted a trend analysis. At the same time, they drew a map of the traffic noise in Guangzhou. Bian Guiguo, Zhang Jinyan, Wu Duilin, Yu Shiqing, et al. conducted research and analysis on urban traffic noise monitoring in Xiamen, Tianjin, Dongguan, and Hangzhou, respectively. Zhang Shoubin and others analyzed the current status and changing trends of environmental noise pollution prevention in China, and also put forward suggestions for improvement. This study mainly monitors the traffic noise of the main roads in the Chengdu area, which is beneficial to assess the pollution of traffic noise throughout the region and provide a scientific basis for regional traffic noise monitoring and related analysis.

(Figure 1 Road noise detection points)
2. OVERVIEW OF MAJOR ROADS IN CHENGDU

(Figure2 Chengdu Comprehensive Transportation Planning Map)  (Figure3 Map of main roads in Chengdu area)

Chengdu, a city with a history of more than 2,300 years of urban construction, the urban transportation system has been initially established since the Qin and Han Dynasties, and the remains of ancient imprints can still be found. After the founding of New China, Chengdu, as an important provincial capital of Southwest China, has always shouldered the responsibility of rapid development. During the 70 years of urban development, Chengdu's transportation system has played an important role in supporting urban development at different stages of development.

After several decades of development, Chengdu has made remarkable achievements in road construction. At present, the urban area has formed an inner ring road, first ring road, second ring road, centered on Tianfu Square, the intersection of Shudu Avenue and Renmin South Road. The ring-shaped radioactive road traffic system surrounded by the Third Ring Road and the ring-freeway (Figure2 and Figure3). [3]The structure of urban traffic in Chengdu is a "well + ring" road network structure, of which the first, second, third ring road and the ring-free expressway form a circular traffic road network, while Dongchenggen Street, Hongxing Road, Binjiang Road and Xinhua Avenue It constitutes a "well" shape road network structure, with Shudu Avenue connecting east and west, Renmin Road running through the north and south, forming Wenqiong, Chengguan, Chengpeng Expressway, Chuanshan Road and Chenglong Road, etc. The loops intersect radioactively and connect the surrounding satellite towns. [4]

3. IMPACT OF ROAD NOISE ON CHENGDU CITY ENVIRONMENT

In addition to air pollution, noise and vibration are also non-negligible pollution problems in urban road traffic.

Noise pollution is one of the four major pollution problems among air pollution, water pollution, solid waste pollution and acoustic pollution, and it is a kind of physical pollution. With the enhancement of people's awareness of environmental protection and the improvement of environmental quality requirements, the quality of acoustic environment has caused widespread concern. The composition of urban environmental noise is mainly composed of four types of noise sources, namely industrial noise sources, traffic noise sources, social life noise sources, and construction noise sources. [5]The urban environmental noise in the period is mainly composed of industrial noise sources. With the development of the city and the positioning of the return function, most production-oriented industrial enterprises have moved out of the urban area and moved to specialized industrial areas. [6]Therefor, in most large cities, traffic noise has replaced industrial noise as the main source of noise pollution affecting the acoustic environment of cities. Its impact surface is large and its strength is high (Table 1). It can be said that controlling traffic noise pollution is the key to improving the quality of urban acoustic environment.

| grade          | Heavy pollution | Moderately polluted | Light pollution | Better | Good |
|----------------|-----------------|---------------------|-----------------|--------|------|
| Equivalent sound level | >74.0          | >                   | >               | ≥      | ≤68.0 |
| dB(A)          | 72.0-74.0       | 70.0-72.0           | 68.0-70.0       |        |      |
3.1. Road noise generation and characteristics

Our usual definition of noise, in physics, is the irregular superposition of sounds of various frequencies. From a physics point of view, any sound that interferes with people's rest, study, and work can be called noise. [7] The noise of urban roads is usually defined as: the sound of motor vehicles driving on the traffic trunks, generated by the vehicle itself and the process of vehicle travel, and exceeding the national noise measurement standard (70dB during the day, 55dB at night). Among them, we call the noise generated by the engine, intake and exhaust, cooling fan, etc., the vehicle self-noise. Secondly, we call tire and whistle noise as vehicle running noise (Table 2). [8] It is worth noting that motor vehicle noise is the source of urban main road traffic noise. It is a kind of unsteady noise with strong mobility and randomness. The general noise range is between 60 and 80 dB. Vehicle type, speed, road type, etc. are closely related and have the following characteristics:

- Urban road traffic noise is affected by factors such as the slope of the road, the roughness of the road surface, and the location of the road section. It is worth noting that even at the same location, the road noise will change when it is at different times, so there is a certain amount of road traffic uncertainty.
- The distribution of urban main road traffic noise is usually consistent with the main road network. It mainly affects residents and buildings within a certain area on both sides of the trunk road (Figure 4).
- There is a close relationship between the traffic noise of urban arterial roads and the real-time road traffic conditions. Generally, the noise increases with the traffic volume.
- The noise caused by the vibration of the vehicle tread and the inside of the vehicle carcass is also one of the sources of urban road traffic noise.

| Table 2 Vibration levels along the road caused by a single car driving |
|-----------------|-----------------|-----------------|-----------------|
| Large car       | Vibration level (VLZ10dB) | Small car       | Vibration level (VLZ10dB) |
| Dongfeng 140    | 78               | Beijing 212     | 60               |
| Dongfeng 140    | 73               | Minicar         | 60               |
| Liberation 141  | 68               | Beijing 130     | 77               |
| Liberation CA10 | 75               | Minibus         | 65               |
| Dongfeng Bus    | 78               | walking tractor | 67               |
| Yellow River JN162 | 70               |

(Figure 4 Impact of road noise on surrounding buildings)
3.2. Road noise hazards

- The influence of urban road noise environment on the mental health of urban residents mainly refers to that it will seriously affect people's emotional fluctuations in a noisy environment, and will seriously disrupt breathing, heartbeat and nerves, and bring great harm to people's health. Relevant research shows that when the noise decibel reaches more than 80, it will cause damage to human hearing. Seriously, it may cause hearing loss, deafness and other related diseases. Even under a relatively low decibel, it will cause some physical and neurological discomfort to varying degrees. Research related to the normal life and work of urban residents will specifically divide the specific state of the impact, but it is not difficult to understand Yes, the psychological impact of urban road noise environment on urban residents is huge, and we must pay attention to it.

- Urban road noise will affect the physical health of urban residents mainly because the noise will seriously affect people's heart rate and blood pressure, which in turn will cause other related diseases, mainly caused by nerves will seriously damage the physical health of urban residents.

- Urban road noise will affect the quality of life of urban residents, so it will have a certain impact on the choice of home buyers when choosing a house. Buyers will definitely choose houses with good greening and road environment. If a community is faced with trunk roads or trains, stations and other areas where people flow and noise are concentrated, then the decibels of noise will naturally be much higher, which will cause certain Impact (Figure5). [10]

(Figure5 Impact of road noise on the surrounding area)

- In actual life, the whistle of cars at night is still quite serious. This seriously affects the quality of sleep of residents on the side of the road at night. In actual life, we can clearly find that many cars still whistle at night. City residents who are close to the road are often awakened by the sound of the car whistle late at night, which seriously affects the night rest and urban residents. Physical health.

In view of the lack of awareness of the night driving mode, it is a problem of consciousness. It is difficult to improve the consciousness problem in a short time. In my country's driving school exams, the theoretical department's test questions on night driving whistle and the lottery ratio of the night exam are very small, which has caused the driving license to pay less attention to the night driving rules. In addition, our country has no relevant punishment mechanism, and there is no supervision on the monitoring of urban road noise at night, which relaxes the restrictive measures of urban roads at night, so that when the urban roads are driven at night, they do not pay attention to the use of lamps for warning. A whistle sound was produced. [11]

However, we must realize that the phenomenon of car whistle at night is serious, and the consciousness of the night driving mode is difficult to improve for a period of time. Therefore, regarding the car whistle at night, the consciousness of night driving mode Weakness needs to be considered long-term.
4. INFLUENCING FACTORS OF ROAD NOISE IN CHENGDU

The size of the vehicle noise has a certain relationship with the vehicle type and speed. In the research of road traffic noise, vehicles are usually divided into two categories: large, medium and small. The vehicle classification given in the Environmental Impact Assessment Specification (Trial Draft) of my country's highway construction projects is shown in Table 3.

| Model       | Total car quality (t) |
|-------------|-----------------------|
| Small car   | 3.5 or less           |
| Midsize car | 3.5-12                |
| Large car   | 12 or more (Including containers, slippers, engineering vehicles, etc.) |

For large vehicles, intake and exhaust noise account for a significant share of vehicle noise; for small vehicles, tire noise accounts for a large proportion of vehicle noise, and increases with vehicle speed.

The vehicle noise intensity is the average radiated sound level measured at the observation point in the vehicle noise measurement. It is one of the main factors that determine the amount of highway traffic noise. The intensity of vehicle noise varies with the speed of the vehicle. The intensity of road traffic noise is generally between 70dB-90dB(A), and the instantaneous noise level of some large transportation vehicles can exceed 100dB(A).

In addition to the vehicle type and speed, the noise level of vehicles running on the road is also related to the vehicle load, vehicle conditions (new and old conditions and maintenance status), road conditions (road performance, roughness and smoothness) and road longitudinal slope, etc. According to the measurement and data introduction, the load has little effect on the noise of gasoline vehicles, which makes the noise level of medium-sized trucks slightly increase. The noise level of heavy trucks increases by about 3dB (A) when it is empty.

Studies have shown that the noise level of small cars on rigid roads is about 3dB (A) compared to flexible roads at the same speed, because the tire noise of small cars on rigid roads is much larger than that on flexible roads; medium-sized cars and large cars The driving noise level of the car on the rigid and flexible roads is basically the same. At the same speed, the noise level on the rigid road is 1dB (A) higher than that on the flexible road. The road roughness has a significant impact on the driving noise of small cars. This is mainly caused by tire noise. The measurement of vehicle noise intensity is generally carried out under the condition of road surface roughness of 04-07mm. When the road surface roughness increases or decreases by 0.3mm, the driving noise level of small cars increases or decreases by 2dB (Δ) accordingly. Therefore, the road traffic noise calculation needs to be corrected according to the actual road roughness. The road surface roughness has basically no effect on the vehicle driving noise level. However, the noise intensity of the road surface increases due to the vibration of the vehicle body. The longitudinal slope of the road has no obvious effect on the running noise of small cars. Due to the increase in engine speed when the truck is going uphill, the dynamic noise is increased, and the driving noise is significantly enhanced. When the longitudinal slope of the road increases to 3%-4%. The corresponding noise level increases by approximately 2dB (A). When the road longitudinal slope increases to 5% to 6%, the noise level increases by approximately 3dB (A). When the longitudinal slope increases to more than 7%, the noise level increases by approximately 5dB (A). Highway traffic noise should be corrected according to the actual road longitudinal slope. [12]
5. PREVENTION MEASURES FOR ROAD NOISE IN CHENGDU

There are many reasons for the noise generated by urban road traffic, and its control should also be considered from multiple angles and aspects. The summary summarizes the basic methods for road traffic noise reduction.

5.1. Install sound insulation devices to reduce the impact of urban road noise

The installation of sound insulation devices to reduce the impact of urban road noise is to establish a barrier between the noise road and the house. The specific approach to prevent noise from being introduced into the house is to constantly seek new sound insulation technology and establish high-tech sound insulation barriers. Effectively block. Need to clearly understand that the cost of installing sound insulation devices is relatively high, which may be more suitable for high-end residential areas, for ordinary residential areas, the cost seems a bit high. In the subsequent development, the government can increase the research and development of sound insulation devices, encourage independent innovation of enterprises, design and develop more effective and affordable sound insulation devices, so that all urban residents can enjoy the safety and convenience brought by technology (Figure 6). [13]

(Figure 6 Road sound insulation device)

5.2. Increase greening ratio and reduce urban road noise

Greening noise reduction is an economical and effective way to reduce urban road noise. Greening noise reduction is to cultivate more green plants, because when the noise passes through the leaves, the plant can effectively absorb part of the noise. The more green plants, the more obvious this effect. In the actual operation process, it is also the easiest to operate. Increasing the proportion of green plants is also economical in terms of economic cost. Therefore, in the method of noise reduction, it is necessary to make full use of this method, which is economical and green. Increasing the oxygen content of residential accessories can also greatly improve the comfort of life (Figure 7). [14]

(Figure 7 Afforestation around the road)

5.3. Construct low-noise roads to reduce the impact of urban road noise

Low-noise pavement is a kind of pavement constructed with special materials with high cost. This kind of road surface can effectively reduce the noise generated by the contact between car tires and the ground, so as to achieve the purpose of noise reduction. In the road construction planning, this
technology should be adopted as far as possible in urban gathering places to achieve the purpose of urban road noise impact. When carrying out road construction budgets, it is necessary to appropriately increase the proportion of noise reduction in the budget and focus on quality road construction and planning in order to reduce the harm of urban road noise and increase the quality of life of urban residents. [15]

Low-noise pavement is bound to be the mainstream technology of urban road pavement technology in the future, so we must continue to innovate low-noise pavement technology to improve the effect of noise reduction. Another aspect is to reduce the cost of low-noise pavement as much as possible. Reduce the cost of urban pavement construction, so that more cities use this low-noise pavement technology.

5.4. It is recommended to install soundproof glass in residential windows to reduce the impact of urban road noise

To reduce the impact of urban road noise, for individuals, the most direct effect is to install sound insulation glass with good sound insulation effect. The choice of windows in a family house is the most direct reflection of the decibel level of the house. Good noise-reducing glass can reduce noise to a large extent, but ordinary glass is difficult to achieve, and it will not achieve noise reduction. The purpose is to cause noise hazard to the living residents. Therefore, as economic conditions permit, it is necessary to install glass with good sound insulation as much as possible, which is a manifestation of physical and psychological responsibility for yourself and your family (Figure 8). [16]

(Figure 8 Soundproof glass windows)

5.5. Raise the awareness of night driving mode and try to avoid whistle at night

To increase the awareness of the night driving mode, try to avoid the whistle at night. On the one hand, it is necessary to improve the driving awareness of the driver. This requires a long-term publicity and teaching, education and guidance in all possible links, in order to reduce the bad habits of driving whistle at night, to reduce the harm caused by urban road noise to urban residents.

The development of consciousness is inseparable from long-term education. In the education of driving schools, we must increase the proportion of night exams or provide a separate option for night exams. In the process, we continue to strengthen night driving consciousness and skillfully teach students. In night driving mode, lights should be used for early warning. In addition, noise monitors can be installed on noisy roads, and vehicles with excessive noise can be educated or fined, so that drivers can develop a good habit of driving at night to reduce noise. There are many such methods, we can think carefully from all aspects, and I won’t go into details here. I hope that everyone can pay attention to the environmental impact of urban road noise, and think positively, and make more contributions to reduce urban noise.

6. CONCLUSION

There are various measures to reduce road noise in Chengdu, in addition to the installation of sound insulation devices mentioned in the article, to reduce the impact of urban road noise; increase the proportion of greening to reduce urban road noise; build low-noise roads; it is recommended to install
soundproof glass for residential windows. To increase the awareness of the night driving mode and try to avoid night whistle, etc., we must adjust the measures according to the changing actual situation, in order to achieve the purpose of reducing the noise hazards of urban roads and improving the quality of life of urban residents. In general, we must pay attention to the roads of urban road quality development. When putting economic costs and benefits first, we must also consider the importance of urban road noise reduction. At the same time, I hope we can pay attention to the problem of urban road noise environmental impact, and think positively, offer suggestion, and make the construction of the city better.

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