

Study on the construction technology of secondary concrete pouring to block strong leakage of basement floor

Lin Chen¹, Li Zhijian², Xiao San Xia³, Liu Yi⁴, Zhang Xiaoxi⁵, Huang Yuesen⁶

1 (China Power Construction Group Fujian Engineering Co., Ltd, Fujian 350000, China)

2 (Fuzhou Industrial Park Development Group Co., Ltd, Fujian 350007, China)

3 (Institute of Engineering, Fujian Jiangxia University, Fujian 350108, China)

4 (Huaqiao University, Fujian 362000, China)

5 (Yongfu Construction Group Co., Ltd, Fujian 350000, China)

6 (Fujian Second Construction Group Co., Ltd., Fujian 350000, China)

ABSTRACT: This article adopts the method of large excavation of the bottom plate and secondary pouring of concrete for sealing, which ensures the quality of sealing and can fundamentally eliminate the hidden danger of re leakage. By installing a diversion and drainage system and burying a submersible pump with valves in the foundation pit below the bottom plate excavation, the impact of jet water flow in the foundation pit on the pouring and sealing of concrete has been effectively solved. There is a certain level of operational difficulty, but the overall cost is low and the sealing effect is good.

Keywords - pouring; blocking; basement floor; strong leakage

I. INTRODUCTION

With the increasing utilization of underground space in construction projects, the burial depth of underground structures is also getting deeper, and the difficulty of waterproofing and anti-seepage is also increasing. Due to improper control or lack of waterproof design considerations during the construction of underground structures, leakage in underground engineering has become a common phenomenon and has become a routine technical issue faced by many projects. Conventional minor leaks can generally be sealed using methods such as grouting or injection of sealing materials. However, when encountering geological conditions with high groundwater head or pressurized groundwater, it is difficult to treat with conventional sealing methods. Even if the treatment is completed, it is difficult to eliminate the hidden danger of leakage that may occur again in the future. Our company, based on actual engineering projects, found that the reserved drainage and pressure relief pipe holes on the bottom plate were not properly disposed of, resulting in the inability to use the original planned process for sealing during the later rainy season due to a significant rise in groundwater level. After research and demonstration, we first chiseled through the bottom plate and excavated a certain space under it, then buried a high-power submersible pump for drainage, and finally used secondary pouring of concrete for sealing treatment. The sealing effect was good; This technology has also been successfully applied in the project. When the concrete pouring of the foundation elevator shaft bottom plate of the project was nearing completion, the supply of concrete was interrupted due to a sudden accident and the material could not be poured as a whole, resulting in local overflow leakage at the elevator shaft. After using this technology for treatment, the leakage problem was successfully solved.

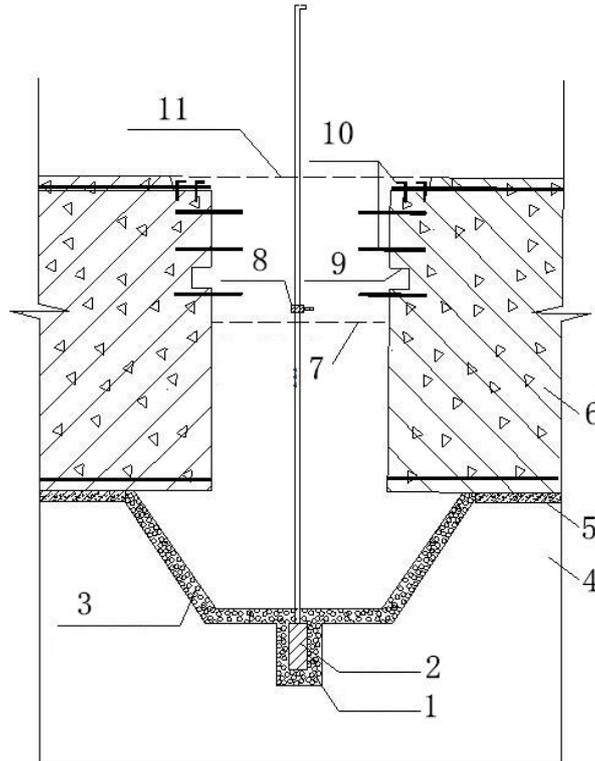
II. PROCESS PRINCIPLES

Principle of pressurized water dewatering process: By using edge pumping to excavate the bottom plate, the bottom plate and cushion layer are chiseled through and continue to excavate to a certain space below the bottom plate foundation, forming a dewatering foundation pit that can be used for submersible water pump operation. A drainage and drainage system is installed around the foundation pit to divert the jet water flow to the collection pit at the bottom of the foundation pit. Then, a submersible pump is used to pump the water inflow from the foundation pit to the outside of the pit to meet the construction conditions for concrete pouring and sealing, as shown in Figure 1. Principle of concrete pouring and sealing process: While maintaining pumping work to prevent water inflow from affecting concrete pouring, the foundation pit and bottom plate are poured with concrete in two stages. The first stage is poured to half the thickness of the bottom plate. After the

Study on the construction technology of secondary concrete pouring to block strong leakage..

concrete strength meets the requirements, the pump is turned off and the valve switch of the outlet pipe is closed.

After removing the pipeline above the valve switch, the bottom plate reinforcement is welded and restored, and the second stage is poured to the original elevation of the bottom plate. The sealing effect is ensured through the following technical measures: firstly, after chiseling through the bottom plate, a certain space is further excavated on the foundation below it, with a section slightly larger than the chisel hole of the bottom plate. This space can not only meet the requirements of dewatering operations, but also effectively block and isolate the underground water below the chisel hole of the bottom plate after pouring concrete. The second is to excavate a 10cm wide and 6cm deep water stop groove on the vertical surface of the bottom plate, and plant reinforcement along the wall of the bottom plate poured with secondary concrete to enhance the overall integrity of the new and old concrete and improve the waterproof effect.



1. Sump pit 2. Submersible pump 3. Drainage system (gravel filter material+iron sheet) 4. Bottom plate foundation 5. Bottom plate cushion layer 6. Reinforced concrete bottom plate 7. First concrete pouring line 8. Cut off valve 9. Water stop groove 10. Reinforcement planting 11. Second concrete pouring line

Figure 1 Schematic diagram of secondary sealing construction with large excavation of the bottom plate

III. OPERATION POINTS

3.1 Continuous precipitation operation

The entire construction process of the cost collection method is almost accompanied by precipitation operations. Due to the pressure bearing characteristics of groundwater, it causes gushing leakage. Therefore, during the sealing process, it is necessary to constantly eliminate the gushing water in order to provide the necessary operating environment and construction conditions for the development of each process. In continuous precipitation operations, corresponding precipitation and drainage methods should be adopted and selected according to the needs of each construction stage and process for the work. This construction method uses submersible pumps as equipment for precipitation and drainage. The number and power of submersible pumps should be selected according to the size of the water inflow in each construction stage and the situation of the working face, based on the standard of meeting the drainage requirements of each stage of operation.

Taking the dewatering method for the basement floor leakage sealing construction of a certain project as an example, during the excavation process of the floor, a high-power submersible pump is used for continuous pumping operation while excavating. When the floor excavation is completed and the excavation of the foundation pit under the floor is carried out, the water inflow increases. At this time, three submersible pumps (one buried in the collection pit at the bottom of the foundation pit and two on the bottom of the

foundation pit) are added for pumping operation to ensure that the accumulated water in the foundation pit does not affect the progress of various works. Before the second concrete pouring, it is still necessary to ensure that the buried submersible pump maintains pumping operation

3.2 Excavation of Bottom Plate and Cushion Layer

While maintaining the use of submersible pumps for dewatering operations, a pneumatic pick machine is used to chisel open the loose concrete on the surface of the bottom plate. The excavation size should meet the operator's requirements for the working surface, and the minimum side length is generally not less than 1.2m. After chiseling open the surface, gas cutting or grinding machine is used to cut off the bottom plate reinforcement, and excavation continues downwards. When chiseling to the bottom plate reinforcement, the bottom reinforcement is cut in the same way. Due to the fact that the excavation process of the bottom plate belongs to underwater operations, in order to achieve better coordination between precipitation and excavation operations, excavation operations should be carried out in layers and zones. That is, a certain area of the excavation surface (such as on one side of the excavation surface) should be excavated with a certain depth of collection pit (the size of the collection pit depends on the number of submersible pumps used), and submersible pumps should be placed in it for pumping operations. Then, excavation should be carried out in sequence around the other edges of the excavation surface, in this cycle, to excavate and break down the excavation surface layer by layer. The water influx and accumulation inside should not affect the excavation and removal of the bottom concrete, as shown in Figure 2.



Figure 2 Construction of Bottom Plate Excavation

During the excavation process, the concrete fragments generated should be promptly transported, cleaned out of the pit, and attention should be paid to controlling the particle size of the concrete produced by excavation to avoid excessive small particle debris that may cause blockage of the submersible pump. To improve the anti-seepage performance of secondary concrete pouring, when the bottom plate is excavated to half its thickness, a circle of water stop groove is excavated around it, with a height and depth of 10cm.

3.3 Excavation of Base Plate (Foundation Pit)

After the bottom plate and cushion layer are chiseled through, the excavation of the bottom plate foundation (pit) is carried out. The purpose of pit excavation is to bury submersible pumps to lower the groundwater level below the bottom plate, so that the bottom plate can be sealed by pouring concrete. But with the drilling of the bottom plate, the water inflow increases dramatically, and a submersible pump cannot meet the demand for precipitation. At this time, it is necessary to excavate the foundation below the bottom plate to form a large sump. The sump is not only used to place multiple pumps for pumping and precipitation operations, but its space is filled with concrete to form the bottom plate (cushion layer) foundation, providing the first rigid waterproof barrier for the bottom plate leakage point. The excavation section of the foundation pit under the bottom plate is an inverted trapezoid with a larger upper part and a smaller lower part. The size of the upper section is 500-600mm wider than the bottom plate hole, and the depth is 600-800mm. The inner side forms a slope (30-50 degrees).

3.4 Buried submersible pump in foundation pit

Excavation and installation of submersible pumps for collection pits (pumping pits): A collection pit is formed by excavating in the middle of the bottom of the foundation pit. The collection pit is square or circular, with a depth slightly deeper than the height of the submersible pump and a width 200-300mm larger than the diameter of the submersible pump. After laying a layer of pebble and gravel filter layer at the bottom of the collection pit, the submersible pump is placed, and pebble or gravel filter material is stacked around the

submersible pump. The particle size of the filter material is controlled between 40-60mm to improve its permeability. Install a shut-off valve at the outlet pipe of the submersible pump, located 50mm above the bottom water stop groove. Requirements for construction dewatering operations: During the excavation of foundation pits and collection pits, as well as subsequent water flow guidance construction processes, continuous dewatering operations should be maintained. Due to the large water inflow during this stage, in addition to burying 1-2 submersible pumps in the collection pit, it is generally necessary to add 2-3 water pumps at the bottom of the foundation pit for pumping. The number and power of the added water pumps should be selected based on their total pumping capacity (drainage capacity) to meet the working conditions inside the foundation pit.

3.5 Construction of foundation pit drainage and drainage system

After the excavation of the foundation pit is formed, its water inflow method has jetting properties, that is, it sprays out from around the foundation pit wall. During the pouring process of the foundation pit concrete, this jetting water flow will cause erosion to the concrete, which cannot meet the conditions for pouring the foundation pit concrete. Therefore, it is necessary to guide the jetting water flow along the foundation pit wall to the bottom of the pit and then extract it. The method is to lay (hang) a crushed stone filter layer on the sloping surface of the foundation pit, and then lay a layer of iron sheet from top to bottom along the foundation pit surface to cover the crushed stone filter layer. Pebble filter layer setting: Lay a layer of pebbles with a thickness of not less than 50mm on the slope surface of the foundation pit. When the water flow is too large and the pebble filter layer is difficult to lay stably, first wrap the pebbles into bags of filter material with a safety net, then insert steel bars on the slope surface of the foundation pit and hang the filter bag on it. The filter layer should be laid from the top of the excavation slope to the bottom of the excavation, and connected to the filter material at the collection pit as a whole. Drainage plate setting: After laying a layer of crushed stone filter material on the slope and bottom of the foundation pit, a thin iron sheet is laid on its surface. The function of the thin iron sheet is to isolate the contact between the concrete and the foundation pit wall during the pouring of the foundation pit concrete, so that after the foundation pit is filled with concrete, the jet water from the foundation pit wall can be blocked by the filter material layer and the iron sheet, and still flow along the inner side of the iron plate to the bottom of the foundation pit, avoiding the erosion of the concrete by the jet water flow. The upper part of the iron sheet should be inserted into the gap between the foundation and the bottom plate, and the lower part should extend to the bottom plate of the foundation pit and cover the filter material on the buried submersible pump surface. When laying the filter material layer on the iron plate, the overlap width is generally 10-15cm. The interface is fastened with iron nails and appropriately sealed with sealing materials to ensure that there is no significant leakage at the interface of the iron plate sidewall.

3.6 Concrete pouring and sealing

The concrete material should use P8 waterproof concrete, which has a strength grade one grade higher than the original base concrete, and is mixed with speed setting agent and micro expansion agent, with a dosage that meets the specifications. Concrete pouring and sealing shall be carried out in two stages: After the completion of the foundation pit diversion work, the first concrete pouring and sealing can be carried out. Before pouring concrete, the bottom reinforcement of the bottom plate should be welded and restored, and space should be left for non buried water pumps to be pulled out of the foundation pit, usually a gap with a diameter of 30-40cm. The first concrete pouring and sealing operation should be carried out quickly. When the non buried water pump is lifted out of the foundation pit (while the buried submersible pump continues to pump water), the pouring concrete should be quickly pumped into the pit without interruption until about 100mm below the bottom water stop groove. The weight of the concrete will exert tremendous pressure on the foundation pit, pressing down on the seepage channel and sealing it. Timely maintenance should be carried out after the first concrete pouring. And check for any leakage. If there is water seepage, a 30mm deep "V" groove should be chiseled and sealed with a leak stopper.

The prerequisite for the second concrete pouring is that the second concrete pouring can only be carried out after the first poured concrete has solidified and produced sufficient strength (usually after the final setting of the concrete). Only when the first poured concrete has solidified and reached the corresponding strength, can the underground pressurized water prevent disturbance and damage to the concrete when the submersible pump stops working and the outlet pipe valve is closed. The second concrete pouring shall be carried out according to the following steps: 1) Grassroots treatment: Before the second concrete pouring, the surface of the first poured concrete should be cleaned, and floating slag and chiseling should be removed. At the same time, the bottom plate along the wall and the water stop groove should be cleaned. 2) Reinforcement planting: In order to enhance the anti floating performance of newly poured concrete and the bonding performance between new and old concrete on the bottom plate, reinforcement is planted on the inner wall and around the holes of the bottom plate before the second concrete pouring. Reinforcement planting inside the hole wall: using structural adhesive material, with a length of 200mm and a diameter of 16 threaded steel, and a longitudinal and transverse spacing of 200mm. Reinforcement planting outside the hole: planting tie bars at a spacing of 150-200mm at the exposed

gluten parts of the bottom plate. The material is the same as the reinforcement planted in the hole wall. 3) Close the submersible pump and its valves, remove the pipelines above the valves, and cut off the pump cables. 4) Welding to restore the bottom plate gluten (for the convenience of pouring and vibration, a certain size of pouring and vibration port can be left, and welding can be restored when the pouring is close to the top surface of the top plate).

IV. CONCLUSIONS

This article focuses on the sealing method of using large excavation of the bottom plate and secondary pouring of concrete to prevent strong water leakage in basement engineering with pressurized water. Compared with the construction method of implementing pipe well dewatering around the building and then sealing, although it has certain operational difficulties, the overall cost is relatively low, the processing speed is fast, and it can fundamentally prevent the recurrence of leakage, which has significant economic and social benefits.

This process adopts effective measures to ensure the overall anti-seepage performance and high pollution prevention and control level of the constructed basement floor, guaranteeing social security and living environment. The craftsmanship fully embodies the concept of economic energy conservation, conforms to the concept of sustainable development, and has significant social, economic, and environmental effects. Since its implementation, this construction method has received good economic, social, and environmental benefits, and the company has also been recognized by social departments, enhancing its reputation. The application of this construction method has achieved good results, and the prospects for promotion and application are obvious.

ACKNOWLEDGEMENT:

This article is published with the financial support of the Natural Science Foundation of Fujian Province (Grant No.2023J01156).

REFERENCES

- [1]. Sun J ,Ding D ,Liu W , et al.Strength and elastic modulus enhancement in Mg-Li-Al matrix composites reinforced by ex situ TiB₂particles via stir casting[J].Journal of Magnesium and Alloys,2024,12(09):3574-3588.
- [2]. Song Y ,Zhou J ,Chen Z , et al.Reducing the cathode Thiele modulus to promote the discharge capacity of lithium-sulfur batteries[J].Journal of Energy Chemistry,2025,106(07):993-1001.
- [3]. Jiang X ,Yu W ,Wei Y , et al.Tailoring precipitation-strengthening in Ir-based ternary alloys:a first-principles approach to L12 phase engineering[J].Rare Metals,2025,44(11):9036-9052.
- [4]. Liu Y ,Xu L .A self-correction algorithm for positioning error in sequential point bending tests of a microbeam for Young's modulus based on atomic force microscopy[J].Nanotechnology and Precision Engineering,2025,8(03):135-141.
- [5]. Gu J ,Wu J ,Xie D .Coastal salt marsh changes in China:Landscape pattern,driving factors,and carbon dynamics[J].Geography and Sustainability,2025,6(04):168-180.

****Corresponding author: Lin Chen***

¹(China Power Construction Group Fujian Engineering Co., Ltd., China)