

The Application Research of Prestressing Technology in Road and Bridge Construction

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Abstract: Pre-Stress Mainly Refers to the Fact That a Certain Load Will Be Applied Before the Construction Member. Before Receiving Such a Load, a Force in the Opposite Direction of the Load Must Be Applied to Eliminate the Load. Because This Force Can Eliminate the Load and Improve the Component Durability and Its Crack Resistance, Increase the Strength of the Component and Its Stiffness. after Applying Prestress, It Can Be Seen That It Will Significantly Improve the Elasticity of the Component and Reduce Its Deformation Problems. Because There Will Be Some Key Load-Bearing Positions during Bridge Construction, Prestressing Must Be Applied, Which Can Not Only Reduce the Weight of the Bridge Itself, But Also Save Economic Costs and Reduce the Weight of Steel and Concrete. in Addition, Because Bridges Are Affected by External Factors, Problems Such as Cracking and Water Seepage Can Occur, and Prestressing Technology Can Play a Certain Preventive Role to Reduce the Occurrence of These Problems.

1. Introduction

In Current Bridge and Road Construction, the Application of Road and Bridge Construction Technology Often Results in Various Types of Different Quality and Characteristics Due to Different Related Technical Applications and Different Choices of Various Processes. the Types of Roads and Bridges Are Created to Meet the Needs of Different Bridges and Roads. for This Reason, When We Explore the Relevant Technical Points and Control Measures for Roads and Bridges, We Need to Be Able to Target Different Construction Technologies and Different Related Bridge and Road Construction Projects, as Well as Different Road and Bridge Construction Points for Different Bridge and Road Construction Projects, Conduct Diverse and Multi-Directional Discussions in Order to Better Grasp the Relevant Control Points. the Prestressing Technology Has Not Been Applied for a Long Time in the Construction of Related Roads and Bridges in China, the Related Technology is Relatively Imperfect, and Its Technology Development System is Not Complete, Which is Also an Important Research Direction for the Current Development of Road and Bridge Technology Applications [1].

2. Basic Overview Analysis of Prestressing Technology

The starting point of the application of prestressing technology can be traced back to the 1950s, and it was only used in construction projects at first, and it was not applied to road and bridge engineering until the 1980s. The prestressing points used in the road and bridge project refer to the prestressing technology used in concrete engineering to ensure that the concrete can generate prestressing in the corresponding structure and reduce or eliminate the tensile stress caused by external loads. By applying the prestressing technology reasonably to road construction, a steady improvement in construction quality can be guaranteed [1].

2.1 Have Good Use Functions

In the scientific application of prestressing technology, in order to ensure the best results, the building materials used should have high quality, thereby reducing the amount of materials used, ensuring that the structural section is appropriately reduced, and the height of the bridge construction

can be reduced. In today's increasingly tight land resources, the scientific application of prestressing technology can effectively reduce the height of overpasses, and at the same time can reasonably reduce the length of approach roads, and effectively save land resources. From the above, it can be known that the reasonable application of this technology can also appropriately reduce the weight of the bridge itself and reduce the possibility of concrete cracks [2]. The gradual reduction of the bridge height also makes the building structure show a benign change, and the appearance quality of the bridge also shows a gradual change.

2.2 Analysis of the Force of the Bridge Itself Before Prestress Construction

In general, in the actual design of highway bridges, while fully analyzing the use functions of the bridge itself, it should also focus on planning urban issues and clarify the laying of underground pipelines. The design of the bridge construction structure should start from many aspects, especially under the situation that the bridge construction has become more difficult at this stage. The design of the load-bearing structure of the bridge structure should fully meet the occupied space while improving the capacity of the bridge itself. In the specific design, a relatively scientific and reasonable layout should also be implemented [2]. The use of prestressing technology has shaped a more complex force system for the bridge structure, which has steadily improved the force capacity of the bridge itself.

2.3 Durability of Bridges

Bridge durability is a relatively important aspect, which mainly refers to its service life, because the reasonable application of prestressing technology ensures that bridge materials are selected from high-quality steel and concrete. Such construction materials can steadily improve the resistance of building problems [1]. Cracking and strengthening its anti-seepage properties can effectively improve the construction quality of concrete projects, reduce the probability of cracks, ensure that bridges are not corroded by water and alkali, and greatly help extend its basic service life.

3. Application of Prestressing Technology in Road and Bridge Construction

3.1 Application of Prestress in Road and Bridge Deck Construction

The main principle of applying prestressing technology in the construction of road and bridge deck is to make full use of the restraining effect of the prestressing tendons to constrain the concrete pavement. In this way, it can effectively avoid the occurrence of pavement cracks in a certain period of time and extend the road and bridge. In specific applications, first of all, a detailed survey of the construction site of the road and bridge deck construction must be carried out, and the temperature and humidity and load requirements required for the construction should be accurately grasped. This will lay the foundation for the scientific application of the prestressing technology and will help the quality of the bridge deck construction quality [3]. In specific applications, different prestressed construction techniques should be selected according to different types of pavement. In general, for a separate pavement, the expansion joint gap is large, so at this time, the pavement must be separated before the prestressed construction, and then the prestressed tendons are used to treat it. In the prestressed concrete construction, the construction personnel must adapt to local conditions, the road and bridge conditions are different, and the prestressed construction technology methods used are different [3]. Under normal circumstances, the relatively simple operation method is to first place the concrete and then pre-tension the steel bars. This method is simple and can also ensure the quality of the road and bridge.

3.2 Application of Prestress in Concrete Structure

Due to the influence of construction technology and various factors, currently, when building roads and bridges, steel bars and concrete components often suffer from loosening and cracking. This has a great impact on the normal and safe passage of roads and directly threatens people. The safety of travel is getting more and more attention. The application of prestressing technology in reinforced concrete structures can effectively prevent cracks in the structure or components [4]. In actual

construction, the first step that needs to be done is to eliminate the pre-stress existing in the concrete in the tension zone, so that the occurrence of cracks can be effectively controlled fundamentally.

3.3 Application of Prestress in Grouting Construction

Carefully check whether the relevant data in the display box jumps, and whether the number of the beam in the upper right corner is correct, and whether there is an error in the pipe connection. After confirming the error, start the “beam hole squeeze water” button in the interface, start the solenoid valve, and remind the beam plate Construction workers on both sides pay attention to safety. During the grouting process, closely observe whether the flow value and pressure value on the notebook computer are in a normal state [4]. Once an abnormality occurs, stop the grouting immediately and continue the operation after the inspection is qualified. Before the next grouting operation begins, the operator needs to carefully check whether the connection of the instrument to the line is normal. After the completion of the primary grouting, butt into the pulp and return pulp pipes, and then click the “cleaning equipment” button on the interface to complete the pipeline flushing. The flushing should be selected at a high flow and low pressure level until the fresh water flows out.

3.4 Application of Prestressed Construction Technology in Bending Members

The application of prestressed construction technology to bending members is one of the main links in the construction of roads and bridges. Because bending members are prone to bending, it may have a certain destructive effect on the stability of road and bridge concrete structures. In this case, The reasonable application of prestressed construction technology is particularly important, not only can fully guarantee the construction quality level of road and bridge engineering, but also can extend the service life of the bending members to the maximum, and then provide a good guarantee for people's travel safety [5]. Relevant investigations show that the current road and bridge construction is applying prestressed construction technology to bending members, mainly by attaching carbon fiber materials to it, which can effectively control and control the bending members, and promote further improvement of stability. In addition, external prestressing technology can also be applied to the bending members. This method is generally applicable to large road and bridge structures. By means of severe dispersion of the force, the bridge building is brought to a stable state, which specifically means that all road and bridge buildings are properly stressed. Assigned to other auxiliary building structures, it is convenient to comprehensively improve the stability of the main body of the bridge, and its application in large bridge structures can also adopt steel cables to centrally disperse the force of the main body of the bridge, which can not only greatly improve the aesthetics of the road bridge structure, and can achieve the best results of bridge structure stability [5].

3.5 Application of Prestressing Technology in Box Girder Steel Strand

In the construction of roads and bridges, the prestressed construction of the box girder strands is an important part of the construction of the shear frame. The selection of the strands should be carried out in strict accordance with the design requirements of the drawings. The determination of the tensile order of the box girder strands depends on the situation, so as not to affect the quality of the entire bridge construction. First of all, we must pay attention to the order of tensioning the strands during the prestressing tensioning process. Generally, the web is taken from the bottom to the top, and the remaining part of the beam is pretensioned and stretched to the end. During the construction process, the construction environment must be strictly controlled [6]. The construction environment is a major factor influencing construction quality.

3.6 Application of Prestressing Technology in Cantilever Hanging Basket Construction

In the construction of cantilever bridge deck structure, prestressed construction is the main way to connect the forces on the bridge deck. Temporary consolidation is performed after the No. 0 block is poured on the bridge pier, and a cantilever hanging basket is installed for preloading. Then the mold is supported on the hanging basket to check the axis position and top elevation, and the No. 1 block is symmetrically poured on both sides [7]. After the two No. 1 blocks are placed, the prestressed tendons are penetrated from the outside and prestressed tensioned to tightly connect the three bridge

deck structures of No. 1 block and No. 0 block. After the prestressed tensioning is completed, the anchor is sealed and the prestressed tunnel concrete is poured. The prestressed tendons wrapped by concrete can effectively resist corrosion, extend the service life, and have the characteristics of long-term stability of the stress structure. During construction, the quality of anchorage, prestressed tendons, prestressed tension procedures, and quality of anchoring concrete should be strictly controlled. Only after the tunnel concrete is cured until the compressive strength of the concrete test block is greater than 80% of the design strength, can the construction of the next process be carried out. Prestressed tensioning shall prepare a special prestressed construction plan, and construction shall be carried out after the project technical person in charge and the supervision engineer review and approve [6]. The tension of the prestressed tendons should be symmetrical and balanced. If the prestressing tendons are in the same plane, they should be alternated from both sides. The space should be symmetrical from the periphery to the middle, alternately and sequentially.

3.7 Application of Prestressing Technology in Reinforcement Engineering

Prestressing technology can strengthen the bridge by improving the bearing capacity of the bridge. It mainly uses component reinforcement and structural performance to effectively ensure the construction quality of bridge engineering, while improving the strength and performance of components, extending the useful life of bridges and meeting the needs of transportation. The application of prestressing technology in the reinforcement engineering, the usual strengthening treatment methods include: strengthening the prestress outside the bridge, reinforcing layer on the bridge deck, changing the structure system of the bridge deck, etc. apply to the actual situation. Bridge deck reinforcement and reinforcement methods, bridge external prestressing reinforcement and sticking steel plate reinforcement methods are used to facilitate the reinforcement control and achieve the effect of increasing the ultimate bearing capacity of the component [7].

4. Matters Needing Attention When Applying Prestressing Technology

4.1 Precautions When Designing Prestressed Structures

Before proceeding with the construction, scientific arrangements should be made for the construction schedule and the construction plan should be improved. In the design of prestressing, to ensure the aesthetics of the structure used, the bearing capacity of the concrete in the structure and the tensile force of the prestressed tendons must be strictly controlled, and the tensile force cannot exceed the bearing capacity of the concrete [8].

4.2 Matters Needing Attention in Prestressed Construction Management

In the construction of roads and bridges, the supervision and management of the construction process must be strengthened, and the quality of building materials must be strictly controlled to meet national quality standards and meet construction requirements [4]. Establish a supervision team at the construction site to direct the site and keep the construction site organized. In the prestressed operation, the engineering materials should be carefully inspected and the unqualified materials should be replaced, and the technicians should be systematically trained to increase their sense of responsibility and operation so that they can perform accurate operations and prevent Project quality problems and economic losses caused by objective factors.

4.3 Precautions during Prestressed Construction

In the prestressed construction of roads and bridges, a scientific and reasonable ratio of cement slurry must be made to meet the engineering requirements, and the tunnels must be kept clean [8]. During the grouting, the speed of grouting should be controlled and kept at a slow and even speed. After the construction is completed, it is carefully inspected to ensure the construction quality.

5. Summary

In summary, in the construction of roads and bridges, prestressing technology has a very critical application, which can enhance the stability of the bridge, extend the life of the road and bridge, make the construction of the road and bridge smoother, and achieve greater economic benefits and society. In the actual construction process, the problems of the bedding surface, the deformation of the anchor plate concrete, and the blockage of the concrete reinforced pipelines have caused a certain degree of impact on the normal construction of the road and bridge. It is necessary to choose the appropriate prestressed construction technology in accordance with the actual situation and continuously improve the construction quality of roads and bridges, promote the smooth development of the transportation industry, and make a positive and useful contribution to the development of the national economy and people's livelihood.

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