



Analysis of Effective Control Measures of Construction Noise

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Abstract. In recent years, the dispute cases about the construction noise are gradually increasing, the site noise control has become an urgent problem to be solved, the construction unit should also pay great attention to this and remediation. With the increasing difficulty of real estate development and old city reconstruction in Jinan, the phenomenon of noise pollution in construction is increasingly prominent, especially the noise pollution of construction sites in areas with relatively dense urban personnel, which has become a hot problem of urban ecological environment complaints. For the sustainable development of urban construction, the urban environment construction, as one of the contents of urban construction, needs more attention at this stage. Based on the causes of the noise disturbance in the construction site, this paper puts forward feasible suggestions and measures to provide reference for effectively solving the prominent environmental problems.

Keywords: construction; equipment improvement; noise control

1 Introduction

With the continuous improvement of people's awareness level and the further promotion of green construction, people pay more and more attention to the construction pollution, especially the noise pollution caused by construction noise, noise pollution not only affects the overall surrounding sound environment, but also causes great harm to people's physical and mental health, work efficiency and rest at night[2 - 3]. Studies have shown that when working in A noise environment above 70dB (A), the efficiency will be reduced by 10%, and may produce depression, anxiety, irritability, antagonism, etc[6]. In addition, construction noise seriously damages the hearing health of construction workers, and noise hearing loss is still the number one occupational disease of construction workers. Therefore, the impact of construction noise cannot be underestimated in both quantity and harm degree. At present, there are still a lot of construction noise nuisance. There are two possible reasons: first, the evaluation standard cannot meet the demand, even if the construction project meets the noise emission standard, it will still affect the surrounding residents; second, the noise emission of the construction project fails to meet the requirements of the relevant

standards and specifications, without the noise control measures in the construction process, resulting in the emission exceeding the standard. In view of these problems, it is necessary to systematically grasp the formation, propagation and harm of construction noise, and establish effective noise evaluation indicators and control methods, so as to realize accurate and reasonable management of construction noise[11]. This paper collects the data of the degree of noise influence of the residents around the three construction sites in Jinan, and analyzes and summarizes the attitude of Jinan residents on the construction noise and the degree of influence by the construction noise.

2 The Concept of Construction Noise

Noise is one of the four major widely recognized pollutants (air pollution, water pollution, solid waste pollution, noise pollution) in today's society. It refers to the phenomenon that environmental noise exceeds the emission standard stipulated by the state and interferes with people's normal life, conversation, study and work. It is a kind of physical pollution. Different from chemical pollution, the impact of noise pollution is not fatal, indirect and slow, but it will cause certain harm to people's psychological and physiological health. Whether a sound is defined as noise or not not only depends on its loudness, but also depends on the frequency, duration, continuity and information content contained, but also related to the person's psychological state and emotional state, which is related to the individual's subjective feelings[10]. In view of construction noise, article 27 of the Law of the People's Republic of China on the Prevention and Control of Environmental Noise Pollution revised in 2018 makes a detailed explanation and provision: construction noise refers to the sound generated in the construction process that interferes with the surrounding living environment. In recent years, the pace of urban development in China continues. Both the first and second tier cities and the accelerating cities are combining the current situation and advantages of the city for planning and construction to expand the scope of urban areas. The construction of new industrial areas or residential and office buildings, and the renovation of old cities, are all proceeding at a faster speed. In the construction process, need to use all kinds of mechanical power equipment, all kinds of equipment will emit sound pressure level, frequency distribution of different noise, makes the surrounding originally quiet urban environment become noisy, especially when the construction site is located in the city, near the life or office or hospitals, sanatorium, construction activities of noise will bring serious influence to the surrounding residents and construction personnel[4].

3 Source of Construction Noise

In the environmental pollution of the construction site, noise is one of the most serious pollution phenomena, and objectively speaking, it is also extremely difficult to avoid. The noise of the construction site mainly comes from the following aspects:

1. Mechanical noise. It is caused by the various types of construction machinery on the site itself, compared with the whole construction site, can usually be regarded as a point sound source. Different construction machinery such as excavator, pile driver, crane, grader, grinding machine, and the site transport vehicles, their noise characteristics are also different, but the mechanical noise is more than the human body can withstand, to the surrounding residents and construction workers, is a more serious part of the construction noise^[7].

2. On-site operation noise. It is in the process of construction operations, construction machinery operation and collision between building materials or ground, cutting, grinding sound, such as pile driver hit the ground when work the sound, cutting machine cutting steel sound and grinding machine in grinding ground and surface friction, the noise instantaneous sound pressure level may reach 130dB (A), produced serious pollution.

3. Collision noise. It mainly includes the noise caused by the collision in the process of handling or vehicle loading and unloading, as well as the scattered noise issued by the loading and unloading of scaffolding, formwork, as well as the percussion sound of workers, and the impact sound of metal materials, usually instantaneous noise.

4. Noise of the construction personnel. It is mainly the cry of the scene workers, the machine intercom or the more noisy noise.

4 Hazards of Construction Noise

The construction noise not only has a high sound pressure level, but also makes the sound pressure level of the site and the surrounding areas at a high level, and the fluctuation is irregular, which has brought a great impact on the life and work of the surrounding residents, mainly reflected in the following three aspects:

1. Affect sleep and rest

Sleep is extremely important for human health. The allowable noise value when people sleep and rest is 30~50 dB (A). When there is noise, human sleep is affected to varying degrees. Studies have shown that for continuous noise, 10% of people at 40 dB (A) have an impact on sleep, and 50% at 70 dB (A); for sudden noise, 10% are suddenly awakened at 40 dB (A), and 70% wake up at 60 dB (A). People sleep, rest in the noise environment, may appear the acceleration of breathing rate, pulse, as well as nerve excitement and other phenomena, serious will also cause insomnia, dream, tinnitus, memory loss and other phenomena, leading to neurasthenia^[8].

2. Affect the normal communication

In general, when people have a dialogue from 1m, the average sound pressure level is 65 / dB (A) can have good hearing. When the background sound is much lower than the language sound, it will not affect the language communication. However, in the noise environment, the background noise will mask the language, reduce the language clarity and affect the normal conversation. When the noise pressure level is 10dB (A) higher than the language sound, the language sound will be completely

masked. When the noise pressure level is higher than 85dB (A), the communication between people is almost difficult to achieve.

3. It affects both physical and mental health

When people are in the noise environment for a long time, it not only has an impact on the hearing, but also increases the impact of the nervous system, cardiovascular system, digestive system and other aspects. The sudden noise generated during the construction may cause sympathetic tension, which may cause accelerated heart rate, elevated blood pressure and so on. Living in an environment with an average noise of 70 dB (A) increases by 30%. In addition to physiological aspects, construction noise will also cause harm to people's psychological aspects, affecting the operation of the human endocrine system, and then produce fatigue, distraction, reduce the work efficiency, but also affect people's emotional health, become irritable, excited, irritable^[5].

5 The Impact of the Construction Noise on the Residents

In this survey, the communities, commercial or public buildings around the construction sites of three construction projects in Jinan were randomly selected as the survey areas. The three construction sites, including residential areas, commercial buildings and urban infrastructure, are all located in the central urban area of Jinan city and are representative. The survey a total of 300 questionnaires, effective recovery questionnaire 283, questionnaire survey using home survey, public space field survey, face to face inquiry, and other forms, the respondents by the investigators randomly selected, the social questionnaire using the international noise research organization group 6, recommended by Tianjin university, tongji university and other five universities joint research and development of two standard noise survey problem, and the corresponding 5 stage language response scale and 11 stage digital response scale (table 1).

Table 1. The International Noise Research Organization Standard Questionnaire

<p>Verbal Question: “Thinking about the last (12 months or so. . .),when you are here at home. how much does the noise from(. . . noise source) bother,disturb,or annoy you; Extremely,Very,Moderately,Slightly or Not at all?”</p>
<p>Numeric Question: “Next is a zero to ten opinion scale for how much (. . . source. . .) noise bothers,disturbs or annoys you when you are here at home. If you are not at all annoyed choose zero,if you are extremely annoyed choose ten,if you are somewhere in between choose a number between zero and ten. Thinking about the last(. . . 12 months or so. . .),what number from zero to ten best shows how much you are bothered or annoyed by(. . . source. . .) noise?”</p>

The comparative analysis of noise source can distinguish the damage degree of different noise to the sound environment, which lays a foundation for the formulation of further targeted noise control measures[12]. Questionnaire will construction noise source is divided into construction machinery noise, transportation machinery

noise, workers' beating noise and workers noise four types, and through the questionnaire survey comparison analysis the different construction noise source of sound environment damage degree (graph 1), the analysis results can be seen that the construction noise pollution impact on the surrounding environment, construction machinery noise, transportation machinery noise, workers' beating noise have obvious impact, workers noise influence degree is low, it may be with high background noise similarity.

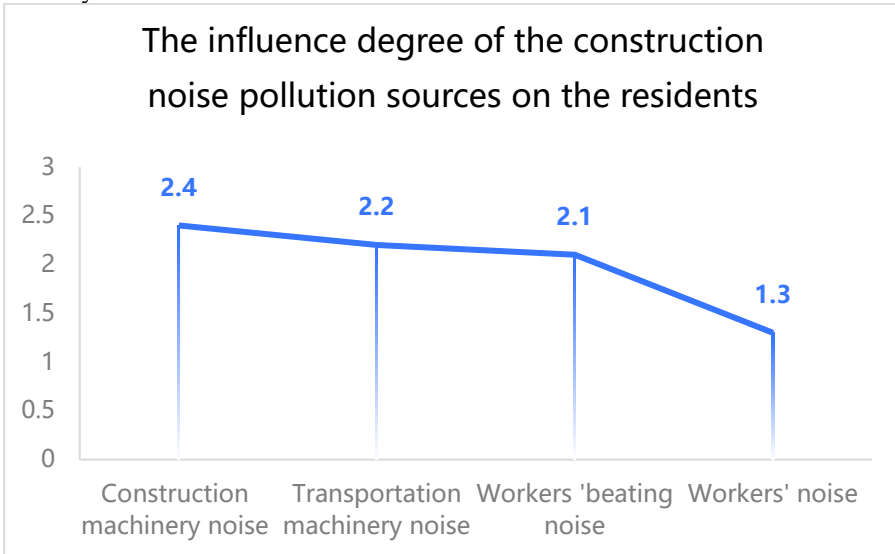


Fig. 1. graph 1 The influence degree of the construction noise pollution sources on the residents

As for the influence of construction noise on specific activities, it can be seen from graph 2 that the degree of construction noise pollution has more influence on people's sleep, rest, learning, work and other activities than those such as talking with people and doing housework. Statistical analysis showed that the difference in the importance of construction noise pollution to the different activities is significant at the 0.05 level. This shows that from the perspective of the harm of construction noise pollution, although construction noise pollution to specific activities such as watching movies, listening to music behavior such as auditory mask effect, but respondents pay more attention to noise of auditory effects, such as physiological health, work efficiency, social interaction, psychological emotion, etc[9].

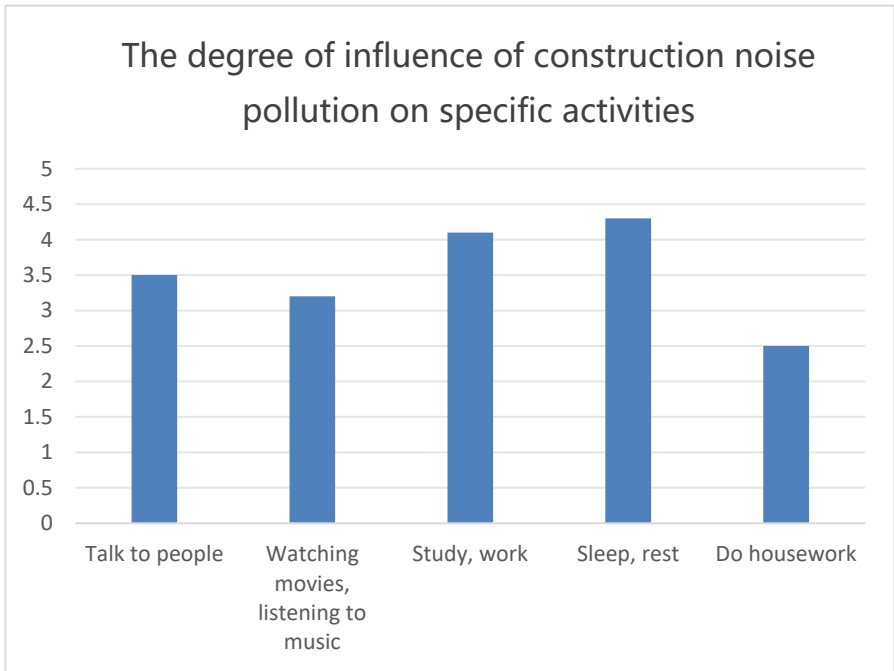


Fig. 2. The degree of influence of construction noise pollution on specific activities

Experimental results

Compared with the noise of workers, the noise of construction machinery, transportation machinery and workers' beating noise have a greater impact on the environment. Construction noise has a great impact on the living environment of residents, and it is easy to make people feel irritable. Affected by physiological health, work efficiency, social communication, psychological and emotional fluctuations and other aspects, construction noise affects residents' sleep, rest, study, work and other activities more importantly than activities such as talking with people and doing housework.

6 Control Measures for Construction Noise

Construction project among the four important links (earthwork, piling, design, installation) planning and implementation preparation is often not single, only managed by a project construction management unit, so means that the relevant departments must be strict, timely and comprehensive grasp of the city jurisdiction, within the new construction site and its construction approval status, such as individual, construction project management unit was found, because the project, environment and impact safety evaluation of approval documents, but start approval construction without authorization, to order them to fill, to the time limit to apply for fill to give corresponding punishment. After the construction investment unit has handled the examination

and approval documents for the evaluation and impact of environmental quality, it indicates that it must obtain the examination and approval permit at the same time, and the party can examine and approve the start of construction. But the situation is often that the construction unit can not timely pollution declaration in accordance with the local environmental laws and regulations. Then the market supervision and other departments should quickly intervene in the site at this time, and further understand and analyze the specific engineering situation of the site. If we do not investigate and grasp the actual progress of the project in time, the department will make the inspection of the main construction design unit of the project with a short division of labor period, and will withdraw immediately after the completion, and it will become difficult for the construction party to trace the party responsible for noise pollution. So enterprises in the environment and impact safety evaluation of the relevant approval document materials, must truly a "five timely" process, namely to apply, on time for examination and approval, check schedule, timely investigation, on time, make all kinds of construction project site environment and impact safety evaluation declaration management related work more standardized and convenient[1].

First of all, the most effective way to reduce the construction noise of construction land is to use low-noise mechanical equipment. In the field of construction and construction practice, the construction site also often widely used installed electric stir, mixer, excavator, crane, and mechanical power plant, machinery, and such mechanical equipment run a large number of machine, machinery noise, it is the current construction environment noise problem in the main threat. Noise and vibration will inevitably appear in the construction environment of the project, powerful methods should be adopted to reduce the noise and vibration, in order to minimize the adverse impact on the environment, choose advanced equipment, install silencers, at the same time, do a good job in the maintenance of construction equipment, reduce the interference of noise on residents' life. Monitor the nearby houses in time, and take corresponding safety measures for the possible impact. In the above measures, the improvement of the construction equipment can improve the noise pollution problem on the construction site from the root cause.

Secondly, we should increase the supervision force of the site. In order to avoid the construction unit illegal construction, to strengthen supervision and management, specific should be done to, the next three aspects of measures: one is in the construction site equipped with special supervision, supervision staff, special supervision of the construction in the construction link of noise pollution and other conditions. Second, adhere to the irregular, regular organization of road construction environmental noise and pollution emission detection. Complaints about noise pollution strongly reported by the public shall be dealt with in time. For some temporary no noise complaints of the construction enterprise site, but also must do irregular view. Third, we will continue to carry out a special crackdown on law enforcement. In view of people's complaints about the construction noise pollution situation, to carry out a special rectification. During the period of inspection and rectification of law enforcement, the supervision personnel should take turns to enforce the law on duty at night, and provide supervision report telephone to the people. After receiving the report, the super-

vision personnel should immediately go to the scene, and carry out rectification law enforcement inspection work.

Finally, to govern according to the law and regulations. The illegal construction sites should be dealt with through legislation, and the problem of urban construction noise pollution should be dealt with from the source.

7 Conclusion

In addition to the improvement of construction equipment can optimize the control of site noise, environmental supervision departments and construction administrative agencies should also be required to conduct supervision and supervision, strictly supervise the construction of scientific and reasonable and orderly organization, and regard the environmental construction as the top priority. Construction enterprises should attach great importance to the construction, as well as the serious management of the whole construction site produces serious vibration noise and environmental impact of the problem, the establishment of civilized and law-abiding construction enterprises of various rules and regulations, in order to achieve the standardization of the construction site behavior, and try to reduce the impact of noise pollution on the environmental quality of the site. But the most fundamental thing is to improve the construction machinery, so as to effectively solve the contradiction between urban construction and construction noise. In the future construction work, we must strengthen the consciousness, strengthen the management of all aspects, implement the responsibility, and fundamentally improve the construction site management level.

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