

Integrity Design Strategy in Steel Structure Bridge Design

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Abstract: Nowadays, the scope of bridge construction projects in China is becoming wider, which promotes China's economic development to a large extent and also improves China's transportation system. Meanwhile, people also put forward new requirements for the quality of steel structure bridges. However, in actual design, due to the influence of many factors, some problems are inevitable, which will affect the integrity of the design. Therefore, the designer needs to fully grasp the possible design problems, and then take effective measures to improve the integrity of the design scheme, so as to ensure the quality of the steel structure bridge and improves the safety of the steel structure bridge from the fundamentals. This paper mainly focuses on steel structure bridges, analyzed the current status of steel structure bridge types and their selection, and proposes the integrity design strategy of steel structure bridges.

Keywords: Steel structure bridge; Integrity; Design

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1. Introduction

In recent years, the continuous development of China's transportation industry has provided people with convenience in transportation. However, this problem still exists in bridges at this stage. The more significant problem is vehicle overloading, which has certain impact on the safety of bridges. Once the load limit of highway bridges is exceeded, accidents are prone to occur. If a bridge collapses, it will not only cause casualties, but also result in major economic losses. Therefore, higher requirements have been put forward for the design of steel structure bridges, not only to ensure the integrity of the design scheme, but also to increase the load bearing capacity of bridges as much as possible to extend the service life of bridges, achieve better economic benefits from the steel structure bridges and accelerate the development of China's transportation industry.

2. The Current Status of Steel Structure Bridge Types

At this stage, simply supported bridges and continuous bridges has been widely used in China, while steel structure bridges and arch bridges have relatively few applications. There are often shortcomings in the design of steel structure bridges. The main changes are the following:

- (1) The problem of impurities. When designing a bridge structure, the selection of materials is very important. When non-metallic materials are used, there are more impurities in them.
- (2) Functional problems. When welding steel structures, if the metal crystallization is not handled properly, it will affect the function of the welded part to a large extent, and there will also be corresponding safety hazards.

- (3) Damage problems. In the construction of the project, if the welding worker's technical level is low, it is likely to cause welding damage and fatigue cracks.
- (4) Details issues. When designing the steel structure of the bridge, due to the complexity of the work, it is necessary to focus on the design of the detailed parts. Failure to consider all aspects will result in the safety hazards of the steel structure.
- (5) Environmental issues. Under the influence of environmental factors, the bridge structure will be affected by the external environment. If a serious environmental problem occurs, such as an earthquake, it will directly damage the steel structure of the bridge.

3. Selection of Steel Structure Bridge Types

Under many factors, the damage suffered by different bridge types is quite different. Therefore, when designing highway bridges, it is necessary to select the bridge type reasonably. The following aspects need to be taken notice of: First, Pay close attention to the stiffness and quality of the bridge; secondly, simply supported bridges should be given priority for faults, which can prevent bridges from collapsing; thirdly, arch bridges can be considered if the conditions on both sides of the bridge are more complex, as they have relatively large spans and strong resistance; fourth, on the basis of ensuring the effective connection between the upper and lower structure, the overall balance should also be ensured, and the selected bridge structure should have continuity; fifth, when the steel structure needs designing, the design method of the fuse-type unit needs to be reasonably applied; sixth, under special conditions, if a curved bridge is required, the rigidity of the overall structure should be increased as much as possible at this time, and the connection part and the lower part should be designed specifically .

4. The Integrity Design Strategy of Steel Structure Bridges

4.1. Horizontal Anti-overturning Design

When designing a steel structure bridge, as a designer, you need to fully consider the inclination of the bridge and focus on the anti-overturning design. Especially in the road section with dense vehicles, continuous improvement of the bridge design is required. In order to fully perform the horizontal anti-overturning design work, designers also need to conduct in-depth research on various tasks, conduct a comprehensive inspection of the site, collect relevant data, improve the accuracy of calculation of related parameters, and avoid design errors, which can also render the steel structure bridge with better load bearing capacity and prevent damage to the bridge structure caused by the influence of the layout force. In addition, it is also necessary to reasonably design the stability of the bridge, and the method of sand and gravel filling can be used to improve the force balance.

4.2. Design of welding structure

When designing steel structure bridges, it is necessary to focus on the welded structure in order to ensure the integrity of the design. Due to the continuous development of steel structure, it has been highly valued in the construction industry. In the actual design, it is necessary to pay attention to the structural integrity, and it is also necessary to select compatible materials and technology. According to the actual situation, if the steel structure bridge is damaged, the severity of the damage will continue to expand over time, which will affect the overall safety of the structure. Therefore, the designer must get hold of the details and solve the problem of damage effectively by choosing suitable materials, optimizing the construction process, and fundamentally ensure the integrity of the welded structure. Generally speaking, you can pay attention to the following points: First, it is necessary to ensure the matching of performance in the base materials and welding materials. Second, in the process of welding steel structures, it is necessary to analyze all aspects

of influencing factors. Operators need to focus on the material quality and also need to fulfill the design requirements of the welded structure. Third, strict requirements are put forward for welding quality to ensure that the quality of steel structure bridges can meet the relevant standards and specifications. Welders need to master advanced welding processes to avoid material waste and ensure the overall quality of the bridge structure.

4.3. Stiffening Rib Design

Stiffening ribs refer to a kind of reinforcing item, which can be used in the design of steel structure bridges to improve the stability of components. Generally, U-shaped and plate ribs can be used. In the design of steel structure bridges, stiffening ribs play an important role and designers need to pay close attention to them. Choose suitable stiffening ribs according to the actual conditions of the strip, and also need to accurately calculate relevant data to maximize the accuracy of the data. This allows the design content to be reasonably optimized, thereby ensuring the integrity of the overall design. In addition, when carrying out the designing work, it is also necessary to accurately calculate the internal force of the steel structure bridge. Not only must the appropriate calculation method be applied, but the bridge must also be detailed, divided into several units, and design layer by layer according to the serial number to ensure the integrity of the design.

4.4. Construction Manhole Design

When designing steel structure bridges, it is necessary to get the designing of the manhole construction right, which can provide a good basis for subsequent construction and provide more convenience for construction personnel. As a designer, you need to set the size of the holes on the bridge reasonably to ensure that each hole is allocated at a suitable position. You also need to proofread the manholes design as it is forbidden to have multiple manholes on the same plane, and the arrangement must be staggered. According to past experience, when designing a manhole, it needs to be allocated at a position with a span of 1.5 meters, and it must be allocated at a position with less stress. By reasonably controlling the number and location of manholes, it is helpful to improve the integrity of the steel structure design.

4.5. Anti-corrosion Design

Anti-corrosion design is an important task in steel structure bridges, which directly affects the subsequent use and safety of steel structure bridges. In terms of safety work, it is necessary to get hold of the details. The designer needs to deal with the details of the welded structure and also get the anti-corrosion design right, so that the steel structure bridge can have better anti-corrosion ability, which can extend the service life of the steel structure bridge and realize the economic benefits of bridge projects. When carrying out anti-corrosion design, it is necessary to carry out specific analysis for the environment of the bridge project, select physical or chemical methods for anti-corrosion operations according to the actual situation, and choose suitable anti-corrosion coatings so that steel structure materials can be effectively insulated from air and water, *etc.* to prevent the overall performance of the steel structure from being affected, which not only improves the safety of the bridge structure, but also provided a basis for the service life of the steel structure bridge.

5. Conclusion

In conclusion, with the continuous progress of the times, steel structure bridges have been extensively constructed. For steel structure bridges, in order to achieve economic benefits and promote the development of China's transportation industry, it is necessary to do a good job in design and ensure the integrity of the design, so as to improve the performance of the bridges. When designing steel structure bridges, designers

need to clearly define the design goals. Under the premise of ensuring the service life of the bridge, they also need to increase the load bearing capacity of the bridge as much as possible by selecting suitable materials and optimizing construction technology, *etc.* After analyzing the current status of the steel structure bridge, take effective remedial measures and select a suitable bridge type according to the actual situation of the construction site. These can lay the foundation for the design integrity of the steel structure bridge, so that the construction goal of steel structure bridge can be accomplished efficiently.

Disclosure statement

The author declares no conflict of interest.

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