Construction Control of Long-span Prestressed Concrete Continuous Steel Frame Bridge Based on Grey Prediction

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Abstract: Prestressed concrete continuous steel bridge is widely used in different road structures because of its unique advantages such as economical cost, simple structure, comforTable driving and simple construction. The construction control of long-span prestressed concrete continuous steel frame bridge has become the main link of bridge construction. Therefore, in order to ensure the smooth construction of related bridge projects and meet the corresponding design requirements, it is necessary to strictly implement the construction control method of long-span prestressed concrete continuous steel frame bridge. Based on the grey prediction method, this paper studies the main contents and influencing factors of the construction of long-span prestressed concrete continuous steel frame bridge, and then analyses the construction control methods of long-span prestressed concrete continuous steel frame bridge.

1. Background of the study

1.1 Literature review

In the large span prestressed concrete continuous steel frame bridge structure, the construction behavior in different construction stages is analyzed by establishing corresponding calculation models. Then the corresponding construction parameters are identified and analyzed by the least square method, and then the structures of different long-span prestressed concrete continuous steel frame bridges are re-analyzed, which further verifies the correctness of the relevant calculation models (Yang et al,2010). Bridge construction monitoring is of great significance to the current construction of construction projects. According to the structure and state of the completed construction projects, the construction process of the whole construction project is analyzed. Through collecting the relevant data of the construction site, the real-time structural checking and theoretical analysis of the bridge structure are carried out, and the possible existence in the construction is analyzed. Error problem. Then, the strain early warning system is used to evaluate the construction safety effectively, and then according to the evaluation results, specific suggestions for future construction are put forward (Wang ,2019). By analyzing the construction methods of concrete continuous steel bridge, Li Tianjing puts forward the advantages of building highway bridge. Then, combining with the corresponding construction examples, the main control methods of construction of continuous steel bridge are expounded from four aspects: linear control, temperature control and stress control for safety control (Li,2017). By analyzing the structure of long-span prestressed concrete continuous steel frame bridge and combining with the corresponding environment, the existing problems of the structure are studied, and then the methods to eliminate the errors in the specific construction process are put forward, including least squares method, parameter repair and identification, grey theory method and so on. Moreover, through the analysis of different methods, it is found that the grey prediction theory is mainly used in the adjustment of construction errors of long-span prestressed concrete continuous steel frame bridges (Wang and Song,2011). With the rapid development of transportation, the span of bridge construction is increasing. The long-span pre-stressed concrete structure is gradually introduced into the construction of related bridges. In the concrete construction process, in order to ensure the stability

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of the bridge, the stress of long-span prestressed concrete structure should be analyzed (Zhao, 2017).

1.2 Purpose of research

At present, as the main structure of road across obstacles, bridges play an important role in the construction of urban roads, highways and railways. In daily life, bridges can not only ensure the convenience of transportation, but also effectively reduce the cost of construction. However, due to the influence of natural factors, there are many problems in the construction of long-span prestressed concrete continuous steel bridge, which is not conducive to the stability of the bridge structure. As a method of using grey system to predict relevant factors, grey prediction can distinguish the similarities and differences between different system factors, that is, to analyze the correlation of different factors, and to analyze the changing rules of original data, and then to generate data series with strong regularity, which is helpful for pre-processing. Measure the future development of related things. Therefore, with the help of grey prediction method, this paper studies the related content of construction control of long-span prestressed concrete continuous steel frame bridge.

2. Basic contents of construction control of long-span prestressed concrete continuous steel frame bridge based on grey prediction

2.1 Geometric control

In the process of construction control, the bridge structure is always deformed by internal and external factors, which can easily lead to the deviation of the actual position of the bridge in the overall structure, resulting in serious discrepancies between the bridge body and the design drawings (Liang and Yang,2015).Therefore, in the concrete construction process, it is necessary to control the bridge body, so that the error between the bridge body state and the design drawings can be controlled within a reasonable range, and the requirements of composite architectural design for the overall state of the bridge can be guaranteed. In the process of construction control of long-span prestressed concrete continuous steel frame bridge based on Grey prediction, geometric control is the main control content, which decides whether the bridge body has linear deformation or not. (Wang,2016). Generally, the linear deformation of bridge body can be divided into two aspects. On the one hand, the axes of the bridge body are seriously inconsistent with the design trend. This kind of phenomenon has relatively simple requirements for linear bridges and relatively difficult requirements for curved bridges. Therefore, in the actual construction process, it is necessary to adopt appropriate methods to control the parallel lines of the bridge body. On the other hand, the vertical alignment control of the bridge body. In general, if several points are used in the structure of the bridge, the vertical alignment of the bridge can be controlled by the standard height of the control points.

2.2 Stress monitoring

For the stability of the bridge, the stress condition of the pre-stressed concrete structure is one of the problems that need to be paid attention to in the process of construction control. Generally, it is necessary to control the stress of the pre-stressed concrete structure and understand the concrete situation of the construction in real time, so as to ensure that the stress of the pre-stressed concrete structure is within a reasonable range. If in the process of monitoring, it is found that the stress situation of the pre-stressed concrete structure does not conform to the standard, it is necessary to strengthen the monitoring of the stress of the structure. According to the actual situation, the corresponding stress items are clearly stipulated to ensure the effectiveness of the construction.

2.3 Stability control

As the lifeline of the construction field, bridge engineering plays an extremely important role in the related fields. For bridge construction, the stability of bridge structure is related to safety and economic issues. Generally, the bridge stability coefficient is used to measure the safety performance of the bridge structure. However, in the current relevant codes of the construction industry, there is no inscription on the stability of bridge structures, nor is there a minimum stability factor for different bridge structures. Therefore, in the process of bridge construction, besides the basic control of the stability of the structure, we also need to test the stability coefficients of different construction equipment, such as hanging basket, cable hoisting system and bracket, to ensure that the relevant equipment meets the corresponding requirements.

2.4 Safety control

In the process of bridge construction control, safety control is the main content of bridge structure control. Only by guaranteeing the safety performance of the bridge, can the construction of the bridge proceed smoothly. In fact, in the control of bridge construction, the stress monitoring, stability control and deformation control are mainly aimed at the bridge. Through these three aspects of reasonable control, ensure that each control factor meets the construction requirements, and then meet the safety requirements of the overall bridge. Moreover, because there are different structures of bridges, the influencing factors of construction safety are different under different structures. Relevant personnel need to determine the safety of bridge construction according to the actual situation.

3. Factors affecting construction control of long-span prestressed concrete continuous steel frame bridge based on grey prediction

3.1 Influences of construction technology

Construction control is mainly for the service of construction projects. The quality of construction is directly related to the construction technology. In the concrete construction process, besides the construction technology must satisfy the construction control requirements, we also need to consider some errors in the construction process, which are caused by the fabrication and installation of components, to ensure that the overall construction state is within the controllable range, thus forming a virtuous circle between the overall construction and construction control.

3.2 Influences of construction monitoring

Bridge construction monitoring is one of the most basic means of construction control. Generally speaking, bridge monitoring and control mainly includes deformation monitoring, stress monitoring and stability monitoring. In the specific monitoring process, it mainly involves different factors such as instrument installation, data acquisition, measuring instruments, measuring methods and environment. Due to the great difference of different factors, it is difficult to control all the influencing factors effectively in the actual construction process. In this context, the construction structure and the actual requirements of the parameters appear serious mismatch, or even worse. For the bridge construction process, it is necessary to ensure the reliability of the related structure measurement in the construction monitoring process. In addition, real-time recording of measurement data can ensure the accuracy of calculation results, which is conducive to the construction personnel to make the best construction decision.

3.3 The effect of temperature change

For bridge construction, temperature change has a relatively large impact on bridge structure. The influence will change with the change of temperature. It is necessary to measure the temperature of bridge structure at different times and calculate the specific temperature range that bridge structure may contact. If the factors of temperature change are not taken into account in the concrete construction process, it is likely to lead to the bridge structure, because of the deformation and additional stress caused by temperature change, which will lead to a big difference between the real data of bridge structure and design, and it is difficult to ensure the rationality of the relevant structures. Therefore, in the process of bridge construction, it is necessary to consider strictly the temperature changes, including sunshine temperature difference, different temperature field distribution, sudden temperature difference, participation temperature difference, etc. All of them need to take into account the actual changes of different temperatures under the original temperature. Generally, it is necessary to locate the ideal bridge structure within a specific temperature range, which is helpful to avoid the influence of temperature on the bridge structure.

3.4 Construction managemen

In the field of construction, the control of bridges is mainly aimed at the management of construction links, construction personnel and construction environment. For bridge structure, the quality of construction management directly determines the construction quality and construction progress. Especially for the control of construction progress, if the relevant personnel do not implement strict management of bridge construction projects, it will inevitably have a negative impact on the construction control process. In the process of construction control of long-span prestressed concrete continuous steel bridge, if the construction is not strictly controlled, the progress of related construction projects will vary greatly, which will inevitably lead to the completion of different projects in different time, so it is difficult to ensure the completion of the whole structure.

4. Construction control method of long-span prestressed concrete continuous steel frame bridge based on grey prediction

4.1 Open-loop control

Generally speaking, for some bridge structures with small span and simple structure, the load of the bridge can be calculated during the design process, and the ideal structure state can be generated. Therefore, the relevant construction departments should calculate the standard load of the bridge structure at the early stage of design with the help of grey prediction method, and adjust the usage of prestressing concrete in the bridge structure rationally according to the load results, so as to ensure that the internal force and geometric linearity of the bridge structure are kept in an ideal state. Because in the process of construction control, the control role of the constructors is one-way, and it does not need to adjust the bridge structure according to the actual situation, so it is called open-loop control method. In practical application, this method can minimize the system error and eliminate the noise of the system measurement equation through the structural state equation.

4.2 Closed-loop control

Closed-loop control is mainly aimed at some bridge structures with complex structures and spans. In spite of the above process, the ideal state of bridge structure in different construction environments can be accurately calculated. However, in the specific construction, it is difficult to accurately control the construction structure, resulting in a large error between the construction structure and the measurement system. Therefore, in the specific construction process, it is necessary to take the computer as the main monitoring center to control the relevant factors of the construction environment. Especially for the strain force and temperature parameters of bridge structure, it is necessary to use computer software for real-time monitoring. According to the monitoring results, make appropriate adjustments.

4.3 Adaptive control

Although the stochastic control method has a good control effect on the stability of bridge structure, it can effectively eliminate system errors. However, this method is difficult to adjust effectively after the construction error occurs. Therefore, for the corresponding construction process, the adaptive control method is adopted to identify the parameters of the related face change in real time, and to analyze the real-time structure of the different parameters, so that the relevant parameters can be kept in an accurate and reasonable range gradually after the cyclic calculation and actual running-in.

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