

Construction Method of Loudspeaker Combined Steel Formwork for Sewage Treatment Pump Station

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ABSTRACT : The construction of large volume and variable cross-section concrete in traditional pump station flow channels has disadvantages such as complex processes, long construction periods, severe material loss, and environmental friendliness. An innovative research and development of a combined steel formwork construction technology for sewage treatment pump station horn shaped flow channels has been carried out. The overall steel formwork is made in a complete set, and a sample frame bone support and reinforcement system is added internally. After the overall lifting is in place, steel reinforcement binding and concrete pouring begin. Compared with traditional brick and wood formwork, This construction technology has the advantages of energy conservation, environmental protection, and high efficiency, and has significant engineering application prospects.

Keywords – loudspeaker; steel formwork; construction procedure; construction method

I. INTRODUCTION

Over the years, in the construction of large volume brick and wood cross section of the flow channel of the pump station, but the traditional process is not only complex, the construction period is long, and the material loss is serious, and it is not environmental friendly.

In line with the spirit of energy saving, environmental protection, high efficiency, our engineering and technical personnel after continuous exploration and innovation, developed a sewage treatment pump station horn flow channel combined steel template construction technology, the technology adopts the overall steel mold according to the design line complete production, internal for sample frame bone support and reinforcement system, cover and external steel with welding fixed, approach after the overall lifting to the flow parts, then external steel binding, after the concrete began to remove the design strength. The engineering practice has proved that the benefits are remarkable and have a strong value for promotion and application.

The technology has been successfully applied to the construction project of the company, and the practice has proved that its core technology is mature and has remarkable benefits. In order to promote this technology, this construction method has been formed through continuous improvement and summary.

II. FEATURES

2.1 Short production cycle

Compared with the traditional brick and wood molds, the production time of each set of templates with the same specification can save 7-10 days, and the on-site assembly and demolition is fast, which can effectively accelerate the progress of the project.

2.2 Save the project cost

The flow channel steel formwork has many turnover times and high residual value, while the wood mold and brick mold are all one-time, which has no utilization value after demolition, and the investment waste is large.

2.3 Improve the project quality

Steel formwork has high strength, large combined stiffness, tight stitching, not easy to deformation after reinforcement, and good formwork integrity.

III. SCOPE OF APPLICATION

This construction method is applicable to the construction of inlet water channel in pump station, and can be extended to other special parts such as large volume and special structure concrete.

IV. PROCESS PRINCIPLE

The overall steel mold is made in complete sets according to the design line type, and the internal frame is the sample frame bone plate support and reinforcement system, and the external mold is covered with steel mold and fixed by electric welding. After entering the site, the whole frame is hoisted to the flow channel part, and then the external reinforcement is bound. After the concrete reaches the design strength, the steel mold is removed.

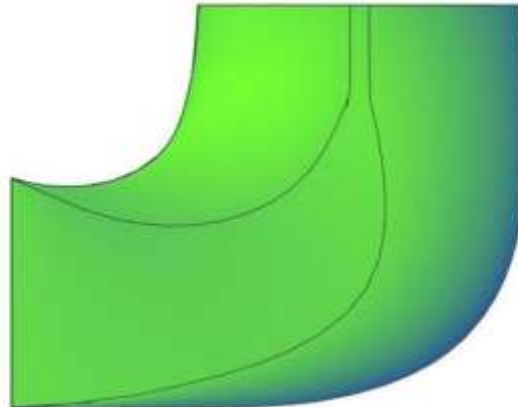


Figure 4.1 Section view of the trumpet flow channel

V. PROCESS FLOW AND OPERATION POINTS

5.1 Process flow

Material selection groove processing gas cutting number material lofting sample frame welding assembly molding according to the single line drawing acceptance sample frame sample frame surface steel formwork overall inspection and acceptance of formwork surface treatment site assembly and transportation to the site according to the order of formwork removal cutting block whole forming.

5.2 Operation key points

5.2.1 Sample frame

The formwork of the horn part of the inlet channel is assembled by steel skeleton. The sample frame piece is made of -65 * 5 steel plate cut and welded after loout. It is made according to the section provided in the design drawing, with a total of 26 sections. Each sample frame piece is welded with -65 * 5 short steel plate. As shown in Figure 5.2.1:

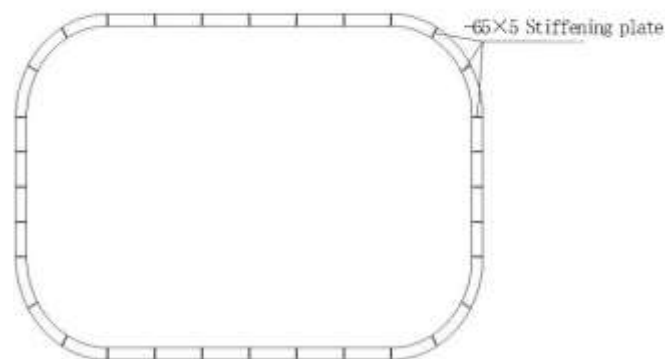


Figure 5.2.1 Plot sample of sample frame

5.2.2 Coordinate system

Establish a coordinate system with 10 # channel steel in the processing site, and mark the coordinates of each section, according to the relative position of the elevation control sample frame of the center line of the pump well and the center line, the sample frame piece is fixed in the 10 # groove, and the horn tail sample frame

piece is positioned with steel plate support. As shown in Figure 5.2.2:

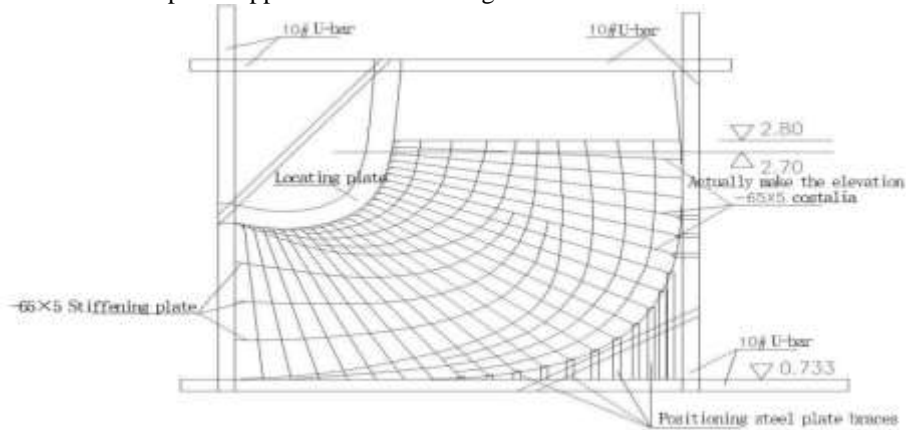


Figure 5.2.2 Establishment of trumpet inlet channel coordinate system

5.2.3 Surface steel plate

After the sample frame is fixed, check the quantity, size and relative position of the sample frame pieces, and install the surface steel formwork after the acceptance. The outer surface steel sheet thickness is 5mm. Because the inlet channel is a non-type structure, in order to ensure the smooth surface of the template and the linear shape meets the design requirements, the steel plate needs to be cut into multiple pieces, using the rolling plate machine processing, covered on the sample plate, and then use the manual fine shaping, so that the steel plate and the side of the sample plate all contact, and fixed by electric welding. The surface steel plate is connected with arc welding, and the weld joint is smoothed by polishing machine. As shown in Figure 5.2.3:



Figure 5.2.3 Steel plate cutting and cover

In order to facilitate the removal of the steel mold, the whole set of template is cut into multiple pieces, and each piece is fixed with bolts.

5.2.4 Surface treatment

The surface is first sandblasted for rust removal. At the same time, check the fixing condition between

each steel mold, and tighten the screw in the loose place. After the rust removal is completed, wipe the template surface with atomic ash 2~3 times, fill the plaster full and bond firmly, and then the paint is sprayed. The paint spraying range mainly covers the contact surface of the newly poured concrete. As shown in Figure 5.2.4:



Figure 5.2.4 Surface treatment of the steel plate

5.3 Installation and reinforcement of steel formwork

5.3.1 Installation of steel formwork

After the surface treatment of the steel formwork is completed, two simple supports are arranged inside (to prevent deformation in the lifting process) before the whole lifting is put in place. During the installation process, the measuring engineer uses the whole station and the level to control the three-dimensional position of the template installation, that is, the axis of the control steel mold is consistent with the axis of the design flow channel, so as to ensure that the flow channel and the design model are consistent after pouring and forming. If there is a slight deviation, the jack is used for fine tuning, and the template is reinforced after accurate placement.

5.3.2 Reinforcement and support of steel formwork

In order to prevent the deformation in the pouring process, the flow channel steel formwork is mainly supported by steel pipe, steel pipe using $\phi 48 * 3.5$ specifications. The four sides of the inlet are welded and fixed with 5 # groove steel. As shown in Figure 5.3.2-1:

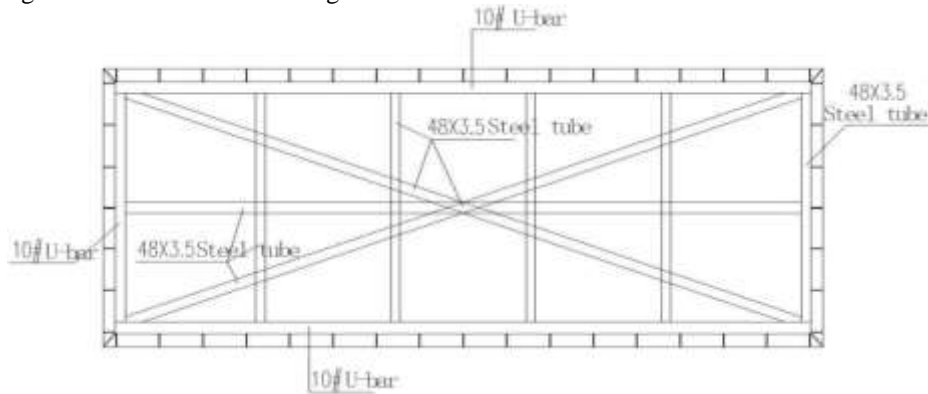


Figure 5.3.2-1 Reinforcement process at the inlet of the flow channel



Figure 5.3.2-2 Reinforcement method at the horn upper outlet

At the same time, in order to ensure the stability of the steel mold in pouring, 1m³ sandbag is arranged inside the steel mold before pouring to increase the weight of the template. At the back side, 2 φ 14 pulled steel bars are welded with the short steel bar embedded in the bottom plate, so as to prevent the counterclockwise rotation of the template due to the concrete buoyancy in the pouring process.

The tail of the steel formwork is welded with 10 # groove steel and supported on the bottom plate concrete oblique, so as to prevent the clockwise overturning of the steel formwork caused by concrete dumping and vibration during the pouring process.

5.4 Demolition of steel formwork

When dismantling, the steel supporting steel pipe and the fixed channel in the flow channel are removed first, and then the pin screw between each steel formwork is removed. After the steel formwork is cleaned up, the steel formwork begins to be removed. Because after the concrete pouring, the steel formwork is under the concrete multi-direction pressure, dismantled by the hand hoist, supplemented by artificial pry bar operation, demolition should pay attention to the protection of the original concrete, to avoid damage to the concrete surface.

After formwork, clean the residual paint on the surface in time, number it in sets and put it into storage. As shown in Figure 5.4-1,2:



Figure 5.4-1 Demolition of steel formwork, Figure 5.4-2 Effect after removal

VI. MATERIALS AND EQUIPMENT

The main tools are shown in Table 6.1.

Table 6.1 Main construction equipment

Order Number	Device Name	Unit Type	Unit	Quantity	Use
1	steel plate	5mm	T	8	Template making
2	veneer reeling machine	W11-12	short for Taizhou	1	Template processing
3	arc welder	50KVA	short for Taizhou	1	electric welding
4	tower crane	QTZ63	short for Taizhou	1	sling

VII. QUALITY CONTROL

7.1 Steel template

7.1.1 Horn flow formwork production is to ensure that the flow meets the requirements of the design line, meet the design flow, reduce the flow resistance important link, using the design steel template, should be the steel structure design, to ensure that it meet the requirements of the external dimension of the flow, the surface steel plate, internal support has the ability to bear the corresponding construction stage load, factory production, transportation, site installation should have the corresponding scheme.

7.1.2 The template making process is a key link of the overall quality control, which has a direct impact on the appearance and structure of the template. The main points of attention are as follows:

1, the trumpet template production process in strict accordance with the drawing size construction to reduce the production error;

2, the joints should be reduced as possible in the production process of horn formwork as far as possible, and the joint width should be reduced as far as possible, so as to effectively reduce the deformation of the formwork itself during concrete pouring.

7.2 Temperature control measures

Compared with the traditional brick mold and wood mold, the heat dissipation of steel mold is faster. In order to avoid the large temperature difference between inside and outside of the concrete pouring, the flow pipe inlet is closed with plastic cloth to reduce the temperature loss of concrete is too fast.

VIII. SAFETY MEASURES

8.1 Standard specifications to be implemented

Building Construction Safety Inspection Standard JGJ 59

Technical Code for Work Safety in Construction JGJ 80

Technical Specification for Construction Template JGJ162

8.2 Safety measures

8.2.1 Establish and improve the strict safety production responsibility system and safety management system, establish the safety production leading group headed by the project manager, and form an effective and perfect safety function system to ensure the construction safety and promote the smooth progress of the project. Do segment responsible, responsibility to the people.

8.2.2 Earnestly implement the relevant national policies and regulations on labor protection and production safety, do a good job in safety education and publicity, set up full-time security personnel and non-construction personnel, and shall not enter the construction site without permission.

8.2.3 Implement safety responsibility and implement responsibility management. The project manager is the first person responsible for safety and directly controls safety. The technical leader of the project shall disclose the safety technology and supervise the implementation of the safety measures. Find hidden dangers, eliminate in time, operators strictly implement safety standardization operations, nip in the bud, establish the idea of safety responsibility for all staff, and effectively achieve no safety accidents.

8.2.4 Each worker must pass three-level safety education, and special work such as electrician, electric welding, crane drivers and large power equipment operators.

8.2.5 During the construction, the construction personnel should wear gloves and rubber-soled shoes, and use safety articles such as safety nets when necessary.

8.2.6 All the selected machines and tools must be strictly checked, and the unqualified products are strictly prohibited.

8.2.7 During welding on site, special windscreen shall be made, and strict treatment measures such as spark connection shall be taken to prevent scald and fire, and welding operations shall not be carried out in the open air in rainy days. Welder must bring "2 he certificate" (welder operation certificate, fire permit), "one" (fire extinguisher), "one guard" (guardian responsibility disclosure). Inflammable and explosive articles must be removed in gas cutting places, and the storage distance between acetylene gas and oxygen shall not be less than 2m, and both shall not be less than 10m when used.

8.2.8 Template installation and removal should set up full-time safety officers to be responsible for safety work, widely publicize the idea of safety first, seriously conduct safety education and safety disclosure, and improve the safety awareness of all staff.

8.2.9 The formwork installation and removal sequence and safety technical measures shall be implemented according to the construction technical plan.

8.2.10 The installation template operator should wear safety helmet and fasten safety belts when working at height. Before the formwork and support system are fixed, it is strictly prohibited to use the pull rod to lift and lift people.

8.2.11 When the formwork is removed, the concrete strength shall ensure that the surface and edges will not be damaged by the formwork; gently remove the formwork from the concrete surface to prevent the concrete.

IX. ENVIRONMENTAL PROTECTION MEASURES

9.1 Establish a construction environmental protection leading group, operate in strict accordance with the GB / T2400 / -2004 environmental management system and national and local laws, regulations and rules concerning environmental protection, and strengthen the control and treatment of domestic sewage, solid waste, dust and soil erosion.

9.2 Strengthen environmental protection education, publicize relevant environmental protection policies and knowledge, strengthen employees' awareness of environmental protection, and make environmental protection become the conscious behavior of construction personnel.

9.3 Choose low noise machinery and equipment, so that the construction noise and vibration reach the construction site boundary environment standards, the operation time strictly follow the relevant regulations, 8 p. clock to 6 a. m. do not arrange the construction, to ensure the rest of the surrounding people, and prevent the occurrence of safety accidents.

9.4 Waste waste oil involved in the construction to prevent "running, running, dripping and leakage"; collect and clean the discarded accessories and scraps in time.

9.5 Adhere to the supervision and inspection system, the project department full-time safety officer, the construction site safety, civilized, environmental protection facilities, measures implementation, daily inspection, inspection, found problems timely remind attention or order rectification.

9.6 Construction waste in the construction site shall be cleaned up in time and transported to the designated place for proper treatment. The materials and equipment in the construction area shall be placed in an orderly manner. After completion, the site shall be cleaned up in time and the materials shall be cleared after work.

9.7 During the construction of the project, the noise, dust, vibration, waste water, waste oil solid waste and household waste shall be comprehensively controlled to prevent the environmental pollution and damage near the construction area caused by the construction.

9.8 Construction should be "cleared after work". After the completion of the construction, the corner waste will be collected together and placed in the designated stacking area (there must be sealing measures or covering measures) to avoid foam flying everywhere and cause "snowflake pollution".

9.9 Strengthen inspection and supervision, strict requirements, perseverance, to regularly (once a month) and irregular way to the construction site for environmental protection, civilized construction inspection, control score, strict rewards and punishments, exchange experience, insufficient, strive for a safe and civilized construction site.

9.10 Equipped with sprinkling facilities, and sprinkle the construction road regularly every day. In the construction peak period, construction roads, temporary living and office areas and nearby residential areas and dry weather season, depending on the road dust situation, increase the number of sprinkling, to avoid the dust pollution to the surrounding air.

9.11 Arrange a reasonable number of garbage collection facilities, and be more than 30m apart from the canteen or water source. It should be designed according to the sanitary requirements, equipped with tap water, lighting and other facilities, and with good ventilation and lighting conditions.

X. BENEFIT ANALYSIS

The construction method of combined steel formwork of sewage treatment pump station is suitable for the construction of large volume variable section concrete. The process has the characteristics of advanced technology, simple equipment, convenient operation, reduced cost, shortening the construction period, easy transportation and so on, and has remarkable economic benefits. Compared with the traditional wood mold construction methods, the economic benefit analysis is shown in the following table (each set):

Economic benefit analysis sheet of single set steel formwork (compare only)

Wood mold construction scheme (20 days per set of installation and removal)	Steel formwork construction scheme (14 days per unit for installation and removal)
1, sample frame piece production (wood) 4.5m³3600 yuan / m³ =16200 yuan 2, sample frame removal: 3,50 yuan / worker, 15 workers = 5,250 yuan	1. Single set of steel mold 8,400 yuan / t×1.9t=15960 yuan 2. Template removal RMB 3,50 yuan / worker, 6 workers = RMB 2,100 yuan 3, I-steel, steel pipe and other rent 200 yuan The total is 18260 yuan, because the residual value is 50%.
Total of 21,450 yuan	Total of 9,130 yuan

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