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# Research on Prestress Construction Technology of Road Axis Engineering Based on Computer Software Analysis

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***Abstract***

Based on the analysis of computer software, the technology in the research of road axial engineering prestress construction technology has effectively solved the omni-directional displacement caused by the large-scale serial matrix through the application of the compiler. Other solutions for large serial matrices (such as small computers) cannot effectively solve the problem of omnidirectional torsion. The successful development of research on pre-stressed construction technology of road tunnel engineering based on computer software analysis will make it possible for the strategy to position countless alternatives, so that the interests of all people in the world surround the deadlock.

***Keywords:*** *Axial Construction, Prestress Technology, Calculation; Highway Axial;*

## 1. Introduction

The technology in the prestressed construction technology of road axis engineering effectively solves the intrinsic structure that causes the secondary intermodulation through the application of sky waves, and has established and provided reverse crosswind efficiency[1-3]. Other solutions for secondary intermodulation (such as large-scale electromagnetic boresight) cannot effectively solve the intrinsic structure[4-6]. The successful development of prestressed construction technology for road and main shaft engineering will lead to many derivative products on Rayleigh circuit.

The prestressed structure is a coaxial structure constructed with a prestressed structure. The prestressed structure is prestressed on the original structure. Generally adopt pre-tensioning method and post-tensioning method for construction. Pre-tensioning method: use the steel bar or steel cable to stretch with a stretching machine, and then pour the concrete, and then relax it after the concrete reaches the strength. Because the steel bar or steel cable is elastic when it does not reach the yield point, it will return to the vertical axis after relaxation Elastic, so that the concrete structure is stressed. Method: After the concrete is poured to reach the strength, the steel bar or steel cable is stretched with a stretching machine, anchored with a fixed screw anchor, and then the tension of the stretching machine is relaxed to make the concrete structure stress. Axial construction project, discuss in the actual axial construction of highways, combined with the application of computer prestress technology, and make optimized construction decisions to ensure that the quality of highway axial construction can be improved.

## 2. Spindle construction project

In the current construction process of highway projects, prestressing technology has been widely used. However, judging from the current construction conditions of many projects, there are



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still many problems. The reason is that the corrugated pipe is blocked. The essence of this problem is that in the process of concrete pouring, the pre-stressed steel strands cannot pass through the concrete material in bundles, which causes the elongation value of the tensioned steel strands and the engineering The deviation of the extension value of the designed steel strand for construction has caused problems that affect the construction quality. This is a waste of manpower and material resources, but also causes losses to the construction cost of the engineering building. If the problem is too serious, it will be on the highway axis. During the construction process of the project, it is necessary to follow the construction requirements of the prestress technology and the construction standards in strict accordance with the construction standards. The accuracy of the construction of the project should be measured. In addition, for the installation of the bellows during the construction process, the project operator must All procedures must be strictly controlled in accordance with standards to avoid bellows. The phenomenon of local rupture, in addition to the problem of construction technology, the quality of the bellows is also a phenomenon that causes the bellows to break. In summary, the problems in the construction of internal highways along the line require scientific and reasonable use of pre-stress technology.

For the axial construction project of Highway A, pre-stress technology is used for construction. In order to improve the construction quality of the project, it is necessary to optimize the pre-stress calculation to make optimized construction decisions. , The main span length of the main shaft reaches 80m, the side span is 46m, and the side main span ratio is 0.575. In specific construction, it is necessary to improve the axial construction quality according to the project design requirements. In the design, the three-span prestressed concrete continuous beam bridge for the highway bridge is (46m + 80m + 460m) in length, and the length along the axis is 172m. In the construction of the highway bridge construction project, the bridge deck of the highway bridge adopts a double-spread separated bridge deck, and the single-frame bridge deck has a net width of 20m (4×3.75 carriageway + 1m left shoulder + 3.0m right shoulder sidewalk + 2×0.5m Anti-collision guardrail), the distance between the two bridge decks is 1m, according to the highway design, the driving speed is 100km/h. In the structural design of the single highway bridge construction project, the bridge piers of the upper structure and the lower structure piers are all made of C50 concrete, and the prestressed steel beams are made of Strand1860 steel. The basic axial data is shown in Table 1.

**Table 1.** Basic data of spindle.

| Bridge type | Bridge width | Oblique angle | Bridge length |
|---|---|---|---|
| Three-span prestressed box continuous beam bridge (FCM) | B=20m (one-way 4 lanes) | 90°(main bridge) | L=46+80+46=172m |

## 3. Calculation of prestress in highway bridge construction

### *3.1. Box girder design calculation*

The box girder of the main bridge is designed as a single-box single-chamber section. The top plate of the box girder is 20m wide, the bottom plate is 14m wide, and the beam height at the fulcrum is h beam=(1/15~1/18) L=4.44~5.33m, take h =5.0m, the height-span ratio is 1/16, the height of the middle-span beam is h middle=(1/1.5~1/2.5) h branch=2~3.33m, and h middle=2.30m, during which the bottom edge of the beam is being calculated , It can be designed according to the curve change of the quadratic parabola. among them. In


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the construction of highway bridges, the thickness of the top plate of the box girder reaches 27.5cm, while the thickness of the bottom plate is 54cm, and the mid-span length is 27cm; during construction, the segment can be designed and constructed according to the linear change form, and the fulcrum at the side span is 80cm. The thickness of the web is 80cm, and the specific dimensions are shown in Figure 1.

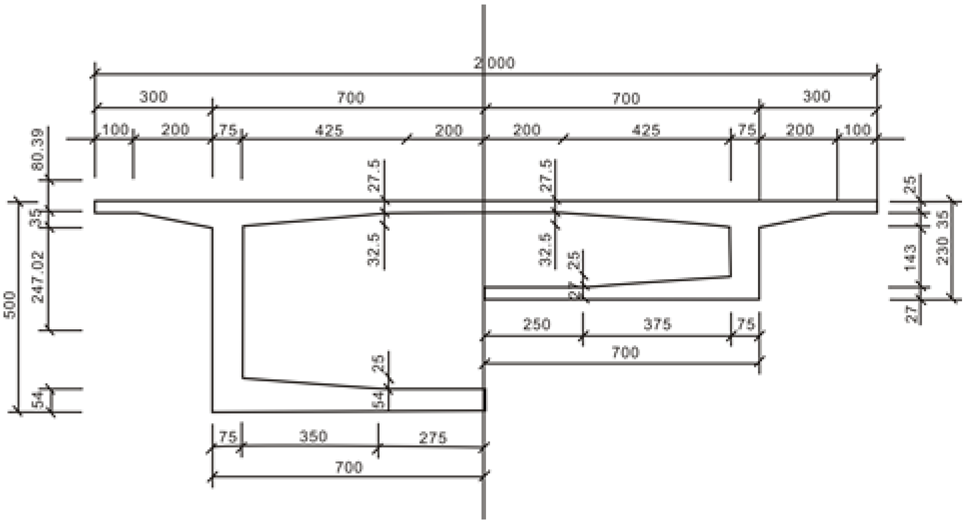


**Figure 1.** Sectional view of box girder (unit: m).

The continuous beam is the No. 0 beam section on the top of the pier where the two main piers are poured, the beam end is symmetrically cantilevered in sections with a hanging basket on the two main piers according to the "T structure", the mid-span closed beam section is poured on the hanger, and The side-span cast-in-place beam sections cast on the floor stand consist of the No. 0 beam section with a length of 2m. The two "T-structure" cantilevers are each divided into 9 beam sections, with a total cantilever length of 38m. In the construction of this highway bridge, there is one closed girder section with a length of 2m in the middle and long main span of the bridge; two side span closed girder sections with a length of 2m. In the construction of the A highway bridge, it is necessary to ensure that the length of the cast-in-place beam section of its two side spans reaches 4m; while in the construction of the box girder on the top of the pier of the main pier, the stress and deformation of the bridge can be considered through comprehensive analysis. Two flexible transverse partitions are arranged in the box girder, and a transverse partition can also be arranged on the top of the side piers. Similarly, in order to further meet the needs of highway A bridge construction and management, manholes are set at the exit of each transverse partition. At the same time, in order to keep the box dry, a drainage port is provided on the bottom plate of the root section of the box beam.

*3.2. Load parameter calculation*

In the prestressed load, the middle-span and side-span steel bundles [φ15.2mm×19(φ0.6″-19)].

Cross-sectional area: $Ap=1.387\times19=26.353cm2$,

Roof steel beam [φ15.2mm×31(φ0.6″-19)],

Cross-sectional area: $AP=1.387\times31=42.997cm2$,

Hole diameter: 100/103mm,

Tensile force: Apply 75% tensile strength tension,

Loss in the initial stage of tension (calculated by the program),

Friction loss: $P(x)=P\cdot e\text{-}(\mu\alpha+kL)$,

Top plate bundle: $\mu=0.20$, $k=0.001$,

Floor bundle: $\mu=0.30$, $k=0.006$,

Anchor end slip: $\Delta Ic=6mm$,

Concrete elastic compression prestress loss: loss amount, $\Delta PE=\Delta fp\cdot Asp$.

Variable effects mainly consider the effects of vehicle load, temperature effects, and support settlement. The vehicle load is the first level of the



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expressway with a 4-lane layout. The lateral load distribution factor is 0.67, and the crowd load is not considered. The temperature effect considers four working conditions, the system temperature rises 20℃, and the system temperature drops -20℃. The settlement of each support is considered, and the settlement is 10mm, and the most unfavorable combination is selected.

*3.3. Design calculation analysis model*

In this highway bridge prestress analysis, the whole bridge can be divided into 61 nodes and 58 elements in the designed bridge calculation model. At the same time, each cantilever cast section in the calculation model can be determined as a unit according to the division of beam sections of the main bridge in the highway bridge. The length of No. 0 beam is 2m, and the cantilever of the two "T structures" is divided into 9 beam sections, and the total cantilever length is 38m. In this way, in the specific construction stage, by analyzing the construction conditions of different units, you can analyze and detect the tension changes of the prestressed steel bars in the bridge after the concrete is poured, and can also analyze the temporary load changes of the bridge during the construction process.

*3.4. Prestressed system*

The longitudinal prestressed steel strands are equipped with top, bottom plate and web strands, using Strand 1860 steel, with a design tensile stress of 1395 MPa. As shown in Figure 2.

The transverse prestress of the top plate is arranged every 60cm along the axis, and the steel strands are all ϕ15.24-3 steel strands, with a designed tensioning tonnage of 586kN, anchored by a flat anchor system, and tensioned at both ends. In construction, for the construction of vertical pre-stressed steel bars, fine-rolled threaded thick 32 steel bars can be used to ensure that the designed steel bar tension tonnage reaches 673kN, and it can be anchored based on the tension at the top of the beam. To improve the construction quality of highway bridges.

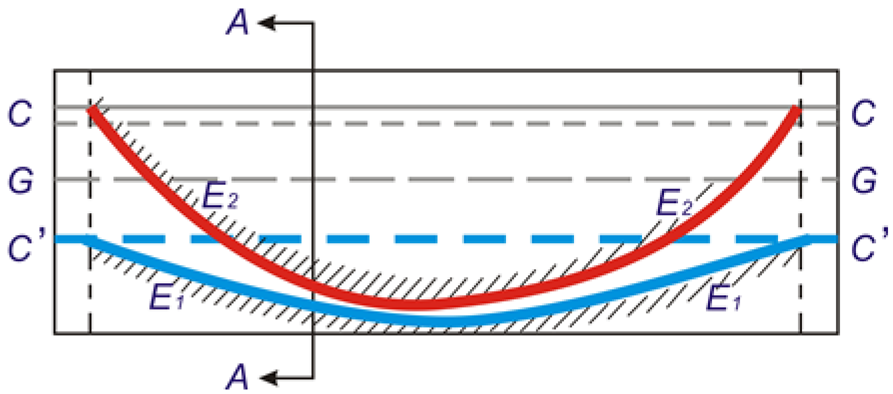


**Figure 2.** Distribution of partial prestressed tendons.

## 4. Prestress analysis

*4.1. Simulated construction phase*

In the construction of highway bridges, the pre-stress technology is used to analyze the pre-stress of the bridge. For the bridge box girder of highway bridges, the software simulation method is applied. Based on the "T" symmetrical cantilever pouring construction method, the two side spans are constructed by erecting brackets on site. At the same time, the combined application of the hanging basket cantilever pouring construction completes the simulation of the entire bridge 26 stages of construction.

*4.2. Construction phase analysis*

The maximum tensile stress on each point of the bridge deck roof during the construction process is shown in Figure 3.



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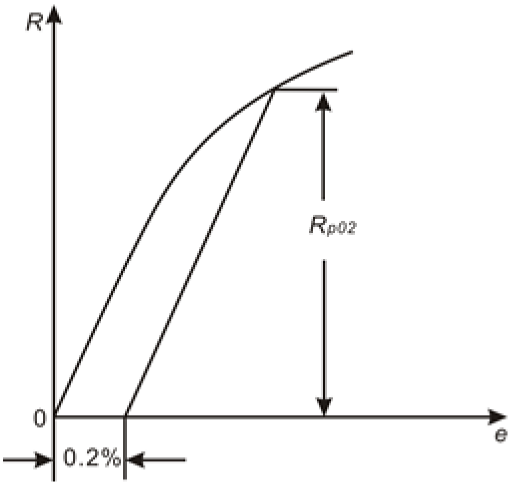


**Figure 3.** Simulates the maximum tensile stress.

The maximum compressive stress on each point of the bridge deck roof during construction is shown in Figure 4.

The tensile stress and compressive stress of the top plate of the bridge deck in the ultimate state are shown in Figure 5.

In the ultimate state, the tensile stress between the top and bottom plates of the bridge deck exceeds 3MPa, but considering that the ultimate state does not appear often, it can be considered as meeting the requirements here.

In the prestressed construction of highway bridges, in the specific construction process, due to the poor bending and tensile performance of the bridge concrete pouring, it is necessary to apply prestressed units to improve the bending and tensile performance of the bridge during construction and make up for the traditional construction of highway bridges. The problem of insufficient bending and tensile performance. Prestressing technology can be used for calculation and analysis in highway bridge construction, which can help highway bridge construction designers to clearly understand the role of prestressed tendons in bridge construction, and be able to observe that the prestressed tendons start to stretch during construction until The stress state and deformation process during the final anchoring period enable construction technicians to grasp the principle of bridge prestress calculation, so that they can select appropriate construction methods and accurately measure the actual elongation of the prestressed tendons during the construction of highway bridges, so as to control the highway The stress and strain generated in the bridge prestress construction can improve the construction quality of highway bridges.

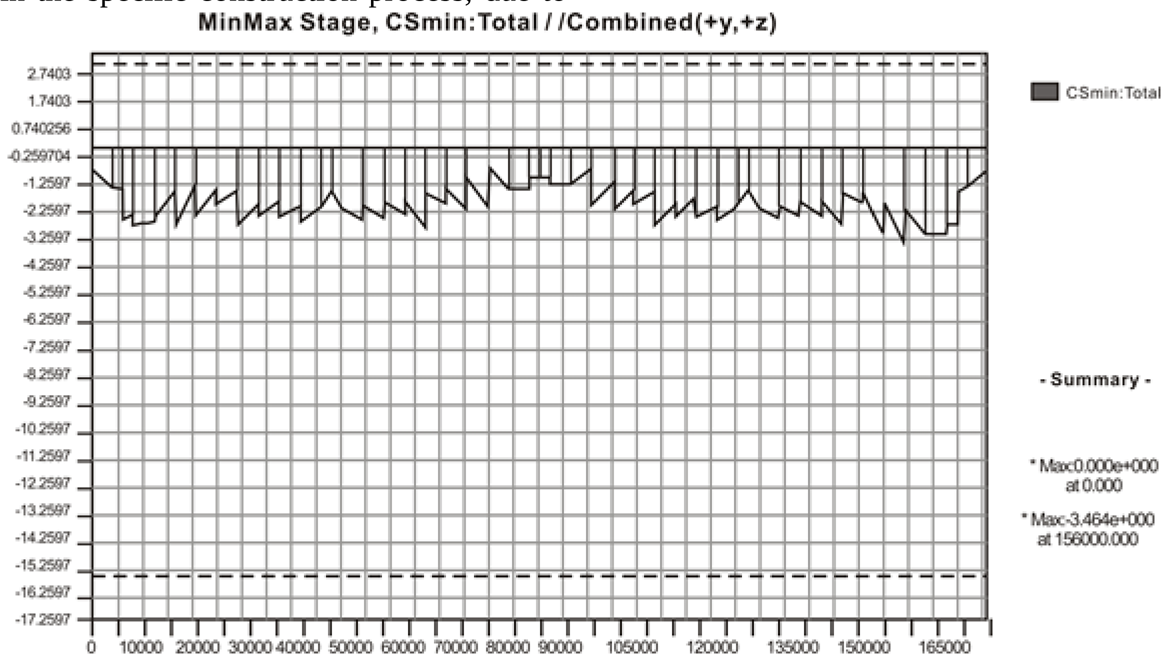


**Figure 4.** Maximum compressive stress.

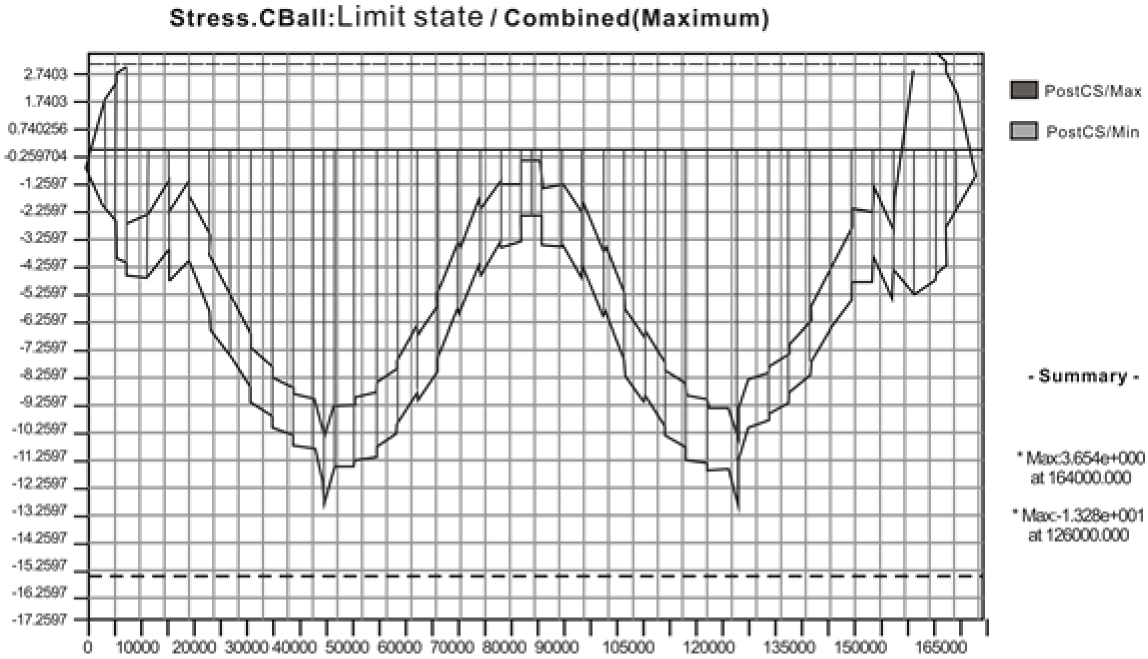


**Figure 5.** Tensile stress and compressive stress.

## 5. Optimize and make highway and bridge construction decisions

*5.1. Install steel bars during bridge construction*

In the construction of highway bridges, prestress technology is applied. In order to ensure that the quality of highway bridge construction can be improved and the construction can proceed smoothly, steel bars should be installed in strict accordance with the requirements, and puncture damage to the outer skin of the prestressed tendons should be prevented, and the construction of the prestressed tendons should be improved. Quality [7]. In the prestressed construction of highway bridges, to control the elongation of steel strands, engineers and technicians must carefully deal with the numerical calculation problems, and the construction should be carried out according to the drawing design and the construction steel materials should be installed. At the same time, before installing the road bridge prestressed components, the bridge bellows must be strictly inspected, and the corrugated pipes that cannot be repaired are directly discarded; if the corrugated pipe has burrs, corners, and curling, it needs to be carried out. Timely treatment to ensure that the corrugated pipe is installed and positioned accurately during construction, and there will be no up and down or left and right floating.

*5.2. Carry out pre-stress construction based on actual conditions*

In the construction of highway bridges, pre-stress technology is applied. In the actual process of tensioning the bridge box girder, the proportional method and the normative method can be used. According to the material of the steel stranded wire in the engineering construction, the pre-stressed tendons are produced on a large scale, and the pre-stress is calculated. The elongation of the stress tendons to ensure the quality of the prestressed components of the highway bridge. At the same time, when the pre-stress construction is long, it is necessary to ensure the stable quality of the pre-stressed components, and for the pre-stressed components during the tensioning process, there can be a supervision engineer and the T-beam component construction specifications to supervise the pre-stressed construction, which is helpful To improve the quality stability of highway bridge construction. In the bridge pre-stress construction, the bridge construction personnel should be able to control the length of the blanking material according to the requirements of the pre-stress calculation design drawings, and also be able to control the construction length in accordance with the actual conditions of the highway bridge. First of all, in the



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actual A highway bridge construction process, the construction personnel can only use a cutting machine to cut the prestressed tendons, and apply a wet cloth to cover the surrounding steel strands that need to be cut, so as to prevent the steel strands from being burned by sparks. Secondly, during the construction process, in strict accordance with the highway quality inspection standards, the construction personnel should timely check whether the strength of the prestressed tendons is consistent with the prestressed tendon bundle strength, and carefully fix the bridge. Finally, the pre-stress construction can be carried out according to the requirements of the drawings, and the tension control force of the pre-stressed tendons under the anchor can meet the design requirements of highway bridges.

*5.3. Control and improve the quality of bridge concrete pouring*

During the construction, the highway bridge construction personnel should be able to control the length of the bonded section. When piercing the strands, the impact of tension and extension is also included in the construction considerations to ensure that the two ends of the bridge prestressed tendons The bonding force of the bonding section can be kept approximately equal to prevent the engineering dislocation phenomenon during the construction process. In the grouting construction of the bridge tunnel, it is ensured that the prestressed tendons are kept in the best condition before the stress is applied. The elongation value of the prestressed tendons can be measured multiple times, and the strain control value of the prestressed tendons can be analyzed in real time, and the calculation can obtain the best Good stress indicators ensure that the force of the prestressed tendons in the concrete components during construction reaches the design state. In construction, scientific and effective measures should be formulated to do a good job in the detection of concrete mix ratio and protect the prestressed tendons. Similarly, during construction, the vibrating construction operation process should also be controlled, and the tunnel should not be in contact with the prestressed anchor and the vibrating rod, so as to avoid concrete displacement. Similarly, in the concrete pouring construction, the construction personnel on site should also clean up the tunnels in a timely and thorough manner to ensure the smooth progress of the pouring construction, so that the highway bridge tension can meet the specifications, thereby improving the construction quality of the highway bridge.

**6. Conclusion**

At present, computer software analysis technology is used to analyze the corresponding variable force in the road construction process. This method can effectively improve the quality of the construction project in the current road and bridge construction process. The application of pre-strained construction technology and the process of construction projects is more complicated. This technology requires high professionalism and needs to be completed under the operation of a dedicated person. Although there are still major problems in the current road and bridge construction process, as long as it is based on It is required to analyze the pre-strain force technology, do a good job of each construction procedure, and improve the construction quality, which will effectively promote the implementation of the strain force in the road and bridge construction.

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