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Continuous rigid PC frame box girder cantilever pouring construction reasonable maintenance method

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Abstract
In recent years, prestressed concrete continuous rigid frame box girder plate and web plate produced a large number of non-structural cracks disease caused the attention of large bridge workers, to solve the problem of continuous rigid-frame structure of the cantilever of the disease, this article briefly introduced the cantilever construction method and the performance requirements of modern concrete, through to the modern concrete composition change and keeping in good health on the impact of environment on its early performance analysis summary, points out the present problems of box girder early curing, finally combining with the characteristics of modern concrete performance and the characteristics of the cantilever construction method, puts forward "model attach +manual+automatic water spray mist stick " composite curing method in order to reduce the structural cracks, provides a new train of thought.

Keywords: Continuous rigid frame HPC Cantilever construction Maintenance method

I. The introduction

In recent years, the cantilever construction of large span concrete box girder to produce large amounts of structural cracks, especially in the mountains of long-span prestressed concrete continuous rigid frame box girder, because its span and large volume, box girder plate and web plate produced a large number of cracks and excessive midspan deflection problem is more serious.On the one hand, because of the segmental cantilever pouring construction method, outside the box girder section after demoulding due to limit of the work surface is difficult to reasonable maintenance, the box bottom and the outside of the maintenance to be box girder web maintenance "blind Angle".On the other hand, the composition of modern concrete have great influence on its early performance, did not cause enough attention to the construction site.Construction of box girder concrete curing is still using the past curing method, compared with the past the structure of concrete, concrete structure cracking phenomenon is more common now.Therefore, the deep understanding of modern concrete changes and therefore the required early curing environment, and take effective measures to ensure the maintenance of the cantilever construction of large span concrete construction quality and durability is necessary.

II. Summary of continuous rigid frame box girder cantilever pouring construction method

By the cantilever construction method is to use hanging basket cantilever construction, bridge pier to bilateral symmetry in situ to curing of concrete, to achieve a certain strength after tensioning prestressed tendons, and then move on to the next section of the hanging basket template construction method.The process can be divided into four parts, namely the

pier top beam segment (0 # block), bilateral symmetry the cantilever segmental pillar top, the edge folded across different stent placement in the edge and beams.According to the first pillar top again cantilever construction order, as well as for side span stent placement, finally folded across in the period of pouring.As shown in figure 1.

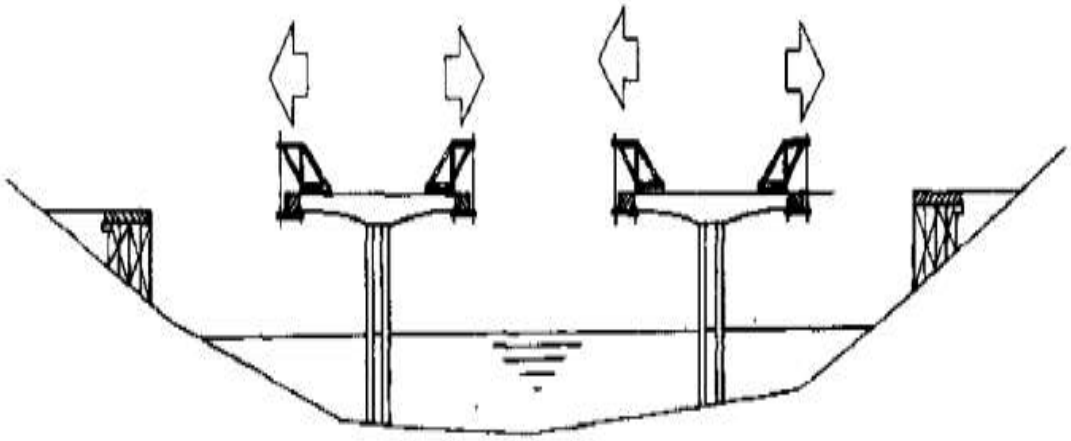

Figure 1 Continuous rigid frame box girder cantilever construction sketch

Cantilever construction technique of casting method has simple process, less facilities, the advantages of rapid construction speed, especially in deep water, large-span, navigation, canyons, under the condition of the high pier bridge construction, has a strong applicability and economical efficiency.But due to the limitations of the construction method and enclosure structure characteristics, the hanging basket after removed from the chamber and the top of the roof, construction personnel easy to reach, the traditional artificial water spraying method can be effectively maintained, but body outside, no special maintenance channel, often become maintenance "blind Angle", combined with the box body external climate changeful environment, prone to early non-structural cracks, it is also one of the problems existing in the present box girder cantilever construction.

III. The requirements of cantilever construction of modern concrete performance

3.1 High strength

Structure is different, continually at the king's larger span of modern concrete structure, the direction of the section is thinner, so demand increasing concrete strength.Especially in the prestressed concrete continuous rigid frame box girder cantilever construction process, the early strength of concrete is often becomes the key to control the construction progress.

3.2 High workability

The workability of concrete fluidity, filling ability including, cohesion, pumpability, such as performance, is mixing, transportation, cast, plaster, and so on main operation process can be successfully completed, is also to ensure that the concrete compactness and uniformity of the main performance index.High workability is a modern one of the essential properties of pumping concrete, will become the concrete development direction.

3.3 High durability

Durability refers to the concrete resistance to environmental medium and long term maintain its good use performance and appearance integrity, so as to maintain the safety of the concrete structure, the

ability of normal use.Durability of the concrete structure has a huge impact to the development of society.The durability of Bridges and other important buildings for more than 100 years.

IV. The early curing situation and existing problems of box girder cantilever construction

Combining the maintenance of the cantilever construction process of concrete situation can be found that the present stage in the process of cantilever construction of concrete curing mainly two problems: maintenance exist "blind Angle" and the curing time is too short.Lack work channel box girder lateral difficult to maintenance, and at the same time these parts directly affected by the cantilever construction site environment, it is easy to lead to concrete due to adverse curing early shrinkage crack.Combined with the modern the cantilever bridge widely used cement fineness is bigger and add the high efficiency water reducing agent of high-performance concrete, the early shrinkage of concrete material increased and the early curing environment become more dependent on the sensitive, the lack of maintenance further aggravated the cracks of concrete early.

Therefore, combining modern the early performance of concrete, and the characteristics of the cantilever construction method and maintenance method of cantilever construction at the present stage also has many deficiencies, to ensure the durability of Bridges, is very necessary to find a more comprehensive in view of the hanging basket cantilever pouring construction effective early curing method.

V. The curing process adapted to box girder cantilever pouring construction of concrete

5.1 The recommended summary of composite curing method

Early modern concrete performance change makes it to the requirement of early curing also changes accordingly.Early curing methods and combining with the concrete characteristic and the particularity of concrete box girder cantilever site cast construction method, move the hanging basket is recommended for “model attach +manual+automatic water spray mist stick” curing method.

Concrete curing process is as follows: in the process of box girder cantilever casting construction, the segmental concrete pouring is completed, with the need of prestressed tensioning construction process and the influence of the hanging basket facilities, hanging basket before mobile don't have the requirement of erection spray maintenance facilities.For the convenience of prestressed tensioning, outside the web module after the concrete pouring 2 d mold, outside the web mode, maintenance mode of web lateral using artificial water spray.At the same time, should be timely after concrete pouring on top of the roof and floor in the central secondary bare concrete surface plaster zones to cover a wet sack on the curing.And bottom bottom template for the whole section under load, the hanging basket can't release before moving, to reduce its shrinkage deformation, should be on the floor at the end of the template layout concrete model, make its box girder floor in front of the hanging basket mobile using mold maintenance.When hanging basket after moving to the next section, attached to the automatic water spray mist on the hanging basket maintenance facilities can easily move with the movement of the hanging basket, which has just finished casting section water fog curing immediately, box girder section was a very short interval time for maintenance.In this way, the box girder is difficult to adopt the traditional maintenance method for curing the parts can be easily spray fog curing, it solves the concrete box girder has the problem of maintenance "blind Angle".At the same time, automatic water spray mist after curing for the movement of the hanging basket, the curing time can completely, and the construction period of the next section.

5.2 the characteristics of composite curing method

This composite curing method is suitable for the long-span prestressed concrete continuous rigid frame box girder bridge cantilever construction of the segmental concrete curing.Solve the long-span prestressed concrete continuous rigid frame bridge during cantilever construction due to the lateral plate, flange plate and web box girder slab bottom surface is not easy to maintenance, resulting in the web and flange plate and bottom plate of the early crack problem.Combining the whole curing process and the process of cantilever construction, almost no adverse effect on the process of cantilever construction.

The composite curing method is successfully applied in chongqing Shuitangba bridge, Wansheng super-large bridge ,Catch the water bridge project.Engineering practice fully proves that this method has a strong security, practicability and economy, can significantly improve the bridge early unstructured crack a lot of problems, thus saving bridge maintenance costs, increase service life of the bridge, so as to reduce the comprehensive cost of the bridge construction.

5.3 The application example of the Wanshenglarge bridge

Wansheng super major bridge in chongqing wansheng WanDong Town new tamura dam, for chongqing to the nanchuan wansheng A1 contract section of freeway.Continuous rigid frame box by the single single room section, C55 concrete, three-way prestressed, 6.8 m wide, at the bottom of the wing plate cantilever 2.6 m, 12 m in full width.Box girder root 10 m tall, and across the high end of 3.5 m, the construction method of cantilever construction of hanging basket.Box girder cantilever construction stage of the "automatic water spray mist stick + artificial +" composite curing method, compared with Bridges without adopting the curing method, greatly reduce the cracks of the box girder web plate and bottom, rendering shown in figure 2 ~ 4.In terms of quality and efficiency of a superior departments owners and consistent affirmation, achieved good effect.Wansheng super-large bridge completion figure as shown in figure 5.

Figure 2 Bridge girder crack figure without adopting the maintenance method

Figure 3 Lateral maintenance web rendering

Figure 4 Floor maintenance effect

Figure 5 Wansheng bridge completion photos

VI. the conclusion

This paper briefly introduces the continuous rigid frame box girder cantilever construction method and the present stage of the status quo of the cantilever construction process of concrete curing and combining with the characteristics of modern concrete performance and cantilever construction method, proposed the present stage in the process of cantilever construction maintenance problems and deficiencies, then draws the necessity of the early concrete curing process of cantilever construction.And put forward a set of suitable for the cantilever construction process of early curing method, namely "model attach +manual+automatic water spray mist stick" composite curing method.In general, the composite curing method is very good to adapt to the particularity of the cantilever construction method, greatly solve the deficiency of the early modern concrete performance, durable performance of the cantilever cast-in-situ concrete box girder is a strong guarantee.With the development and construction of long-span Bridges in our country, the maintenance method and maintenance concept will be widely used.

References

[1.] Fu-rong zhou(2006). Maintenance and the influence of early shrinkage and cracking of oncrete[D]. Zhejiang: construction engineering college, zhejiang university.

[2.] Wang Tiemeng(1997). Engineering structure crack control [M]. Beijing: China building industry press.

[3.] Wei-wei zhu(2012). Long-span prestressed concrete continuous rigid-frame box girder cantilever pouring construction segment different regimens early research [D]. Chongqing: chongqing jiaotong university.

[4.] Yuan Yong(2004). Early concrete structure crack control [M]. Beijing: science press.

[5.] GuJinJun(2013). Large span prestressed concrete continuous rigid frame box girder cantilever pouring

construction process segment curing technology research [D]. Chongqing: chongqing jiaotong university.

[6.] Ming-quan zhong(2011). The ministry of communications - west traffic construction science and technology project concluding report cement fineness and composition of bridge concrete performance effects and countermeasures research [R]. Chongqing city transportation planning survey and design institute.

[7.] People's traffic press.(2011)"technical specification for construction of highway bridge (JTG - TF50-2011),

[8.] people's traffic press,(2009)"concrete project with permeable formwork cloth (JT/T 736-2009), the concrete water-saving moisture conservation film (JG/T 188-2010), China standard press, November 2010.