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Application of static elastoplastic method in seismic design of Bridges with double cylindrical piers

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Abstract: *In order to improve the seismic coefficient of Bridges and other structures, people usually use various high-level technical means, among which the time-efficient and accurate method is relatively high, that is, static elastoplastic method. In the design process of double cylindrical pier bridge, once an earthquake occurs, the top of the bridge is prone to a certain displacement, but the bearing structure is not prone to deformation. In addition, the stability of the structure is relatively strong. Based on this, this paper focuses on the application of static elastoplastic method in seismic design of double cylindrical pier Bridges, so as to provide reference for relevant personnel.*

Keywords: *static elastoplasticity; Double cylindrical pier; Seismic design*

1. Introduction

In the process of the earth's crust operation, affected by various factors, it is easy to produce natural disasters, of which the deadliest is the earthquake, which is not only easy to destroy the building but also may cause serious casualties and economic losses. For the land transport system, with the increasing number of vehicles, the carrying capacity of the bridge has also changed. Therefore, the elastic-plastic method can be used to enhance the seismic level of the bridge while strengthening the force.

In the construction stage of a double-cylindrical pier bridge, the staff used about 30 meters of 7-hole reinforced concrete material in its top structure. The height of the pier is known to be 25 meters, and in the construction process of the pier, the common C27 concrete on the market is applied, and the edge is circular section with a radius of 0.7 meters. When natural disasters such as earthquakes occur in the where the bridge body is located, the seismic capacity of the bridge is 6 degrees. When the earthquake frequency is maintained at 0.8, the bridge is prone to a certain degree of damage. The static method can be used to improve the seismic ability of bridge and prolong the service life of bridge structure.

2. Static elastoplastic method

2.1 Principles

In the bridge design stage, the staff should combine the current actual situation, adopt scientific technology, focus on the analysis of the seismic level of the relevant system, and use this to estimate seismic capacity of the bridge. It should be noted that in the actual operation process, the staff needs to give the bridge a certain external force to ensure that its strength is uniform. With the passage of time, when the bridge has continuous and uninterrupted bearing capacity, it is easy to appear deformation phenomenon, which gradually changes from weak resilience to damage. In addition, in the test, the should complete the acquisition of data in real time, and draw the corresponding curve around the relevant content, draw the corresponding map, and use the most intuitive means to predict the possible situation of the bridge in the earthquake.

Combined with the actual situation, it can be seen that the timeliness of seismic level data is usually related to the bearing method and shape variable. Therefore, the staff should pay attention to how to enhance the accuracy of the estimated data with reasonable means. For example, the use of science and technology to determine the extent of possible displacement. The application of static elastoplastic method has many advantages, including simulating the damage degree of the building structure in the

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epicenter, determining the relatively vulnerable part, and dealing with it in a scientific way, so as to improve the safety factor of the bridge structure [1].

As the static elastoplastic method belongs to a class of simulation kinetic energy reasoning methods, it is necessary to apply a vertical force to the building to avoid the overall deformation, and on this basis, add a horizontal force to it. At the same time, the vertical force should be in a constantly increasing state, and the overall structure will undergo a certain deformation, and under the action of the horizontal force, there will be displacement. In general, horizontal forces usually exist in three forms: single presence, triangular distribution, and others. Common inference methods are used in the prediction and simulation stages of new modules to understand whether the relevant structures have strong seismic resistance.

2.2 Assumptions

With the in-depth communication and discussion of the staff, in order to ensure that the static elastoplastic method can be applied to the seismic design of the double cylindrical pier bridge, it is not only necessary to fully consider the various variables, but also to implement the relevant technologies around the following aspects.

First, when an earthquake occurs, the seismic resistance of the bridge structure usually changes due to external causes. Second, in the seismic experiment, if the whole bridge does not appear deformation, it means that the contour height of the bridge is susceptible to certain influence. After the above hypothesis is completed, the static elastoplastic method is helpful to change the overall parameters of the bridge, which provides a theoretical basis for the subsequent seismic design. It should be noted that due to the high timeliness of the test link in the primary stage, it can be seen that the application of relevant methods in the seismic design stage of bridge structures has strong plasticity.

3. The measures of applying static elastoplastic method in seismic design of double cylindrical pier Bridges

3.1 Pier design

For the seismic design of the double cylindrical pier bridge, it should be combined with the actual situation and specifications of the bridge body, around a certain ratio, the use of measuring equipment to divide it into equal parts, among which, the more common organization structure includes: load platform, equal proportion of the bridge body, cover beam, etc., the main material of the bridge body is concrete structure. Under normal circumstances, the selected concrete material should have strong rigidity. At the same time, the main components of the pier are bundled with a number of equal specifications of steel reinforcement materials, and the radius of steel reinforcement is about 40 mm, which is arranged in accordance with a certain proportion. For the fixation of specific areas, a relatively high weight steel bar material should be used to support, in order to enhance the safety degree and firmness index of key areas.

By using scientific and technological means and applying professional measurement APP, the parameter module is visually presented in front of people, and the data of concrete material is input in it to complete the three-dimensional modeling of the double-cylindrical pier bridge. Under normal conditions, the single bearing method is used for the cap, which is easy to affect the expansion index. All kinds of bridge structures are connected by rigidity. At present, prestressed components are not widely used, and once an earthquake occurs, the bridge structure will be damaged [2]. At the same time, the remaining part is not supported by external forces, which shows that the stability of the relevant system is relatively poor. In order to properly solve the relevant problems, a certain external force can be applied to the steel bar structure to improve the compressive level of the material.

3.2 Load calculation

In the process of seismic design of double cylindrical pier bridge, the maximum displacement parameter of bridge body can be calculated by means of inference method, and the specific operation seps are shown as follows.

First, the engineer need to determine the maximum Angle under normal circumstances. In order to obtain relevant data, the bending index of the beam of the bridge can be used. At the same time, the

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staff need to fully grasp the bending data and the maximum Angle index of the bridge.

Second, after completing the construction of the data model, the load capacity of the pier structure is proposed as a variable. Through calculation, it can be seen that when the load capacity of the upper part of the bridge reaches a certain height, in order to ensure that it is always in a stable state, the force should be evenly distributed so that each independent pier has the same force.

Third, when applying specific building materials to implement the construction of the model, the rigidity of the relevant structure should be proposed as a fixed value, the maximum pressure value that the bridge can bear, and the matrix data are calculated.

Fourth, for the reinforced concrete structure, the calculation formula of its module is known as F=E1(E1/E2). For the relevant concrete material, the cutting surface is usually quadrilateral structure.

The engineer need to complete the corresponding calculation around the transverse and longitudinal prestress of the pier. The engineer need to know the exact values of the force and stress values of the piers on both sides and carry out the calculation based on this, then calculate the load value of each structure, determine the maximum bearing capacity of different piers, and calculate the core gravity of the pier columns on the left and right sides with the help of reasonable means. The difference of force between different pier and column structures is determined.

In the process of loading the bridge body, the lateral and vertical centripetal forces are easy to occur under the action of external forces. For this reason, considering the high risk occurrence rate, the staff can use professional APP to calculate the accurate value. At the same time, combined with the actual situation, it can also complete the repeated calculation, the data shows that the continuous implementation of two operations, the maximum difference is about 0.03. Compared with the standard deviation of each pier, it is often lower than the ideal. It can be seen that the stress and difference are limited to a certain extent and meet the requirements. After completing the above operations, the staff needs to conduct a thorough reasoning on it. In order to ensure the accuracy of the data obtained, the relevant personnel should fully consider the various external forces and the weight of the bridge itself, so as to avoid unnecessary risks.

3.3 Analysis and reasoning

In the actual calculation stage, the staff need to add the weight, load capacity and static load parameters of the bridge itself, so as to control the actual situation of the double-cylinder bridge, and apply reasonable means to clarify the area where the midpoint of the bridge is located. When the single force and load capacity are the same, the deformation phenomenon is very easy to occur. It can be seen that in the design process, a certain weight should be applied to the area to be measured by the law of gravity, so as to determine the maximum shape variable that it can bear. Generally, the steel frame structure of the bridge body can be divided into three categories, and the rigidity of different sections should be measured by reasonable means. When the stiffness value is clear, the rigidity parameter of the left pier should be calculated. Similarly, obtain the relevant data of the right pier. After the above operations are completed, all kinds of data obtained are added together to draw the line chart related to it [3]. In addition, combining with the main characteristics of the double cylindrical pier bridge, the analogy technology is adopted to ensure that the stress value of the relevant area is at the highest point.

As we all know, the horizontal force of the double-cylindrical pier bridge usually appears in the middle of the bridge body. To this end, in the seismic design stage, the staff should use the corresponding bearing step to obtain the required data and information. In the process of the experiment, the movement of the horizontal plane is controlled, the corresponding concrete module is built, and the parameters of four types of forms are easily generated when the concrete structure changes, and advanced technical means are used to complete the data analysis of the bridge body. After the above operations are completed, the maximum force values of different components are determined with the help of the measured data of the modeling APP. Through analog reasoning, it can be seen that when the pier changes to a certain extent, the mobile data of different areas can be learned with the help of professional software. At the same time, when the corner reaches a certain limit, the minimum displacement parameter can be obtained. At the same time, the personnel should also deeply consider the force applied to the bridge section.

With the help of advanced technical means, the staff can deduce all kinds of data obtained to know the displacement degree and bending index of the bridge within the standard range. In addition, the important reason that it is easy to affect the relevant values is the horizontal force. By analogy

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reasoning, it can be seen that there are strong differences between the horizontal force and the data of the bridge itself, leading to some parameters of the bridge are inconsistent with the idealized model. In order to solve related problems, the corresponding value can be obtained by using the bending degree of the curve.

3.4 Calculation methods

At present, in our country, the important fields of the application of relevant methods are Bridges and other building systems. In the process of building the bridge, there is a strong difference compared with the traditional building structure. First of all, inside the bridge, because the plate is always in a plane structure, its own rigidity is relatively poor. Second, piers are usually used to carry the weight of the bridge and remain horizontally placed. On the contrary, in the building system, the structure that plays a supporting role is usually a three-dimensional structure, which needs to ensure the overall stability of the building with the assistance of various external forces. Finally, when using the static elastoplastic method, the staff should also select a specific point and draw the corresponding curve according to its own deformation degree.

Due to the strong difference between the double cylindrical pier bridge and the common building system, in order to make full use of the static elastoplastic method, the following operations can be carried out. First, the engineer need to build the same data model as the bridge to be built, and obtain the variable parameters and corresponding matrix of external forces through reasoning on the data, so as to determine the maximum bearing capacity of the system at the epicenter. Secondly, understand the application of various external forces when using static elastoplastic method, and draw the corresponding parameter diagram. For example, when the external force is in a stable layout, the forces applied in each key area can be drawn up as a specific matrix model, which can be added by reasonable means to obtain the state of the force in the plane structure. Third, the engineer need to determine the key position of curve data acquisition [4]. In general, in a building system, the selected observation area is usually a specific area of the main body. For the bridge structure, the part close to the pier should be selected around the displacement degree in the bridge body. When the static elastoplastic method is applied in the seismic design of the double cylindrical pier bridge, the simulation and reasoning can be completed around the known displacement parameters until the predetermined target is reached, and the corresponding force image can be drawn around the current situation. Fourth, regarding the stress curve, there are various methods commonly used in the drawing stage of the idealized model. For this reason, the law of conservation of energy can be used to process the idealized model when the coverage area of the actual data module is close to the same. Fifth, after obtaining the corresponding curve, it is converted into an energy line with the help of a specific equation, and the corresponding data image is obtained according to the seismic capacity and external factors.

In the construction stage of bridge structure, it is necessary to apply the static elastic-plastic method in order to understand the seismic coefficient of the system. Because the difficulty coefficient of data acquisition is relatively low and the operation is simple, it can meet the demands of construction at this stage. At the same time, by reasoning linear changes, the staff can effectively understand the various variables in a timely manner. However, in the process of application of this method, there are still many practical situations to be solved. For example, in bridge structures with relatively large coverage area, high-frequency vibration is easy to affect the relevant system and reduce the accuracy of data. At the same time, the experiment shows that by creating the corresponding matrix model and using the static elastoplastic method, we can master more reasonable seismic data, which is conducive to promoting the stable development of the construction industry.

4. Conclusion

To sum up, as a more important part of the construction of double cylindrical pier Bridges, the staff should place the focus of work in the seismic design, enhance the design level, and fundamentally improve the seismic ability of the bridge. With the help of static elastoplastic method, the overall level of seismic design of Bridges can be optimized fundamentally. Therefore, a reasonable plan should be formulated and implemented to ensure the safety of people's travel and improve the seismic level and service life of the bridge.

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