Research on Construction Quality Management of Prestress Technology in Road and Bridge Construction

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Abstract: Prestressed construction technology has greatly developed in recent years, and related supporting facilities are constantly being improved. Therefore, prestressed construction technology has been widely used in roads and bridges, which has improved the efficiency of highway bridge construction and the overall construction quality. However, there are still some problems in the application of prestressed construction technology in roads and bridges. Only by controlling quality can the application effect of prestressed construction technology in roads and bridges be guaranteed.

1 Advantages of prestressed technology construction in road and bridge construction

As far as pre-stress technology is concerned, it can be divided into two types: pre-tensioned pre-stress construction technology and post-tensioned pre-stress construction technology. Compared with ordinary concrete, prestressed concrete has the absolute advantages. In details, prestressed concrete can ensure the quality of the project while reducing the use of materials, and it can effectively control the distance between piers while improving the stability and durability of structure. In addition, prestressed concrete is also an important guarantee for the implementation of large-scale component assembly construction, so that the structure is more systematic and integrated. The advantages of prestressing technology in road and bridge construction are mainly reflected in the following points: First, its fatigue resistance and seismic resistance can be significantly improved whether it is a bridge component or the bridge as a whole, extending the service life of road bridges; Second, the stress technology can significantly increase the internal force of the concrete, which also improves the Young's modulus of the structure; finally, the stiffness of the bridge is significantly improved than before, which not only prevents the occurrence of deformation, but also relieves the pressure of the bearing structure.

2 Problems in the process of prestress construction

Prestressing has complex procedures and strict requirements in the construction process, so corresponding strategies need to be made in all aspects of construction. Common prestress construction techniques

mainly include the following.

2.1. Blockage of steel pipes

Since most of the current construction workers in China are migrant workers, their work process is of poor accuracy, and they lack the overall awareness of bridge construction. In the actual construction with concrete, the construction workers did not protect the steel pipes, but poured them without caution, making the waste slag easy to enter the steel pipes that are easy to be blocked, which may not cause the steel bars to pass smoothly or to withstand the pressure of passing through. The occurrence of either situation will seriously affect the tensioning effect of the prestress, leading to actual length of the steel strand to be inconsistent with the design length. It will not only make it difficult to guarantee the quality of the bridge, but also easily causes accident of fracture because of excessive tension on the steel strand. If the standard position and size operation is not carried out in accordance with the drawings during the construction process, it is very likely to cause the distortion and deformation of the steel pipe. In addition, if the pipe is pulled out too early, it may be deformed because the concrete has not reached a certain strength. If the pipe is pulled too late, it may be difficult to pull the pipe, or even damage the steel pipe during the process.

2.2. Tension technology in multi-span bridges

When connecting it with box girder, prestressing technology of multi-span bridge is currently often accompanied by one-sided stretching technology. Multi-span connecting road bridges are generally between 3 to 5 spans, and the distance is between 30-50m. For multi-span bridges, prestressed steel bars need to pass through multiple box girder diaphragms. The steel strand needs to pass through multiple holes,

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and some of these holes will be twisted and deformed, causing excessive friction which has a certain degree of randomness. And it needs to be tested and measured before it can be finally determined. In international construction convention, once spans are multiple or exceeding 30m, both sides need to be tensioned at the same time in the use of prestressing, so that a large enough resisting bending moment can be formed in the bridge body. If only one end is stretched, it may cause cracks in the concrete structure due to uneven force. The coagulation cracks caused by this situation are commonly seen in China.

2.3. Cracks caused by the characteristics of concrete

Some concrete may cause cracks due to later curing or drying shrinkage, temperature difference and other reasons. Some cracks have appeared before the prestressing, which makes the anti-cracking effect of the prestressing unable to be realized. It may be due to the shortening of the initial setting period and hardening period of the concrete, which caused the concrete to crack in advance, or it may be deformed due to the long-term prestressing action. Although the use of a certain amount of additives in the early stage of concrete can have better performance, the effects of additives require experiments in the real place. If the experimental data is not accurate, it will not only fail to prevent cracking, but will also affect the quality of the project to a certain extent.

3 Analysis of key points of prestress construction

Concrete is an indispensable structure in the process of road bridge construction, and the quality of concrete is related to the firmness of the road bridge. The application of prestressed construction technology can give the concrete tougher strength and bearing capacity, which strengthens the road and bridge.

3.1. Focusing on steel selection

In the prestressed construction process, whether the steel selection is reasonable and whether it has been scientifically applied has a key impact on the entire construction process. At present, low-tension steel strands are commonly used in the pre-stressed construction process. It has also been widely used in the process of bridge construction due to the characteristics of good look, convenience and stable. At the same time, the amount of low-tension steel strand material is only about 60% of that of ordinary steel. However, it is worth mentioning that we must always consider its application range and scenarios to ensure the consistency of the material and the application range when selecting low-tension steel strands.

3.2. Selection of anchor

To put it simple, the anchor is the tool used for anchoring, and it is also an indispensable type of tool in the prestress construction process. It can connect prestressed steel bars and interiors of concrete by the use of anchor, so anchors are also a commonly used tool for connection. As for the anchor plate, the angle is usually fixed, which not only improves the accuracy of its curvature, but also have the characteristics that it is smooth and easy-to-move after carefully polishing its various parts. When using anchors, you need to pay attention to the reasonable arrangement of anchors and anchoring positions to prevent the steel strands from being compressed.

4 Quality control in prestress construction

Controlling the quality of prestress technology construction plays a key role in ensuring the construction quality of the entire project. It can not only avoid the increase of costs and economic losses due to rework of the project, but also effectively avoid a series of disputes caused by the delay of the construction period. The following mainly explores the construction quality management of prestressing technology in road and bridge construction.

4.1. Quality control at the first period

Reinforcement embedded engineering is a crucial part of prestress construction technology, and it needs to be carried out based on the embedded engineering of steel reinforcement when positioning the elevation of each control point of bridge or road. Therefore, the curve of pre-embedded steel bars should be highly valued and grasped during prestress construction. For the construction workers, apart from precise positioning of various elevations, the improvement of the stability and accuracy of the positioning points should be treated as a key task, and the problems in the process of pre-embedding of steel bars should be run through other procedures and links. Consider and solve them. In addition, the necessary protection should be given to the prestressed steel corrugated casing.

4.2. Quality control in tension and grouting

The tensioning and grouting phases need to give reasonable control over the stretching and tensioning capacity and specifications of the steel bars to ensure that their specifications meet the relevant standards for usage. The best time for stretching and tensioning should be chosen. Some roads and bridges are apply of early-strength agents to increase the strength of concrete. Construction of stretching and tensioning can be implemented after using the early-strength agents for three days, but it cannot guarantee the quality of tensioning and stretching, so the workers need to follow the construction conditions to carry out pre-tensioning

treatment to avoid loss of a large load of pre-stress, otherwise cracks may occur. In order to ensure the saturation of the slurry in the hole, the quantity of grouting must be reasonably considered according to the actual situation. After the grouting work is completed, corresponding inspections and tests are also necessary.

4.3. Preventing blockage of tunnels and protecting prestressed steel

During the construction of the project, the tunnels and connections must be blocked, which is also an effective measure to prevent unknown materials from entering the tunnels and blocking them. Whether installing steel bars or welding common steel bars, always protect the pre-stressed steel bars to avoid damage. If deformation or blockage of the tunnel is found during the construction process, it should be solved in time. If the due attention is not given to it, the force of the prestressed steel bar will also be weakened.

4.4. Effective control of water consumption during construction

Water consumption is also a key factor to be considered during the construction of the project. Therefore, in order to ensure the quality of the project, it is necessary to realize the reasonable allocation of water after making sure of relevant proportions of water. If the fluidity of concrete is not strong and shows a downward trend, then it is not advisable to directly add water to ensure its fluidity. For the mixer, it is very important to ensure its cleanliness. If its cleanliness cannot be guaranteed, there will be other material residues in it, and the strength and stability of building materials and the overall quality of the construction project will also be directly affected.

4.5. Strengthening the control of the construction process

In the prestress construction process, the process also plays an important role. The process determines whether the goal can be achieved smoothly. In view of this, the construction unit must strictly refer to the procedures specified in the design drawings for construction, and carry out corresponding quality inspections after the completion of each procedure, and make it as the basis and premise of the next procedure. Taking the construction of a large-span prestressed bridge as an example, due to the high complexity of the construction process of the steel skeleton stress, the safety of the bridge cannot be guaranteed if the construction workers can't strictly follow the construction drawings or design.

4.6. Paying attention to the control of prestressed tendon breakage

Since cement and oil stains often adhere to the tendons during the construction process, the probability of corrosion will increase greatly. At this time, the strength

of the steel bar will also be affected. Not only will the prestressing effect be restricted, but even catastrophic accidents will occur. Therefore, in order to control the quality of the prestressed technology construction, it is necessary to give certain protection to the prestressed tendons. After the construction is completed, the cement or oil stains attached to it must be cleaned in time to avoid broken wires. In addition, we must pay attention to the rust daily prevention of metal to delay its oxidation rate.

5 Conclusion

Prestress technology is widely used in all aspects of bridge and road construction to ensure the quality and strength of bridge and road construction and increase the bearing capacity of bridges and roads. Therefore, the application of prestress technology has an important impact on project quality. At the same time, the quality of materials and construction technology is the foundation of the quality of the entire project. Only by ensuring the quality of materials and construction technology can the quality of the entire project be better guaranteed.

References

1. Tang Junhao. Analysis of the construction quality management of prestress technology in road and bridge construction[J]. Doors and Windows, 2018(01):182.
2. Cao Kun. Analysis of the construction quality management of prestressing technology in road and bridge construction[J]. Juye, 2017(07): 111+113.
3. Dang Xiangdong. Analysis of the construction quality management of prestressing technology in road and bridge construction[J]. Sichuan Cement, 2016(01):234.