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KEY CONSTRUCTION TECHNOLOGY OF STONE-LIKE CONCRETE HANGING PANEL CURTAIN WALL

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Abstract: As an important building decoration material, concrete hanging board is widely used in modern building exterior wall decoration with its excellent physical properties and beautiful decorative effect. This paper aims to explore the key technologies in the construction of concrete hanging board, including material selection, prefabrication process, installation technology and quality control, so as to improve construction efficiency and project quality and ensure the beauty and durability of the building.
Keywords: Concrete hanging board; Construction technology; Prefabrication process; Installation technology; Quality control

INTRODUCTION

Concrete panels have gradually become the mainstream material for modern building exterior wall decoration due to their high strength, durability and diverse surface treatment effects. However, the construction technology of concrete panels is complex and involves multiple links. It must be carefully planned and implemented in terms of material selection, prefabrication, on-site installation and quality control to ensure the final project quality and decorative effect.

1 PREPARATION OF IMITATION STONE CONCRETE PANELS

The production process of this project is casting molding, and the production process flow is as follows Figure 1:

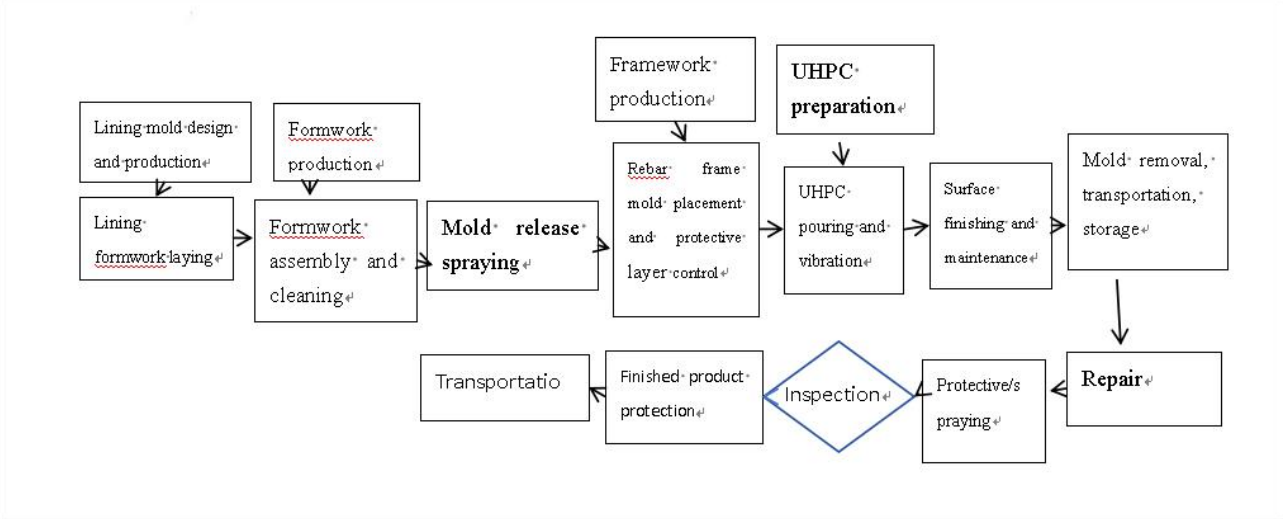

Figure 1 Production Process Flow Chart

1.1 Preparation before Production

Prepare the necessary tools such as mud trowel, rubber bucket, water scoop, brush, electronic scale, hopper, slurry transport vehicle, etc.
Check whether the raw materials are complete and whether the measuring instruments are calibrated.
Check whether the mixing system is operating normally.
Check the mold and confirm whether it meets the requirements for starting work.
Check whether the embedded parts are installed properly, and whether the specifications, models and placement dimensions are consistent with the requirements of the drawings.

1.2 Mold Making

Flow chart of mold making process can be seen in Figure 2.

Figure 2 Flow Chart of Mold Making Process

1.3 Casting process

1.3.1 Making UHPC casting material

1) Formula: Use Subot UHPC powder, supporting additives and fibers, etc.Casting material ratio values can been seen in Table 2.

Table 2 Casting Material Ratio Values

	Powder	water	Water reducing agent	fiber6mm	fiber12mm	Steel Fiber
Ingredients ratio	80	7.44	0.96	0.72	0.72	3.2
Quality Ratio	100	9.3	1.2	0.9	0.9	4
1cube（kg/m³）	2093	194.6	25.12	18.84	18.84	83.72

2) Slurry mixing

Mix the weighed water (use ice water when the room temperature reaches above 25℃), water reducer and defoamer in a container. Turn on the mixer, add the weighed UHPC dry powder mixture into the mixer and stir, and start the timer at the same time. After the dry material is stirred for about 2 minutes, add water, water reducer and other mixtures at one time with the mixer turned on, and continue to stir until a uniform flowable state appears. This process takes about 5-6 minutes. Then sprinkle the weighed fiber with the mixer turned on. This process takes a long time to operate, so don't be anxious. The fiber must be spread evenly and there must be no fiber clumping. If the fiber is spread on the stirring wing during the fiber spreading process, notify the operator to stop the mixer, quickly scrape the fiber on the wing into the slurry, and then turn on the mixer to continue stirring until the fiber and slurry are fully mixed. This process takes about 6-8 minutes. Finally, stop the mixer to measure the material temperature and viscosity. The material temperature is tested using an inserted electronic thermometer and should be controlled within the range of 20-22°C in summer and autumn.Slurry mixing construction drawing can be seen in Figure 3.

Figure 3 Slurry Mixing Construction Drawing

1.3.2 Casting slurry

First, put the mixed slurry from the mixer into the special slurry transport hopper, then quickly transport the slurry to the production operation surface at the fastest speed and quickly pour the slurry into the mold. According to different mold

shapes, first select the discharge position, open the discharge port under the hopper for rapid discharge. At the same time, the height between the discharge port and the mold surface should be controlled well, generally within the range of 500-600mm. After the entire product is cast, the operator should quickly wipe and clean the residual slurry on the mold surface. Finally, the quality personnel should check the size of the embedded parts and the overall thickness of the product. If any problems are found, notify the production operator in time to correct them to ensure that all parameters of the product are consistent with the requirements of the drawings.

1.5 Preliminary maintenance

After all the above work is completed, the wet curing agent should be sprayed on the back of the product immediately. The wet curing agent is diluted with propylene emulsion, and the dilution ratio is propylene emulsion: water = 1:3. When spraying, it is mainly on the visible surface of all products. Then cover with colored strips and plastic film for static curing.

1.4 Demolding

1.4.1 Demolding time

UHPC components can only be demolded when they reach a certain strength, so that they can have sufficient strength during demolding and transportation, and reduce the edge and corner damage caused by insufficient strength. Under normal circumstances, when the temperature is 20℃, UHPC components should be demolded after 12 hours.

1.4.2 Demolding method

When demolding, every detachable part of the mold should be removed, and large components should be assisted by a lifting device. The specific demolding method should be determined according to the shape of the mold in production. The demolding of the product can also be set up with necessary demolding hooks during product production as needed. If the steel frame is carried, the position of the demolding hanging point needs to be determined according to the engineer's advice.

After demolding is completed, check whether there are cracks at the demolding point (stress concentration area) and whether the embedded parts used to help demolding are loose. If there are these defects, they should be repaired in time.

1.5 Curing and Storage

After the product is demolded, it is placed on a special shelf and transported to the curing area for further curing.

2 INSTALLATION OF STONE-LIKE CONCRETE HANGING PANEL CURTAIN WALL

2.1 Construction Preparation

Before construction, a detailed site survey should be conducted to formulate a reasonable construction plan to ensure the completeness and safety of lifting equipment, scaffolding and other tools.

2.2 Installation and Fixing of Hanging Panels

2.2.1 Installation of supports and thermal insulation and waterproof materials

In figure 4 and 5, when hanging panels, the support system must be installed first. This support is a conventional screw form, which can achieve three-dimensional adjustment for the panel, and the operator can adjust it at the top. The site plans to use a boom truck to install the support and thermal insulation rock wool.

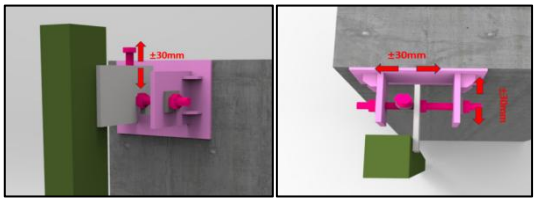

Figure 4 Three-dimensional Adjustment Display

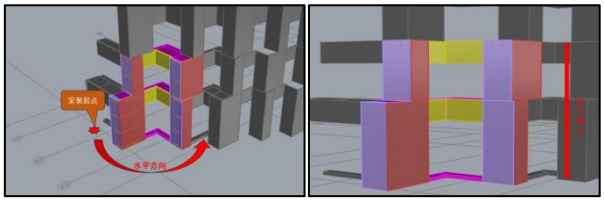

Figure 5 Schematic Diagram of the Installation Direction Sequence

2.2.2 Construction methods and measures for various types of panels

1) Installation steps for L-shaped panels, U-shaped panels, and beam side panels

① The tower crane/truck crane moves the panel to the target position 0.5m away from the structure.
② The operator hangs the manual hoist hook on the panel lifting point and tightens the steel cable. The hand chain hoist is fully stressed and releases the tower crane/truck crane rope.
③ The operator adjusts the hand chain hoist steel cable to connect the lower ear plate of the panel with the bracket hanger, and after accurately adjusting the position of the panel, locks the upper connection component.
④ The installation is completed.
Manual hoist installation can be seen in Figure 6 and Connection nodes of upper and lower parts of hanging board can be seen in Figure 7.

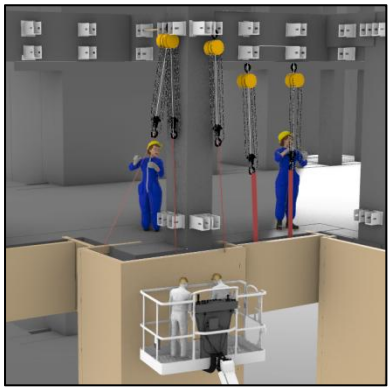

Figure 6 Manual Hoist Installation

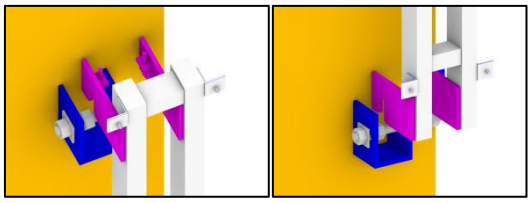

Figure 7 Connection Nodes of Upper and Lower Parts of Hanging Board

2) Column side plate installation steps
①Fix the fixture and column side plate firmly on the ground.
②The truck crane lifts the plate assembly to the target position.
③The operator adjusts the assembly to connect the lower ear plate of the plate with the bracket hanger, and after accurately adjusting the position of the plate, locks and installs the assembly.
④Installation completed
Measures: Truck crane, truck crane + fixture, straight arm truck
Assembly lifting can be seen in Figure 8.

Figure 8 Assembly Lifting

3) Installation steps of ceiling panels
① Use a construction hoist or tower crane/truck crane to transport the panels to the floor through the north and south window openings.
② Transfer the beam bottom plate to the platform and use a hydraulic forklift to lift the hanging plate to the target position at the bottom of the beam.
③ The operator connects the inner ear plate of the plate to the keel hanger and the outer connecting component locks.
④ Installation is completed.
4) Installation steps of beam cover plates and benches
① Use a construction hoist or tower crane/truck crane to transport the panels to the floor through the north and south

window openings.

② Use a hydraulic forklift to lift the hanging plate and transfer it to the target position on the top of the beam.

③ The operator locks the plate according to the specified node connection method.

④ Installation is completed.

3 QUALITY CONTROL

In order to strengthen the quality control of construction projects and clarify the focus of quality control at each construction stage, the quality of construction projects can be divided into three stages: pre-control, in-process control and post-control.

4 BENEFIT ANALYSIS

4.1 Environmental Benefits

① Saves natural stone and has no radioactivity

② Better thermal insulation properties

4.2 Social Benefits

The use of mature reinforced concrete structure for plate processing and installation connection is safer and more reliable than stone, and can make larger specifications and more shapes of plates, with good overall decorative effect and fewer joints.

5 SUMMARY

The construction technology of imitation stone concrete hanging board is complex, but as long as strict control is exercised in material selection, prefabrication process, installation technology and quality control, the decorative effect and durability of the hanging board can be ensured. By continuously summarizing and optimizing construction experience, the technical level and engineering quality of concrete hanging board construction can be further improved.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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