Opinion Article

Impact of Aqueduct on Environment and Countermeasures

Abstract: Nowadays, China's development is becoming increasingly comprehensive, and the connections between regions are becoming increasingly close. The demand for aqueduct construction is growing daily. In aqueduct construction, people are not only concerned about the quality of construction but are also increasingly focusing on the impact on the environment during the construction process. This article evaluates and prevents the environmental impact of aqueduct construction from various aspects during the construction process.

Key words: Aqueduct; ecological environment; development; hydraulic structures.

Introduction

Water structures, as important infrastructures for water conveyance, alter the hydraulic conditions and pollutant migration processes in channels, potentially affecting the environment[1]. This study investigates the impact of water structures on water quality changes in channels through sampling at typical water structures such as inverted siphons/ aqueducts and drainage gates. Over the past 30 years of reform and opening up, China's bridge construction has developed rapidly, with tens of thousands of various bridges and aqueducts being built across the country to meet demands, promoting regional economic, political, and cultural development[2]. The construction of bridges and aqueducts is a complex and challenging task, requiring engineers to design reasonable bridge and aqueduct structures according to local conditions, while construction workers must complete construction tasks within a short time and ensure construction quality. Bridges are an important manifestation of human resistance against nature, and in bridge construction, the impact on the surrounding environment has increasingly attracted the attention of people and construction workers[3]. Therefore, analyzing the environmental impact of bridge construction has a deeper significance, and the corresponding countermeasures also have guiding significance for environmental protection in bridge construction[4].

1.The impact of aqueduct construction on the ecological environment

In each construction phase of the aqueduct, the types of pollution are intermingled and complex. Aqueducts and other hydraulic structures have an impact on the distribution of PCODMn in water bodies, and this impact is related to hydrodynamic and seasonal factors. During the summer, the PCODMn at the outlet is significantly higher than at the inlet ($P<0.05$), while in spring and autumn, there is no significant impact ($P>0.05$); no significant impact was observed on other quality indicators. The sluice gate affects the pH distribution of the water body, and this impact is also

related to hydrodynamic and seasonal factors. In spring, the pH at the sluice gate is significantly higher than in the water conveyance channel ($P<0.05$), while in summer and autumn, there is no significant impact ($P>0.05$).

1.1 Impact on soil erosion

Because the construction of aqueducts is not completed overnight, construction workers need to find a place to live in order to carry out long-term work. Especially in the wild, where there are no other living places, construction teams will first find a suitable piece of land, and then use large machines to level the required site. This inevitably leads to the original ecological balance being trampled, potentially becoming barren; at the same time, most construction teams will build convenient transport roads for construction under the bridge and material transportation, which requires destroying many plants on the ground to make way for construction. Without the protection of plants, and with the trampling of construction personnel, the soil becomes loose and prone to dust.

Especially since we are in the northern semi-arid ecological fragile area, with low soil water-holding capacity, loose particles, and strong dependence of soil on vegetation, the ground exposure caused by construction gradually leads to desertification, soil salinization, and severe soil erosion, eventually forming natural disasters such as sandstorms, mudslides, and soil collapse. Moreover, the fertility of the soil is difficult to recover for a certain period, and the quality and productivity of the land decrease. At many sites where construction has taken place, excavated soil gullies and soil collapses are visible everywhere, construction roads still exist, construction waste and construction debris sway in the wind, like after a sweeping, and the surface vegetation gradually shows green only 2-3 years after completion.

Figure 1 The impact of aqueducts on soil erosion

1.2 Impact on acoustic and vibration environments

The aqueduct is divided into three parts: the foundation, the substructure, and the superstructure. During the construction process, different procedures and work areas are started simultaneously. If construction is taking place in a residential area, the constant flow of construction trucks, the rumbling of the rollers compacting the temporary roads, the excavators and loaders digging and expanding the foundation, the concrete mixing equipment and rebar cutting machines at the precast concrete hollow slab production site, and the mechanical noise from drilling and mixing concrete for the bored pile foundations at the Hunhe River back bridge and the Willow Forest bridge, can even interfere with the construction workers' normal sleep, conversation, work, and thinking. In severe cases, it may cause diseases in the nervous system, cardiovascular system, digestive system, and other parts of the body. The mixed strong noise also makes the livestock in the village restless,

with constant bleating, and the birds in the vicinity are almost unseen during the construction period[5].

1.3 Impact on the water environment

The lower part of the aqueduct construction is the pier construction. This needs to be carried out in the water. Construction workers need to use machines to complete the pier construction and pouring, which inevitably stirs up the bottom of the water body and destroys the ecological environment at the bottom[6]. It can even bring catastrophic disasters to the plants and animals in the water.

In addition, the production wastewater and waste materials during the construction process may also be discharged into local rivers and lakes, polluting the water environment. The domestic wastewater produced by construction workers, if not properly treated, can also pollute the water environment when discharged into nature. Some chemical waste discharged into the ground may even affect the groundwater, which in turn may affect the drinking water of local residents[7].

1.4 Impact on the atmospheric environment

The impact of aqueduct construction on the atmospheric environment is mainly reflected in the dust during the construction period and the exhaust gases produced by the operation of large construction machinery. Since the construction of bridges requires a large amount of cement and lime, and some also require stone materials, it is easy for dust to enter the atmosphere. At the same time, processing stone materials will also produce solid particles that enter the atmosphere, affecting the atmospheric ecology. The impact on the atmosphere is not directly reflected; the mobility of the atmosphere will lead to the transfer of pollutants, so the pollution of the atmosphere may be a widespread pollution.。

2.Countermeasures

2.1Protect the soil at the construction site

Regarding the phenomenon of land and soil damage at construction sites, it is actually not difficult to solve. First, the issue of exposed ground: when local vegetation has to be cleared, it is important to promptly cover the exposed ground to prevent soil erosion and protect the local soil. Secondly, on paths where construction personnel walk frequently, cement can be laid down to reduce damage to the local soil. After completion, these pavements can be removed and the fertilizer can be appropriately treated.

For harmful chemicals used during construction, proper treatment is necessary. Wastewater should also be stored appropriately and undergo detoxification treatment before being discharged to designated areas. Discharge must not be random; it must strictly follow process specifications to avoid polluting the land and harming the local ecological environment.

2.2 Noise and Vibration Control

Set up a water diversion barrier. This barrier is installed along the flume, dividing the water body horizontally, while some through holes are set up to facilitate the passage of water, thereby changing the lateral vibration characteristics of the water body in the flume, and thus reducing the seismic response of the flume. Although noise is inevitably produced during the construction process, the following measures should still be taken to control noise and mechanical vibration:

1) The noise at the construction site must not exceed the requirements of the national standard GB 12523—2011 "Noise Emission Standard for Construction Sites".

2) Real-time monitoring and control of noise at the construction site. The monitoring method

is carried out in accordance with the national standard GB 12524—1990 "Noise Measurement Method for Construction Sites".

3) Use low-noise, low-vibration tools, take sound insulation and vibration isolation measures to avoid or reduce construction noise and vibration.

2.3 Proper treatment of wastewater and efficient utilization of water resources

As our country's social economy continues to develop, the scale of water conservancy construction projects has significantly expanded. However, the construction of water conservancy projects can have a major impact on the natural environment, making it extremely important to properly manage construction waste. Specific discussions have been conducted on the treatment methods and processes for construction wastewater from aqueducts. Most of the water resources used during construction come from local groundwater. To ensure that construction can continue smoothly and without affecting the normal water supply of residents in the area, all construction units must make full use of water resources. For example, construction units should strengthen the inspection of water-using equipment to prevent leaks, which not only waste water resources but can also pose safety hazards to construction personnel. In addition, wastewater will be generated during construction, and it is necessary to properly dispose of this wastewater to reduce its impact on the surrounding environment[8]. For construction wastewater, there are generally two treatment options: first, consider whether it can be reused, and second, if reuse is not possible, arrange for appropriate discharge plans, and if necessary, treat the wastewater before discharging it. The wastewater treatment process typically involves: sedimentation → coagulation → precipitation. Coarse inorganic particles, sand, and soil particles in the wastewater have a high specific gravity and can be separated by natural sedimentation; finer particles and colloids require coagulation to form "flocs" and then settle and remove. The structures mainly include one sedimentation tank, one flocculation tank, one sedimentation tank, and one drying field.

Secondly, the use of concrete is indispensable in bridge construction, so it is very necessary to set up sedimentation basins next to the relevant concrete mixing facilities. This allows the wastewater to flow into the sedimentation tanks, and after the wastewater has been treated to meet discharge standards, it can be discharged again. For the treatment of domestic water, the method usually involves grease traps, and the treatment process must strictly adhere to wastewater treatment standards.

2.4.Dust control

In the construction of roads and bridges, the problem of dust is an issue that many experts find truly frustrating and seemingly impossible to completely solve. Although China possesses the most advanced bridge-building technology in the world, it still requires time to completely address this problem. However, we can reduce the harm of dust to the environment in various ways.

Dust is mostly produced during the construction period, especially when using concrete, where dust is particularly severe. We can build a water pool next to the concrete mixer to absorb a large amount of dust. Then, treat the wastewater before discharging it. For machines that produce a lot of dust, we can implement shielding measures, isolating the machines to reduce dust emissions.

3.Conclusion

The comparability and completeness of environmental monitoring are conducive to fully utilizing the supporting role of environmental monitoring in overall environmental protection, promoting environmental protection work to better serve social development and improve people's

living conditions[9]. Environmental monitoring is an important basis and support for environmental protection work, and the effective implementation of environmental monitoring work is the foundation for the smooth progress of environmental protection work. It can greatly reduce the workload of environmental protection and improve the efficiency and quality of environmental protection work. Fully recognizing the positive role that environmental monitoring work plays in environmental protection also promotes the better implementation of environmental monitoring work. Through the analysis and research in this article, it can be seen that continuously increasing financial investment in environmental monitoring work, enhancing personnel capabilities and technological innovation, improving the supervision and management system, and raising the awareness of all sectors of society towards environmental monitoring work have an extremely important role in promoting the value of environmental monitoring in environmental protection work[10-12]. Environmental protection work is already one of the primary tasks of the world today. It is hoped that the analysis and research of environmental monitoring work in this article can serve as a reference for environmental protection work[13].

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