A study on environmental impact assessment of prefabricated building construction

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Abstract. In the process of urbanization in China, the environmental pollution in the construction industry has aroused people's concern. This paper discusses the relevant issues in the environmental impact assessment of the construction projects of characteristic small towns from the perspective of the impact of new buildings on the environment. This paper mainly analyzes the impact of the prefabricated construction method on the environment before and during the construction of the characteristic small town buildings from the three aspects of atmospheric environment, acoustic environment and solid waste. Through the analysis of practical cases, this paper discusses the environmental impact degree of the prefabricated building method in construction, so as to benefit decision makers.

1. Introduction
At present, China's rapid social, economic development and construction projects are emerging in an endless stream. However, in the construction period of the construction project and after the production and operation, there are environmental impact problems to varying degrees. Therefore, the environmental impact assessment of construction projects is of great significance for achieving environmental, economic and social sustainable development. The environmental impact assessment of construction projects mainly focuses on water environment, atmospheric environment, sound environment, soil environment, ecological environment and environmental risk. In this context, how to help construction projects better develop towards the direction of green, energy saving and environmental protection through environmental impact assessment and become the focus of people's attention. Taking the construction of characteristic small towns as an example, this paper explores the environmental impact factors in the environmental impact assessment of construction projects, so as to reduce the environmental impact of construction projects and achieve the goal of coordinated development of economy and ecological environment.

2. Literature research
The development activities of the project have gradually increased the disturbance and destruction of the ecological environment. Therefore, the impact of development projects on the living environment
has gradually received attention. The following is a literature study on environmental impact assessment, the impact of new projects on residents, and the way construction is constructed.

2.1. Environmental Impact Assessment

Environmental impact assessment is an evaluation system for estimating environmental pollution. Based on relevant data and actual environmental conditions, the development project or project construction plan is analyzed in detail to evaluate whether the implementation of these project plans will cause pollution to urban ecology and resource environment, and the severity of pollution is estimated. The evaluation of the development project by the environmental assessment system is an important reference for the project to be implemented. Its emergence has greatly promoted urban environmental protection and screened out many engineering projects that will cause significant harm to the urban environment.

2.2. Impact of construction projects on the living environment

The main contents of the environmental impact assessment of the construction project mainly include: the geographical location, topography, landform, soil and soil quality of the project; the water system and hydrological status of the area, the climate profile; the local environmental quality of water, sound, atmosphere and soil; the actual functional environment of the development area. The environmental impact assessment of construction projects is mainly carried out in accordance with environmental factors: water environment, acoustic environment, ecological environment and atmospheric environment. It is especially important to analyze the impact of the external environment on residence in the environmental impact assessment of construction projects. According to the statistics of residents' environmental complaints, the environmental factors affecting the quality of life of residents are atmospheric, noise and solid waste.

2.3. Construction method

2.3.1. Traditional reinforced concrete structure

For a long time, most of our buildings have adopted traditional cast-in-place reinforced concrete structures. This structure has played an important role in the past few decades. With the rapid development of the national economy, it has presented many shortcomings: waste of resources, environmental protection problems, hidden dangers and accidents, poor working environment of employees, high labor intensity, low degree of construction mechanization, and relatively low efficiency. These problems have plagued the development of China's construction industry, as well as advanced concepts that are contrary to green development. These problems in the development of construction industry, also goes against the green development concept.

2.4. Prefabricated building

Prefabricated concrete building refers to a kind of concrete structure building which is designed and constructed by means of on-site assembly and mainly consists of precast concrete components produced in factories. The construction components are mechanized in the prefabricated component factory, which can shorten the construction period, improve production efficiency and precision components. The appearance quality is very good, and the plastering process can be avoided during the decoration. There are few wet jobs on the construction site, and the construction waste is greatly reduced. Significant savings in formwork, scaffolding and support. Simple construction machinery, high degree of industrialization.

3. Research methods

This paper chooses the construction project of Xingjing town as an example, and analyzes the environmental quality of the three elements of atmosphere, noise and solid waste. Field investigation method and experimental investigation method are combined to summarize the evaluation obtained from
the above analysis. According to the actual situation of the project, the comparative method is used to analyze the environmental impact of the prefabricated building construction process.

- Site survey. Before the project construction and project construction phase field investigation to understand the surrounding environment, mainly including the construction process, operation records, environmental protection measures, the impact on the residents.
- Data collection. According to the construction process of the surrounding environment, the data of air, noise and solid waste at sensitive points around the area are measured. And data is collected through monitoring reports.

4. Research results

4.1. Research field
Xingjing Town is located in Xixia District, Yinchuan City, Ningxia Hui Autonomous Region. In 1983, residents of Xingjing Town moved from Jingyuan County in Ningxia to Yinchuan City. This project transform the existing towns and build houses for placement, tourist reception centers, day care centers, hospitals and supporting services along the streets within the land area of the original towns and villages. All buildings adopt green assembly construction. The construction period of this project is from May 2017 to April 2018, and the construction period is 11 months. The main pollution processes during the construction period are exhaust gas, noise, wastewater, solid waste generated during the construction of the structure.

4.2. Air quality
Environmental quality monitoring is carried out at the site of the proposed construction project, and the monitoring results are evaluated against the environmental quality standards of the monitoring factor.

4.2.1. Status survey.
The current monitoring items are PM10, PM2.5, SO2 and NO2. The specific monitoring data are shown in Table 1.

4.2.2. Environmental investigation during construction.
During the construction process, atmospheric pollutants mainly come from construction dust, and a large amount of dust is generated during the construction process, which has an impact on the surrounding atmospheric environment. The main pollution factor is TSP. When there is the wind, the total suspended particulate matter (TSP) in the ambient air of the construction site exceed the standard. The TSP emission source is 10-50mg/m³ and 0.3-0.5kg/h.

4.2.3. Comprehensive evaluation.
According to the above-mentioned current situation investigation and the value after investigation in the construction, according to Table 1, it can be seen that the degree of air pollution can be increased during construction. Therefore, it is necessary to increase pollution prevention facilities during construction to reduce the degree of air pollution caused by construction. The dominant wind direction of Yinchuan city is northeast wind throughout the year, and there is no environmentally sensitive target point under the dominant wind direction of this project. Therefore, dust during the construction period of the project is mainly the impact on the construction personnel.

| Table 1 | Table of atmospheric environmental quality monitoring results |
|---------|-------------------------------------------------------------|
| **Evaluation Items** | **SO₂ (ppb)** | **NO₂ (ppb)** | **PM₁₀** | **PM₂.₅** |
| Survey concentration before construction | 57 | 37 | 111 | 56 |
| Survey concentration during construction | 48 | 42 | 117 | 49 |
| Standard Value | 60 | 40 | 70 | 35 |
4.3. Acoustic environmental quality
The acoustic environment quality analysis is mainly based on the monitoring method, supplemented by the data method and the forecasting method. The influence of noise is usually local and attenuates obviously with the increase of distance. Therefore, when monitoring the site boundary of the proposed project, focus on the investigation of noise sources within 200m.

4.3.1. Status survey.
This evaluation monitor the sound environment quality before construction, and conducted around the factory boundary of the project from April 19 to 20, 2017. According to the current situation of the surrounding environment, a monitoring point is set up at 1m outside each factory boundary of the project area, with a total of 4 monitoring points. These are continuously monitored for 2 days, monitored twice a day, once every day and night.

4.3.2. Environmental investigation during construction.
This evaluation monitors the acoustic environment quality during the construction phase, and conducted around the factory boundary of the project from November 19 to 20, 2017. According to the current situation of the surrounding environment, a monitoring point is set up at 1m outside each factory boundary of the project area, with a total of 4 monitoring points. These are continuously monitored for 2 days, monitored twice a day, once every day and night. The evaluation standard is in accordance with 《The Class 2 District Standard of the Acoustic Environmental Quality Standard》 (GB3096-2008). The environmental noise monitoring results are shown in Table 2.

4.3.3. Comprehensive evaluation.
According to the above survey and the test values in the construction stage, it can be seen from table 2 that the noise and vibration caused by construction have a great impact. The noise during the construction period mainly comes from the demolition of buildings, civil engineering noise and transportation vehicle traffic noise. Therefore, special attention should be paid to its prevention and control measures during construction.

| Monitoring point | Monitoring value during construction | Monitoring value during construction | Evaluation results |
|------------------|------------------------------------|------------------------------------|--------------------|
| 1#               | 43.5 42.7 44.5 42.8               | 39.5 38.7 39.4 37.7               |
| 2#               | 44.1 43.2 43.1 43.9               | 39.5 40.1 39.5 40.2               |
| 3#               | 41.8 42.7 42.8 42.1               | 37.9 38.4 37.8 39.4               |
| 4#               | 43.5 42.8 41.5 42.5               | 39.8 38.1 36.8 35.1               |

4.4. Solid waste
4.4.1. Status survey.
The solid waste before construction is mainly the old building demolition waste. The amount of solid waste generated by the project construction is estimated according to the area. The construction area of the project is relatively flat. The demolition area of the building is about 263,310.15m², and the demolition of solid waste is calculated as 0.3m³/m², so the demolition amount of solid waste is 78993m³. If the utilization rate of demolition solid waste is calculated by 30%, the solid waste production volume of demolition and removal in this project is 55295m³. In summary, the amount of solid waste to be demolished in this project is 55,295 m³.
4.4.2. Environmental investigation during construction.
The solid waste during the construction period is mainly the construction waste generated by the construction project and the domestic garbage generated by the construction personnel. During the construction period, the amount of construction waste was 829t, and about 46.2t of household waste was generated during the construction period.

4.4.3. Comprehensive evaluation.
According to the current survey and the values after construction, according to Table 3, it can be seen that the pollution level is not large, because most of the wastes are properly handled. Waste pollution is mainly caused by construction, as long as there is a correct treatment will not cause great environmental pollution.

5. Research result

5.1. Air quality
According to the monitoring data, the monitoring values of pollutants PM$_{10}$ and PM$_{2.5}$ exceed the secondary standard requirements of 《The Ambient Air Quality Standard》 (GB3095-2012). The reason for exceeding the standard is relatively large wind sand in the area and high dust generated during construction.

5.2. Acoustic environmental quality
Noise measurements were carried out both before and during the construction of the project. According to the measured data, before the construction project, the daytime noise value of the project boundary is 41.8-43.5 dB(A), and the night-time noise value range is 37.9-40.1dB(A). During the construction of the project, the noise value of the project boundary is 41.5-44.5dB (A) and the night noise value range is 36.8-40.2dB (A). It can be seen that the noise values at daytime and at night before the construction project and the project construction meet the Class 2 standards of 《The Acoustic Environmental Quality Standard》 (GB3096-2008).

5.3. Solid waste
The solid wastes during the construction period of the project mainly include demolition, construction and domestic garbage. Demolition of garbage and construction waste transport to the municipal designated places for storage. After the garbage is collected centrally, it is transported by the sanitation department. Solid waste mainly affects the quality of the construction site and the surrounding landscape.

6. Conclusion
This paper takes the construction of characteristic towns with prefabricated construction technology as an example. According to the monitoring data before and during construction, this paper compares and analyzes the changes of local environmental quality before construction and during construction. Then, the environmental impact range during construction is judged by its difference. This approach facilitates decision making by environmental impact assessment reviewers or decision makers.

This case study shows that during construction, the most impactful projects are noise vibration, air pollution and waste. If the project is constructed, the monitoring data of a monitoring project will become smaller, and the environmental quality will improve year by year. This indicates that the construction of the construction project has a positive impact on the local environmental quality.

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