

# Integrated Construction Technology of Large-Scale Floor Structure and Decorative Surface

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**Abstract:** In order to solve the many deficiencies in the construction method of secondary pouring of large-scale floor decoration surface layer, this paper proposes the integrated construction method of large-area floor plate structure and decorative surface layer, and clarifies the principle, main technological process and quality of construction process of this construction method. Control points, on the basis of comparison with the traditional secondary pouring method, the advantages of the integrated construction method are clarified. The research results show that the integrated construction method can save cost and construction period, and can achieve that the surface layer after construction is not hollow, cracked, flat, wear-resistant, and dust-free. The construction process is low-carbon and environmentally friendly, and it is worthy of follow-up. It is popularized in the construction of large-scale floor decoration surface layer.

**Keywords:** Floor structure, Decorative surface layer, Integrated construction, Quality control.

## 1. Introduction

Warehousing is an important part of modern logistics and plays a vital role in the logistics system. Efficient and reasonable warehousing can help manufacturers speed up the flow of materials and reduce costs, so as to achieve effective control and management of resources. Considering the large-area characteristics of the logistics and storage floor structure and decorative surface, the construction is time-consuming and the construction cost is also high [1]. The traditional decorative surface layer construction generally adopts the secondary pouring method. First, the construction of the floor structure is carried out. After the structure is capped, the base layer cleaning, the construction of the bonding layer, the construction of the leveling layer, and the secondary pouring of the decorative surface layer are carried out [2]. Combined with the construction process of the secondary pouring method, it can be seen that this construction method mainly has many shortcomings: ① The long construction period leads to a long construction period. The construction of the floor structure is carried out first, and the secondary pouring of the decorative surface layer is carried out after the structure is capped. After the pouring is completed, a long period of maintenance and other construction procedures are required. The long construction period of the whole process results in a long construction period for the entire project [3]. ② The construction cost is high. The pouring construction of the decorative surface layer of the floor structure first, the amount of concrete is large, and the cost of engineering materials is high. The secondary pouring construction has complex procedures, difficult on-site operation, and high labor costs [4]. ③ Construction quality is difficult to be effectively guaranteed. The secondary pouring method is used for the construction of the decorative surface layer. If the quality control of the construction process is not appropriate, the deformation of the floor structure and the decorative surface layer will easily occur during the use period, resulting in problems such as cracking of the decorative surface layer. ④ The construction operation is more difficult [5]. Before the second pouring, it is necessary to clean up and level the base

layer, and there are many construction procedures, resulting in time-consuming construction operations and low production efficiency. ⑤ Environmental pollution. Before the second pouring, it is necessary to carry out grassroots cleaning and leveling. These processes will inevitably cause dust pollution and damage the health of the workers; the second pouring operation is a wet operation, which will inevitably cause water pollution.

In order to effectively avoid many shortcomings of the secondary pouring method, this paper proposes an integrated construction method of large-area floor slab structure and decorative surface layer, and clarifies the principle, main technological process, and quality control points of the construction process. Based on the comparison of secondary pouring methods, the advantages of the integrated construction method are clarified. In order to facilitate the promotion of this construction method in subsequent similar projects.

## 2. The Principle of Integrated Construction Method

After the floor formwork and steel bars are installed and accepted, the vertical components such as wall columns and other vertical components are poured first. After a certain technical interval is reached, the floor structure concrete is poured. First, rough leveling manually, and then use a laser leveling machine for secondary leveling. , vibrating and leveling, and manually cooperate to close the edges; spray the hardener evenly before the initial setting of the concrete, and use a grinder to grind and finish to make the hardener fully fuse and solidify with the concrete; cover and maintain for not less than 14 days, and do a good job Finished product protection.

After the construction of the main structure is completed, the ground is trimmed, and the hardened ground is ground multiple times with different mesh grinders to further improve the flatness and gloss of the ground. After cleaning and drying, dust removal and spray curing agent.

### 3. Main Process Flow

#### 3.1. Construction Process

Formwork installation → hoisting PC board → steel bar laying and pipeline installation → pouring concrete → ruler scraping → leveling and grouting again → floor maintenance → base surface treatment → curing agent construction.

#### 3.2. Key Points of Construction Operation

##### 3.2.1. Template Installation

According to the design and calculation requirements, the support formwork is erected, the periphery and the beam position are covered with diagonal braces, the first horizontal bottom surface and the top surface are horizontal scissor bracing, and horizontal pocket nets are laid. The template is set up on site according to the template scheme, and the sub-warehouse line is popped up according to the design requirements, and is clearly marked. Elevation control points for on-site concrete pour construction are identified and marked.

##### 3.2.2. Hoisting PC Board

Before hoisting the PC board, a sponge strip should be posted around the formwork to prevent the concrete from leaking. The PC floor slabs are hoisted by partitions according to the PC board number, and a special person is arranged to adjust the steel bars reserved for the PC board into the beams.

##### 3.2.3. Rebar Laying and Pipeline Installation

Carry out the rebar binding work according to the drawing requirements. Before tying, do a good job in the positioning of the steel bar, and draw the line for the installation position of the steel bar. Considering that the later cutting seam will cut the steel bars, when laying the steel mesh, the steel bars are broken at the longitudinal and horizontal separation seams. When binding structural components with complex shapes, the finished mesh should be cut in advance. Special personnel are used to watch the reinforcement and other measures to ensure that the reinforced mesh has an anti-cracking effect. For the lap joints bound by steel bars, the thickness of the concrete protective layer of the stressed steel bars shall meet the requirements of the specifications and design documents. Concrete can be poured only after the reinforced mesh has been bound and qualified. Before the concrete is poured, the surface of the board shall be cleaned and wetted with water, but there shall be no stagnant water. The electromechanical pipelines shall be installed and fixed according to the design drawings before the gluten binding.

##### 3.2.4. Placing Concrete

1. When the concrete is poured, the elevation control steel bar shall be controlled with a line. After the concrete pouring is completed, the concrete elevation shall be 1cm~2cm higher than the finished surface. After leveling with a laser leveler, the flatness can be controlled at 3mm/3m.

2. As shown in Figure 1, use a small laser leveler for paving and leveling. The leveler laser transmitter is installed on the tower crane column or the adjacent building structure that has been poured. It is strictly forbidden to install the leveler laser transmitter on the structural template.



Figure 1. Laser Leveling

##### 3.2.5. Scraping with Ruler

After preliminary leveling with a laser leveler, check the flatness of the concrete surface with a ruler. As shown in Figure 2, first use a 6m long ruler to level the whole level, and then use a 3m long ruler to check the flatness of the concrete surface. When checking, the ruler is placed on the concrete surface. When the bottom edge of the ruler is away from the concrete surface, the maximum is  $\leq 1\text{mm}$ . qualified. Before scraping, first place the ruler on the concrete surface, hold it with both hands near the middle of the ruler, press down with both hands during scraping (the strength of both hands is even), and then drag the ruler back and forth to scrape. During the leveling process, the ruler is scraped vertically and horizontally. When shaving in one direction and the other side, the ruler extends into the previous shaving range for a distance of  $\geq 0.5\text{m}$ . When the local height difference is large, use a shorter ruler to rub and scrape. During the whole scraping process, the force of both hands must be uniform, so that the ruler is always scraped in a horizontal position. If the concrete is uneven, it should be leveled with a 1:2 cement mortar mixture.

For the first time of manual scraping, a 6m scraper must be used, and a 3m scraper should be used where the 6m scraper cannot be constructed. Use a 3m scraper for the second time, and then use a 2m scraper for subsequent scraping. Scraping makes the flatness of the entire construction surface meet the requirements.



Figure 2. Scraping with ruler

### 3.2.6. Smooth the Pulp Again

Before the initial setting of the concrete, the hardener is evenly sprayed, and the grinding machine is used for grinding and polishing, so that the hardener can be fully integrated and cured with the concrete. After the concrete is leveled, use a single-disc and double-disc trowel to trowel. As shown in Figure 3, install the leveling disc, and level it repeatedly when the concrete is bleeding and initially setting, until the concrete slurry is raised. The vertical and horizontal directions run parallel to each other at a constant speed.



Figure 3. Polishing and pulping

### 3.2.7. Floor Maintenance

(1) The back layer of the trowel is still messy. In order to eliminate the disorder of the trowel, a thin steel trowel is used to manually calender the surface layer in an orderly and in the same direction to complete the finishing process.

(2) After the construction of the floor is completed, a cordon will be set up on the site to prohibit other types of workers from entering the newly completed floor area.

(3) As shown in Figure 4, the floor maintenance can be performed with geotextiles and wooden formwork. The maintenance should be followed up after the final setting of the concrete to ensure that the concrete surface is wet. To avoid cracking caused by drying too fast, the curing time is not less than 14 days.

(4) Strictly control the maintenance time for the floor surface layer, and prohibit material cutting, stacking, and entry of various types of vehicles (including forklifts, climbing trucks, etc.) within 14 days of the maintenance period.



Figure 4. Maintenance

### 3.2.8. Basic Treatment

Recycle the template and geotextile, remove the dust and stains on the ground, and use oxalic acid cleaner to wash and grind the base surface for many times according to the condition of the base surface to remove the efflorescence phenomenon.

### 3.2.9. Curing Agent Construction

(1) Coarse grinding 1: The 50# water-grinding sheet is crossed twice horizontally and vertically with water-grinding to remove the ground cement residue, ash and sand layer, and

grind to the same rough surface.

(2) The first penetration of the curing agent: After the ground is completely dry, according to the amount of curing agent of  $0.20 \text{ kg/m}^2 \sim 0.25 \text{ kg/m}^2$ , use a sprayer to evenly spray the liquid curing agent material twice on the dry base surface. The dust pushes and rubs hard to make the curing agent spread and penetrate evenly. Practice shows that the grinding effect is better after the curing agent penetrates for 8 hours.

(3) Coarse grinding 2: Use a 150# water-grinding sheet to grind with water twice horizontally and vertically, repair the scratches left by the previous process, and grind it to the same rough surface.

(4) Fine grinding 1: Use a 300# water-grinding sheet to grind with water crosswise twice horizontally and vertically to remove the traces left by the previous grinding sheet, and grind the ground until it is fine and smooth.

(5) Fine grinding 2: Use a 500# water-grinding sheet to cross the water-grinding twice horizontally and vertically to remove the traces left by the previous grinding sheet, and grind the ground until it is fine and smooth.

(6) Polishing 1: As shown in Figure 5, use a 500# dry grinding sheet to cross it twice horizontally and vertically, and dry it until the ground is matte.

(7) Second penetration of curing agent: After the ground is completely dry, according to the dosage of curing agent of  $0.20 \text{ kg/m}^2 \sim 0.25 \text{ kg/m}^2$ , use a sprayer to evenly spray the brightener material twice on the dry base surface, and make it osmotic reaction. Continue to polish the base surface after 5 hours of complete penetration.

(8) Polishing 2: Use a 1000# polishing sheet to cross it twice horizontally and vertically, and dry it until the ground is smooth.

(9) Polishing 3: Use a 2000# or more polishing sheet to cross it twice horizontally and vertically, and dry it until the ground is clear and bright.

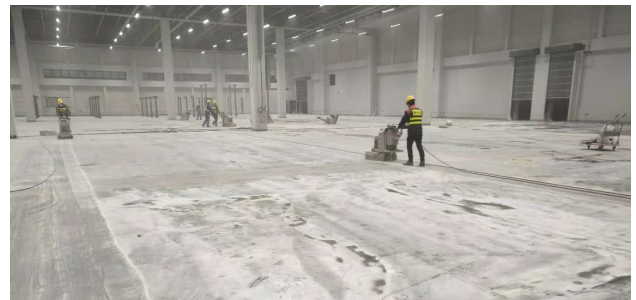


Figure 5. Polishing

## 4. Quality Assurance Measures

### 4.1. Control Points

(1) Control the spreading of wear-resistant materials

To ensure the good bonding between the wear-resistant material and the cement concrete base and the color of the floor is consistent, mainly to control the spreading timing of the wear-resistant material and the spreading amount per square meter. The spreading should be selected at the initial setting stage of the concrete, and the spreading amount per square meter should be To achieve uniform spreading by spreading twice, the spreading amount is  $\geq 5 \text{ kg/m}^2$ .

(2) Prevent wear-resistant floor cracks

Preventing shrinkage cracks in wear-resistant floors is mainly to control two aspects: First, control the dryness of the concrete surface before spreading the wear-resistant material.

Shrinkage cracks. The second is to cut the expansion joint in time, 2 days after the cement concrete is poured, that is, 1-2 days after the wear-resistant floor is completed, and it will not work if it is later.

### (3) Control the flatness of floor construction

The flatness of the floor construction is mainly controlled by the flatness of the cement concrete base, and the wear-resistant material is only a dense layer with a thin surface, so controlling the flatness of the surface before the initial setting of the concrete is a key process. The flatness of the cement concrete must be strictly controlled. This project uses a special laser leveling machine for paving construction, and the parts that cannot be used are leveled with a screed bar. In addition, at the construction joints adjacent to the two concretes, because it is close to the construction joint template, the trowel is not easy to polish when the floor is polished and formed, so it is easy to cause a height difference at the construction joints. Therefore, the construction joint cleaning work should be carried out after the formwork is removed. The method is to use a cutting machine to cut the concrete with a width of 50mm and a depth of about 50mm along the elastic line of the construction joint, and chisel it off before the second pouring concrete, so as to ensure that the second pouring concrete and the already poured concrete are level. Straight, pay attention to the elastic line, cutting should be straight.

## 4.2. Basic Measures

### (1) Make a good disclosure

For each process, type of work, and the operation team, make in-depth and detailed disclosure, do a good job in the disclosure of drawings, and decompose the drawings, so that the field operators can understand the design intention, technical requirements and process standards of the process they undertake. For each sub-project, in combination with the relevant national process standards, make a good process disclosure to the workers. For each sub-item project, the quality of each operation team is disclosed, so that each participating employee can understand the relevant quality standard requirements of the country in which they work.

### (2) Implement quality listing system

Do a good job of process identification, publicity templates, and ensure the traceability of the responsible person for quality problems, operation time, and causes.

### (3) Model guide

Before the start of each sub-project, workers and masters with high technical level and strong sense of responsibility should be invited to make models, and relevant teams should be invited to observe and explain the relevant technical points and process methods in detail.

### (4) Self-inspection, mutual inspection, handover inspection

Quality activities make every operator and manager realize their position in the quality management system, form a good atmosphere and atmosphere in which everyone talks about quality, talks about quality every day, and talks about quality in everything, so that quality problems can be eliminated in the team, Destroyed in the bud. The quality problem of this process has not been solved, and it will never enter the next process.

### (5) Data can be traced back

The quality of data and construction data are the records of the entire project construction, and at the same time can effectively guide the construction. The project department is equipped with qualified and high-level data personnel to be

synchronized with the construction production, timely, accurate, organized and standardized to organize the construction data. , and must implement the functional responsibility system for data quality.

### (7) Adhere to the quality inspection and award system

Implement the system of quality inspection and inspection and daily inspection of the construction site. For the problems found in the inspection, they must promptly order and supervise the rework, fill in the quality problem notice, send it to the team and ask for a receipt. If the matters ordered to rework are delayed or criticized by the owner's supervision, supervision station, and design institute, the person responsible for rectification is required to be resolutely fined, supervise the rework, and review their technical qualifications. Even transferred from technical positions.

### (8) Construction during rainy season

Construction measures for concrete wear-resistant engineering during rainy season: try to avoid concrete pouring and ramming during heavy rain. If it is unavoidable, use concrete to adjust the mix ratio and appropriately reduce the amount of water added. The vibrated concrete should be covered with plastic film/color strip cloth in time, and then covered with wooden boards to avoid rain erosion and affect the quality of concrete pouring and tamping. The pouring operation should be carried out in time after the rain stops. When using electrical equipment in the open air, there must be reliable leak-proof measures.

## 5. Safety Measures

### (1) Strictly implement various safety systems

Strictly implement the relevant safety responsibility system, safety education system, safety facility acceptance system, safety inspection system, safety production rules and regulations and various safety measures, make safety disclosures at all levels, and strengthen safety education and safety inspection.

### (2) Post-training with a certificate

All operators participating in the construction must pass the safety technical operation training before entering the site for construction. Electricians, welders, crane drivers, crane commanders and other special types of work must hold an operating license to work, and it is strictly forbidden to work without a license.

### (3) Equipped with full-time security officers

According to the construction characteristics of the project, the full-time safety personnel will conduct on-site safety inspections frequently in combination with the safety production system and relevant regulations.

### (4) Regular inspection of construction machinery and tools

The performance of the tools used in construction should be checked regularly, especially the force-bearing tools should be complete to prevent accidents such as slippage and slippage.

### (5) Strictly manage large-scale machinery

A special system should be established for the use and management of large-scale machinery, and a special person should direct the operation. The driver operates according to the command of the commander, and the command must have a special signal. The safety limit device should be checked every day before the shift to see if it is sensitive and reliable, and it should be checked and maintained regularly according to regulations. Conscientiously implement the management regulations of the machinery and the regulations on regular inspection, repair and maintenance, and frequently test

whether its performance is normal according to the technical regulations of the machinery itself.

(6) Ensure the safety of electricity use

The power tools used must meet national standards. Construction site machinery and electrical safety management regulations and various inspection systems must be established at the construction site. During construction, electromechanical workers should be on duty day and night to deal with electromechanical failure accidents. Non-professional personnel are not allowed to touch electromechanical equipment. The total power distribution, lines, lighting, power and grounding protection devices in workshops and on-site must meet the relevant technical requirements of the Ministry of Construction's "Technical Specifications for Temporary Electricity Safety at Construction Sites". Electrical workers must wear protective equipment and hold certificates.

## 6. Features of Construction Technology

The characteristics of the integrated construction method of logistics and storage floor structure and decorative surface layer are:

**Save cost and construction period:** Reduce the original design of 80mm thick building surface to 20mm thick, and adopt the integrated construction technology of building decorative surface layer and floor structure, less construction difficulty and less labor required for construction, less concrete consumption, and lower engineering costs. Compared with the secondary pouring method, the construction period of the integrated construction technology of the logistics storage floor structure and the decorative surface layer is shorter.

**No hollowing and no cracking:** the integrated construction of the structural surface layer and the building surface layer improves the bonding strength between the structure and the surface layer, and avoids the hollowing and cracking of the surface layer due to the secondary construction of the surface layer, which leads to poor adhesion. , affecting the use of functions.

**High ground flatness:** mechanized leveling, vibrating and leveling construction, the ground flatness can reach 2m and the error is not more than 3mm.

**Wear-resistant and dust-free:** After the integrated construction of the structural construction and the surface layer has been completed, to achieve a certain strength, first grind, and then spray the sealing curing agent, which can enhance the wear resistance and strength of the ground; the concrete strength is increased by 40%, and the wear resistance is improved. 50%.

**High degree of mechanization:** The material storage is

generally large-span and large-bay, and the structural construction and the surface layer are integrated, which is convenient for the construction of modern unwinding, vibrating and leveling machinery, reduces labor input, and avoids manual unwinding, vibration and light harvesting. At the same time, it can reduce the input of labor and further save the cost of the project; at the same time, the mechanized operation has high efficiency, which can effectively guarantee the progress of the project.

**Low carbon and environmental protection:** The original design of 80mm thick building surface layer is reduced to 20mm thickness, which can reduce the amount of concrete and meet the low-carbon requirements of national policies; the use of integrated construction technology avoids floor cleaning and secondary pouring of the surface layer, which can avoid the grassroots Dust pollution caused by cleaning and water pollution caused by secondary pouring are in line with the guidance and requirements of national environmental protection policies.

## 7. Conclusion

This paper puts forward the integrated construction method of large-area floor structure and decorative surface layer, and clarifies the principle, main technological process, and quality control points of the construction process. advantages of chemical construction methods. The research results show that compared with the traditional secondary pouring method, the integrated construction method can save cost and construction period, and can achieve that the surface layer after construction is not hollow, cracked, flat, wear-resistant, and dust-free. The process is low-carbon and environmentally friendly, and it is worth promoting in the subsequent construction of large-scale floor decoration surface.

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