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OVERALL FLOOR FLATNESS CONTROL TECHNOLOGY FOR ULTRA-LONG AND ULTRA-LARGE EXHIBITION HALLS

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Abstract: With the continuous development of modern construction technology, the demand for the construction of super-long and super-large exhibition halls is increasing. The flatness of the exhibition hall floor directly affects the display effect and usage function. Therefore, higher requirements are put forward for the control technology of floor flatness. This paper studies the flatness control technology in the construction process of super-long and super-large exhibition hall floors, and studies a customized special adjustment bracket to fix the floor armor seam and cooperate with laser or optical level to accurately measure and control the floor flatness.
Keywords: Super-long and super-large exhibition hall; Floor flatness; Control technology; Construction process

INTRODUCTION

Due to their unique spatial requirements, ultra-long and ultra-large exhibition halls have strict requirements on the flatness of the floor. The flatness of the floor is not only related to the beauty of the exhibition hall, but also directly affects the display effect of the exhibits and the visitor's experience. Therefore, the study of the control technology of the flatness of the floor of ultra-long and ultra-large exhibition halls has important practical significance [1-2].

1 PROJECT OVERVIEW

The first phase of the Hangzhou Convention and Exhibition Center project covers an area of about 360,000 square meters, with a total construction area of 643,200 square meters, a ground construction area of 423,500 square meters, and an underground construction area of 219,700 square meters. It consists of a ground garage and 8 exhibition halls, 2 login halls, a central corridor and some outdoor exhibition areas. The underground project is a reinforced concrete frame structure, and the ground structure is a large-span steel structure.

2 CONSTRUCTION METHODS

In actual construction, different methods need to be applied in combination with actual conditions and engineering construction experience. For example: plane overall partition construction method, split-seam skipping construction method. The width of the split-joint jump-bin is 6 m, and the smallest interlayer unit is 6 m×6 m or 4 m×6 m. In order to prevent local settlement cracks and surface temperature cracks in the floor, the compaction degree of the concrete surface layer is controlled first, and then a double-layer bidirectional steel wire mesh is configured in the floor. The bottom layer is HRB400 grade 5mm diameter steel wire mesh with a spacing of 200mm, and the concrete protective layer thickness is 45mm. The upper layer is HRB400 grade 2mm diameter steel wire mesh with a spacing of 200mm and a concrete protective layer thickness of 30mm. The bottom layer of steel wire mesh is laid in sections and overlapped at the jump-bin casting joint to prevent local uneven settlement and deformation of the ground. The upper layer is continuously overlapped in the unit block, and the separation joints are disconnected to prevent cracking of the ground. The concrete pouring adopts the rail leveling strip jump-bin method for construction [3].

3 CONSTRUCTION TECHNOLOGY

3.1 Guide Rail

Guide rails are generally made of 50×20 (wide) channel steel or 50×25 square steel pipe. The width should be narrower, otherwise the steel bar protective layer will be too thick. The spacing between the guide rails should be determined according to the width of the concrete to be poured, but it should generally be less than 4 meters; the guide rails are fixed with a tripod with a Φ12 screw rod, and the tripod spacing should be less than 1000 ㎜; the guide rail surface level is controlled and measured with a level. The guide rail is adjusted by two nuts that fix the channel steel with a Φ12 screw rod. During the construction process, the level of the guide rail should be checked once in a while for timely adjustment.

3.2 Concrete Pouring and Vibration

Before concrete construction, the floor concrete mix ratio is designed: according to the local material characteristics, working conditions, and weather conditions in Hangzhou, the material manufacturer that provides the overall floor system pre-concrete trial mixing in a fixed laboratory until the trial mix concrete meets the requirements, and then submitted to the mixing station for processing according to the trial mix requirements.
Just like Figure 1, the trial mix of concrete for flooring added a multi-phase composite material - steel fiber: the content of steel fiber per kilogram was about 4,600 fibers, and 10-15 kilograms per cubic meter of concrete. The steel fiber distribution density was extremely high, which fully changed the brittleness of concrete, improved the toughness and ductility of the concrete slab, and increased the allowable bending deflection of the slab. The steel fiber was distributed in three dimensions in the concrete from the bottom of the floor to the entire cross-section, which can reinforce the concrete from all directions. The extremely high density can effectively improve the bonding and bite force between the steel fiber and the aggregate, improve the floor's anti-cracking ability, improve the hollowing phenomenon, and effectively ensure the integrity of the floor [4].

Figure 1 Concrete Pouring

3.3 Rolling with a Drum

The drum is made of Φ150 steel pipe. The drum is dragged back and forth along the guide rail to achieve the purpose of preliminary leveling. After grinding with a disc machine to produce slurry, it is rolled flat with a drum.

3.4 Grinding with a Disc Machine

When the concrete is about to set, that is, when the slump of the concrete basically disappears, the concrete is ground with a disc machine to make the concrete surface produce slurry again.

3.5 Scraping with an Aluminum Alloy Ruler

Scraping the concrete surface with an aluminum alloy ruler is an important process to ensure that the surface flatness of the concrete meets the quality requirements. The aluminum alloy ruler should be selected with a large cross-section with high rigidity and not easy to deform, and the length should be 4m to 6m long; after the disc machine grinds the concrete surface to produce slurry, use the aluminum alloy ruler with the channel steel as the guide rail to rotate and scrape the concrete in any direction. After the guide rail is removed and slurry is added, it is scraped flat with an aluminum alloy ruler.

3.6 Smoothing, Finishing, and Maintenance

After the first aluminum alloy ruler is scraped flat, use an iron trowel to smooth the traces of the aluminum alloy ruler on the concrete surface. After the second aluminum alloy ruler is scraped flat, use a polishing machine to polish it. When there is no trace of the iron trowel on the concrete surface, finish the concrete surface. The conventional water storage method is used for maintenance.
In Figure 2 and 3, the steel fiber distribution density is extremely high, which fully changes the brittleness of concrete, improves the toughness and ductility of the concrete slab, and increases the allowable bending deflection of the slab. The steel fiber is distributed in three dimensions in the concrete from the bottom of the floor. The concrete can be reinforced from all directions, and the density is extremely high. It can effectively improve the bonding and bite force between the steel fiber and the aggregate, improve the floor's resistance to cracking, improve the hollowing phenomenon, and effectively ensure the integrity of the floor.

Figure 2: Finishing the Surface

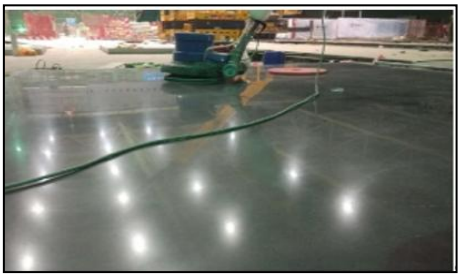

Figure 3: Grinding and Polishing

4 QUALITY CONTROL MEASURES

Before construction, be familiar with the construction drawings, prepare the construction plan according to the requirements of the design drawings and the current national standards and process regulations, and conduct technical briefings to the team to ensure that they understand the flatness requirements and construction methods, and carry out the construction of the sample section. Check the base to ensure that the base is flat, solid and crack-free.

According to the size of the concrete floor area and the span of the plant each time, the spacing of the adjustment bolts and angle steels should be reasonably set. The channel steel should be installed firmly and straight and flat, and the adjustment bolts and angle steels used should be installed firmly. The angle steel elevation should be within the error range and the elevation measurement should be accurate. It is strictly forbidden to collide with the adjustment bolts and angle steels during construction. If damage occurs, re-measure and install them in time. Use tools such as level, ruler, laser leveler, etc. for real-time detection and adjustment during the construction process. Control the mix ratio of concrete and mortar to ensure stable material performance.

When vibrating with a vibrator, the vibration time of each vibration point should be based on the presence of floating slurry on the concrete surface, no bubbles, and no longer settling. When using an aluminum alloy ruler to manually scrape and level, the force should be uniform and coordinated, and the concave parts should be filled and leveled in time. Repeated sawing and scraping, the parts where the angle steel is removed should be scraped and leveled in time, and local parts should be leveled with wooden or iron trowels. After the concrete is poured on the ground, it should be watered and maintained in time. The maintenance time should not be less than 7 days. When the temperature is below 5℃, insulation measures should be taken and watering maintenance should not be carried out [1]. Post-construction inspection should be carried out, and the flatness of the floor should be checked with a two-meter ruler. Parts that exceed the allowable error should be repaired.

5 SAFETY AND ENVIRONMENTAL PROTECTION MEASURES

During the installation of channel steel and angle steel, workers should cooperate with each other, and the process of hammering bolts and reinforcements should be highly focused to avoid workers being injured. After the channel steel, angle steel and other materials are brought into the site, they should be classified and placed neatly according to the requirements of the plane layout, and clearly marked. It is strictly forbidden for concrete transport vehicles to sound the horn when entering and leaving the site at night, and materials should be handled with care when loading and unloading. For construction machinery and tools that generate noise and vibration, noise reduction, sound absorption and sound insulation measures should be taken. After the construction of channel steel, angle steel and other materials is completed, the surface is cleaned uniformly, and then anti-rust measures are taken and reused.

6 CONCLUSION

With the development of the construction industry, the quality control of building and structural floor construction is becoming more and more important. In particular, the control of the flatness of large-volume concrete surfaces in actual construction is a big problem, which requires comprehensive consideration of materials, processes and quality control.

COMPETING INTERESTS

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

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