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The important role of civilized construction - a case study of flood control measures in a bridge construction of Gansu province, China

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Abstract. The paper discussed the important role of civilized construction in the building market, and demonstrated the significance of setting up the civilized construction supervision service system. Civilized construction is the inevitable choice of construction market promoting civilized city construction. Good construction management and civilized construction could decrease the consumption of resources and materials, which is the important way to improve the enterprise competitiveness, the visible carrier of the enterprise culture. Therefore, we should insist on using the civilized constructing technology, making standard of the management of materials and devices, forming the civilized constructing teams, as well as developing the civilized construction supervision service system thoroughly. The green civilized construction involves many aspects of the sustainable development, including dematerializing production, recycling resource utilization, the cleaner production, minimizing the energy consumption as well as the protection of environment. It is significant to promote the construction of ecological civilization, to ensure the urban environment and to improve the image of the city.

1. Introduction
The environmental pollution and natural resources consumption in the construction markets have become increasingly serious, which has aroused great concern in the society. Safety, civilized management and green environmental protection have been put on the agenda during the construction process of the construction market [1]. In the past two decades, China has issued a series of guidelines, policies and standards to standardize the construction process, and strengthened project management and construction management, particularly focusing on safe and civilized construction. The influence and constraints of resources and the environment on economic development have become increasingly concerned, with the sustainable development becoming the theme of global development at the end of the last century. Various industries have gradually changed their production and management methods, adhered to the path of sustainable development, industrialization and mechanization are the main manifestations of construction methods in the modern society and construction market. The civilized construction of the construction markets will also become an important manifestation of modern and industrial construction. With the development of social economy, China's construction market and construction industry only emphasized the quality, safety and construction personnel health at the first
time, and now have increased energy-saving materials and environmental protection, from a single security perspective to safety, energy conservation and environmental protection, so as to minimize the environmental pollution caused by construction. This is the embodiment of modern and civilized construction concepts.

At present, it is unclear about the scope of civilized construction. These inadequacies and erroneous understandings have also led many companies to be unwilling to implement civilized construction, which makes it difficult to promote the civilized construction of the construction market and construction industry. Many cities, especially middle-sized and small cities, exist serious problems in construction management and construction process in middle and small-sized enterprises. The construction of a civilized system is not scientific enough and systematically perfect. At the same time, there is no government department and industry department that has specialized in civilized construction management in China. There is no corresponding incentive policy and no unified civilized construction standards. The impetus for enterprises to implement civilized construction is seriously insufficient [2].

Therefore, the objective of this paper is to analysis the development process of construction market and construction management, to reveal the role and significance of civilized construction in the construction market. The specific process of civilized construction and the significance of protecting the environment were discussed. At last, the controlling measures of the floods were proposed through a case study of bridge construction across Qifeng River by S305 Jiayuguan to Qifeng Highway Project in Gansu province, China.

2. Study area and materials
The S305 road is located in Jiayuguan. The starting point is located at the first pier of the Jiayuguan Great Wall, followed by the Great Wall Tourism Highway under construction, and the terminal is located in Wenshu Temple, a Tibetan township in Qifeng. One bridge is laid along the Qifeng River and crosses the Qifeng River. The length of th Qifeng Bridge is 166m with upper structure adopting 8×20m prestressed concrete continuous small box girder, and the lower structure adopting column pier. The bridge line is set up across the river, and the bank guard is set up up the upper and lower reaches of the bridge platform. Bridge flood control standards was designed according to the once-in-a-century flood frequency, the peak flow is 384 m$^3$/s, and the corresponding flood level is 1669.07 m.

The Qifeng River is a primary tributary of the Beidahe River (Figure 1). It originates from the Daqingsyang Mountain in the north of the Qilian Mountains. The source elevation is 3,520m and it flows through the Sunan from west to east. County Fengfeng Township folds to the north and enters Jiuquan City. It joins the Beidahe River. The length of the river above the entrance is 25.1km, and the average slope of the main stream is 68.3 inches. The catchment area is 385km$^2$. The Qifeng River is wide and is the front edge of the alluvial fan in front of the piedmont. It is in a “U” shape. The bank formation is exposed as a Quaternary full-relief redivual, alluvial sand, and gravel layer. Gravel roundness is better, sub-circular, poor sorting, loose no cement, the density of the stratum is slightly dense. The granularity of the gravel in the riverbed is fine and the amount of clay is large. There is no bad geological and special lithology in the bridge section, and the engineering geological conditions are simple. The riverbed of the bridge site is about 137m wide, and the river channel slope is 7.12‰. The Qifeng River of the engineering area is now accumulating a large amount of abandoned accumulation materials; the right bank of the river has wasteland, woodland, houses and cultivated land, and the left bank is wasteland and cultivated land. Lord, there are sporadic houses.

3. The importance role of civilized construction
3.1. The concept of civilized construction
From the macroscopical point of view, civilized construction refers to the maintenance of cleanliness and sanitation at the construction site and the implementation of reasonable construction procedures. It is the scientific organization of safe production in the construction process of the construction project,
and the standardized and standardized management site[3]. Various temporary construction facilities, raw materials, and structural parts are neat and orderly at the stacking sites.

From a microcosmic point of view, civilized construction is throughout the whole construction process. From the stage of project preparation, it is necessary to have the ideological preparation for civilized construction, optimize the processes and construction plans, ensure the reduction of consumption, and ensure the cleanliness of the site. In the implementation stage of construction, the safety standards and technical performance indicators of machinery and equipment shall be strictly implemented.

![Figure 1. The location of the Qifeng River Bridge and Beidahe River systems](image)

3.2. The Development Process of Civilization Construction

With the continuous improvement of the construction market, the research and development of foreign civilized construction is in the leading position. The concepts of scientific management, green building materials, green procurement, green building, standardized operation and civilized construction are proposed earlier. The concept of sustainable development first appeared in the *World Conservation Strategy*. The UK's economic strength is strong, and the construction market is developing rapidly, ranking among the best in the world [4]. The British construction market is large in scale and has a large number of constructions. The civilized construction management system and building safety regulations are complete. Even some of the EU regulations even directly became British laws, such as the *Work Health and Safety Management Regulations* related to safety in the “Six Regulations” of the European Community. The British government promulgated the *Construction (Design and Management) Regulations* in 1994. The Act requires the use of scientific and rigorous investigation methods to help construction personnel regulate the civilized construction. Overall, the development
of foreign civilization construction has the following characteristics: First of all, the development of civilized construction is getting faster and faster; the construction market management system and civilized construction system in developed countries are very sound; second, all levels of government departments attach great importance to civilized construction, and adopt economic incentive systems and policies by continuously expanding political work, gradually promoting the development of civilized construction in all aspects. At the same time, foreign governments attach great importance to the development of civilized construction technology, continuously integrate civilized construction technologies, and constantly improve the construction of a civilized construction technology system.

The concept of civilized construction was first introduced into China in the 1990s, and China has since entered a period of rapid development of civilized construction. In 2002, China promulgated the Safety Production Law of the People's Republic of China and clarified that it is necessary to strengthen safety production supervision and management and civilized construction management in project construction. In 1997, for the first time, Shanghai issued the Interim Provisions for the Administration of Construction Civilization Construction (1997 Revision), which clarified that the construction unit must carry out on-site inspection before the construction plan is determined and must be civilized. In October 2002, China promulgated the Environmental Impact Assessment Law of the People's Republic of China. In 2003, Beijing Municipality issued the Administrative Measures for the Construction of Beijing Municipal Construction Sites and Five Standards for the Construction of Civilized and Safe Construction Sites for the Construction of Beijing Municipality, clarifying that all enterprises and individuals engaged in construction projects in Beijing, including construction projects, must implement civilized construction standards. In 2004, the State issued the Environment and Sanitation Standards for Construction Sites on the requirements of civilized construction on the construction site, and made specific provisions on how to conduct environmental protection and how to conserve resources during construction of the construction site. In 2006, the Ministry of Housing and Urban-Rural Development began to propose that the construction process must reduce dust, strengthen environmental protection and governance, and reduce resource consumption. At the same time, the Chinese Construction Industry Association has organized large domestic construction companies to major construction projects such as Shanghai, Beijing and Shenzhen to visit and study, advocating construction companies to carry out civilized construction. In 2007, the Ministry of Housing and Urban-Rural Development organized a large-scale construction company to carry out surveys and studies of civilized construction, and released the Green Construction Guidelines at the end of the same year.

In 2010, the Ministry of Housing and Urban-Rural Development issued the Evaluation Criterion for Green Construction of Building Projects GB/T50604-2010, guiding the direction for construction companies to create green construction projects. In 2012, the Ministry of Housing and Urban-Rural Development Guidance on the Application and Acceptance of the Civilized Green Construction Demonstration Project in the National Construction Industry standardized the basic requirements for the civilized and green construction of the construction industry in China. The Regarding Strengthening the Management and Filing of Green Building Evaluation Representations was published in December 2012, which clearly requested the development of civilized green buildings and further standardize civilized construction management; the General Office of the State Council issued the Green Building Action Plan in January 2013, and the same year Building Construction Site Environment and Sanitation Standards upgraded and revised, with the introduction of the concept of civilized green construction into this standard for the first time. In 2014, the Ministry of Housing and Urban-Rural Development issued the Code for the Green Construction of Construction Projects GB/T50905-2014, setting forth clear standards for green construction on the construction site. However, there are many problems in China's civilized construction and site management [2].

Enterprises do not pay attention to the management of construction sites, resulting in insufficient funding for manpower management resources. A manager even performs duties in multiple positions and conducts on-site construction management. It will inevitably be overwhelming and unable to assume the responsibility requirements of each post.
Because China has not specified a sound incentive system to regulate civilized construction. There are many obstacles to the practical application of civilized construction. The national and construction industry companies still have insufficient understanding of concepts such as civilized construction. Civilization construction standards have not yet been implemented, and the corresponding incentive policies are not yet in place. There are some defects in the implementation of “four sections and one environmental protection” in the construction of various enterprises. It is believed that green construction is to sprinkle water at the site, harden the road, control dust, and beautify the site environment. Many construction companies believe that civilized construction is a complex, high-tech construction model, and that it is necessary to increase input in carrying out civilized and green construction.

3.3. The important role of civilized construction
Civilized construction is the only way to build a civilized city. People have higher standards for the environment with the rapid development of China's social economy. Building a civilized city is a landmark project for the construction of material civilization and spiritual civilization. Civilized construction is the inevitable choice and the only way for the construction market to promote the construction of a civilized city. With the tremendous development of productivity, global problems such as depletion of resources, pollution of the natural environment, aridity of desertification and haze are caused by the construction industry and industrial civilization. The creation of a national civilized city is an important way to improve the level of urban functions and social civilization, and to enhance the image of the city and to integrate competitiveness. A civilized city is a form of human civilization. It aims at ecological construction and the environment. To strive for a civilized city, we must take effective measures to do a good job in civilized construction and establish a new image in the construction market to create a window industry in a civilized city.

On the other hand, civilized construction is the driving force to enhance the level of enterprise management. If the enterprise wants to ensure the quality of the entire project and complete the efficiency, it must promote the civilized construction of employees. Good construction management can avoid all kinds of sudden dangerous accidents. Civilized construction at the same time can reduce the construction cost of the company and increase its economic efficiency. Strengthening construction management can guarantee the cleanliness, normalization and standardization of the construction site. In the process of management and construction, it can effectively ensure the life safety and property safety of employees. At the same time strengthening construction management can provide a safe production and living environment for construction workers. It can also fully stimulate their work enthusiasm, enhance the cohesion of employees, and access to the public's recognition[5]. The quality of construction personal image will directly affect the image of the entire construction company. Only by giving full play to individual talent can we create a civilized project and ensure the quality of the project. Therefore, it can be said that civilized construction is of great significance and is the fundamental guarantee for the quality and benefit of the enterprise's project. In combination with the construction of civilized cities, civilized construction, engineering management in strict accordance with the relevant legal basis of construction, can improve quality and protect the environment, and promote the healthy and sustainable development of ecological civilization. The civilized construction of the construction market runs through the entire construction process, promotes safe production through the management of various aspects of the quality of the construction site, and ultimately improves economic and social benefits.

3.4. The Significance of Green Construction
The Green Construction Guideline defines green construction as the prerequisite for ensuring construction safety and construction quality, and adopting reasonable management and reasonable advanced technologies to save as much natural resources as possible and reduce all impacts on the natural environment. The process achieves the "four sections and one environmental protection" effect, including construction energy saving, land saving, water saving, material saving and natural
environmental protection." The Green Olympic Building Evaluation System defines green construction as construction management techniques through an effective project management system to minimize the negative impact of construction activities on the environment, reduce natural resource consumption and energy consumption, and fully realize a sustainable development [6].

The standardization, civilization, and green construction of the construction market is a scientific management task and a comprehensive basic work in project management. It is very important for the project. Since the party’s 18th National Congress, General Secretary Xi Jinping pointed out that “Building an ecological civilization is related to people’s welfare, and in regard to the future of the nation.” General Secretary Xi’s important thesis profoundly explained the significance of advancing civilization’s green construction and ecological civilization construction.

Civilized green construction and traditional construction have different construction goals. The traditional construction refers to the construction enterprise with certain construction qualifications. Through certain management methods and technical measures, traditional construction is various construction production activities for completing the construction contract at the construction site of the construction project, combined with certain natural resources, strictly followed the construction drawings. After the reform and opening up, the market economy system was gradually established. Engineering construction was transformed from building product production to construction commodity production. Construction companies began to pursue the goal of maximizing economic benefits.

Construction companies must attach great importance to goals such as safety, civilization, and schedule. The key point of green construction is to realize “four sections and one environmental protection”. Green construction emphasizes the conservation of resources under the premise of environmental protection, rather than simply pursuing the maximization of economic benefits. In the long run, green construction will increase the overall benefits of the country or related regions. Civilization construction places more emphasis on the requirements of culture and management. Civilized green construction is a more in-depth requirement for protecting the environment, saving resources, reducing waste emissions, and improving operating conditions.

Sustainable construction strives to achieve the full life of the building. The efficient use of resources and environmental protection in the cycle includes the materialization phase and the building operation phase of construction products; while green construction is mainly oriented to the construction phase[7,8]. The construction process is composed of a series of processes (Figure 2). The
3.5. Environmental Protection Technology in Green Construction

Environmental protection technologies in green construction are including two main aspects: dust pollution control technology and noise isolation measures. Dust can cause air pollution. The source of dust during construction is shown in Table 1.

In the construction stage, Acoustic Environmental Quality Standard GB3096-2008 specifies the environmental noise limits of the Category 5 urban acoustic environment functional area. The construction site shall investigate the noise in the site and take reasonable noise reduction and noise control measures to control the site noise limits not exceed national standards and local regulations.

Noise isolation measures: Noise barriers can be installed around the operation surface of construction machinery to isolate noise sources within the barrier. The current technology can reduce noise by about 20dB. Take the necessary noise elimination, vibration isolation and vibration reduction measures for mechanical equipment, and do a good job in daily maintenance of mechanical equipment. If it is limited by the site conditions, it is not possible to cover the sound insulation room in a small area of construction, and a sound enclosure can be added to the construction machinery. For some construction processes where the site is relatively concentrated and the noise is relatively large, such as the processing of reinforcing steel bars and the machining of woodworking forms, the method of stamping soundproof rooms can be used to control the noise within a smaller range. Three sound curtains for sound insulation, dust protection, and security can be used to replace the construction safety net, which is now commonly used in the project, to enclose the noise source.

On-site management and control: Construction companies should also conduct self-discipline and civilized construction on construction noise to avoid disputes caused by construction noise. Controlling noise from time is mainly to reduce the adverse effects of noise. The muffler is the main equipment for preventing and controlling aerodynamic noise. It can reduce the noise by 10-30dB for construction machines that generate aerodynamic noise sources. Without affecting the construction situation, the noise equipment should not be arranged as much as possible, and it should be moved away from sensitive points such as residential houses.

| Table 1. Main dust sources during construction |
|-----------------------------------------------|
| Construction Stage | Construction Technology | Dust Pollution Source |
| Basic Engineering Construction | Pile Foundation Construction | Bored Pile Construction | Slurry in Pile Foundation Construction |
| Main Structure Construction | Cast-in-place part of main structure | Cast-in-situ concrete structure | Scattered and piled dust caused by concretes |
| Wall Construction | Ground construction | Parts Assembly Paste method |
| | Interior and exterior decoration | Assembly method |
| | Waterproof layer construction | Brushing method |
| | Decorative installation | Paste and polish by hand |
| | Construction of doors and windows | Dust pollution caused by dusty raw materials and paints |
4. Case study of civilized construction

4.1. Measures for Flood Control and Safety of Dyke
During the construction process, the water administration department, the river authority, and the local flood prevention department shall cooperate closely. Before the start of construction, it is necessary to compile a construction plan, report it to the competent department of rivers for review and approval, and to supervise the river authority and the local flood prevention department during the construction process. At the same time, the construction of the project was strictly followed in accordance with the established plan, and it was supervised by the local flood control department. After the completion of the project, the construction site will be cleaned up and the construction land will be restored to prevent the spoil and debris from entering the river channel and affecting flood discharge.

On both sides of the river section where the Qifeng Bridge is located, there are dike projects. The left and right abutments of the bridge will affect riverbanks and slope protection during construction. Measures should be taken to discuss and negotiate with the river authorities to propose reinforcement of the upstream and downstream embankments of the section where the bridge is located. With the approval of the competent department of rivers, the program will reinforce the embankments within a certain range of the upper and lower reaches of the bridge and eliminate the impact on the river embankments.

![Figure 3. The schematic diagram of flood control calculation results of river section where the bridge is located.](image)

In addition, the bridge management unit needs to regularly check the reinforcement project and find problems to solve in time to ensure the safety of dikes, bridges, and upstream and downstream.

The design flood of the proposed Qifeng Bridge is 1661.07m once in a century frequency. The height of the floodwater and the height of the waves are 0.30m and 0.089m, respectively. After the bridge is built, the flood level once in a century frequency is 1669.459m; however, the flood levee on the left bank of the Qifeng River floodplain is The elevation of the right bank embankment is 1670.40m and 1649.47m respectively (Figure 3). After the bridge is built, the elevation of the embankment on the left bank and the right bank is higher than the one-hundred-year flood level by
0.941m and 0.011m, respectively, and the flood will not flood the embankment. After the completion of the bridge, the calculation of flood protection and scouring is carried out. In the case of flooding once in 50 years, the structure of the flood protection embankment in this section is stable.

Measures for Remedial measures

4.2. Remedial Measures against the impact of flood control

The construction manager must report to the competent departments of the river for examination and approval, regarding the construction plan and the flood control plan during the construction period and the land situation within the scope of the management of the river course. After approval, the construction permit will be issued within the scope of the management of the river, and the construction unit can organize the construction. The project construction plan shall be submitted to the competent department of the river for examination and approval, and the opinions of the competent department of the river should be fully considered in the part of the construction plan concerning flood control and river management.

After the completion of the bridge, the clearance height between the bottom of the beam and the top of the embankment cannot meet the requirements for embankment traffic, flood prevention and rescue, management and maintenance. For important embankments, when bridges and embankments are crossed, the clearance height between the bottom of the bridge beam and the top of the design embankment shall not be less than 4.5m. Therefore, an anti-mite channel should be constructed on the back water side of the embankment. The emergency passage on the flood control levee can only be obliquely intersected with the bridge. At both intersections, the bridge is connected to the rescue passage of the flood levee on both sides, and a speed-reducing card is set up on both sides to ensure the smooth passage of the rescue vehicle. The maximum longitudinal slope of the upper embankment ramp is not more than 8%, and the angle of intersection with the embankment axis is not more than 30°; the embankment slope is not suitable for cutting the embankment, and the subgrade is padded to prevent weakening of the embankment section.

Civilized construction measures for impact on flood control during construction period should follow the following principles. Firstly, reasonably arrange the construction period, and the main river channel construction and arrangement will be carried out during the non-flood season. Secondly, formulate construction flood prevention plan, sign water and rain information transmission contract with local hydrology, meteorology, flood prevention and other departments, grasp upstream water condition information and real-time weather forecast, and ensure safe construction. It is necessary to implement the flood prevention plan, report it to the relevant management department for approval, conduct safety education for the construction personnel, and deploy full-time supervisors to prevent problems. Finally, in the event of major floods during the construction period, there must be an effective plan for the safe evacuation of construction personnel and equipment and the demolition of the cofferdam, so as to ensure the safety of flood protection on the river section.

5. Conclusion

The importance and role of civilized construction in the construction market were discussed. The quality management measures and technical measures of civilized construction were introduced. The main conclusions are as follows:

The development process of civilized construction in foreign developed countries is getting faster and faster. Foreign countries vigorously develop horizontally and civilized construction technologies. The safety production system and civilized construction management system of construction companies in China are still not perfect.

Civilized construction is an inevitable choice for the construction market to promote the construction of a civilized city. Good construction management and civilized construction can continuously reduce the consumption of various resource materials of enterprises, reduce the construction cost of enterprises, and create more economic benefits for enterprises. It is the
fundamental guarantee for the quality of enterprise projects, and it is also an important way for companies to improve their competitiveness, and it is also a tangible carrier of corporate culture.

Quality management measures for civilized construction include: insisting on the use of civilized construction techniques, highlighting nighttime civilized construction, standardizing materials and equipment management, and building a civilized construction team. It is imperative to build a civilized construction supervision service information system for the construction market.

Civilized green construction is a construction activity that maximizes resource conservation and reduces negative impacts on the environment during project construction. Civilized green construction needs to be effectively realized from both management and technology aspects. The guiding ideology and basic connotation of sustainable construction and green construction are consistent. The development of green construction, although not as extensive as sustainable construction, is in line with the institutional characteristics of China's construction industry at the current stage and has a stronger pertinence. Civilized green construction is of great significance to promoting the construction of ecological civilization, safeguarding the hard environment of the city, enhancing the overall image of the city, and promoting the virtuous circle of urban economy and environment.

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