Construction method of improved process installation for kitchen and toilet pipeline

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Abstract. The traditional method of installation of kitchen and toilet pipes is to reserve holes on the floor when pouring concrete. Once the pipe installation is completed, use the template again to plug the hole. This traditional practice is extremely easy to cause the kitchen and toilet pipe root leakage, in order to achieve the effect of the anti-seepage, the construction method adopts the method of installing the embedded parts in advance, the embedded parts as the formal pipes, so as to achieve the purpose of anti-seepage. This technology accurately positions the embedded parts from various aspects and uses swim lane diagram technology to clarify the contents and responsibilities of civil construction and installation during pipeline installation.

1. Introduction

As one of the most common quality problems in residential projects with the highest complaint rate, leakage of roots in the pipeline between kitchen and toilet is difficult to repair. The traditional method of pipe installation between kitchen and toilet is to reserve the hole larger than the diameter of the pipeline when the concrete is poured into the floor. After the pipeline is installed, the formwork is supported around the hole, and the hole is blocked with concrete. This traditional method has the following shortcomings: after the installation of the pipeline, the formwork needs to be supported again, which results in low efficiency, long construction period, high construction cost. And this method is very demanding for the operation of the construction personnel, a little carelessness will make the root of the kitchen and toilet pipe leakage.

In order to improve the kitchen and toilet pipeline root anti-seepage effect, while reducing the reserved holes, the construction technology by using the method of pre-buried pipelines embedded parts. The main idea of this method is to cancel the reserved hole and pre-buried the embedded parts before the concrete is poured. When the pipeline is installed, the embedded part is equivalent to a direct pipe. The embedded parts are fully combined with cast-in-place concrete, which greatly reduce the leakage of the pipe roots. In order to achieve anti-seepage effect, the following measures have been taken during construction: use origin projection technology to improve the positioning accuracy of embedded parts; the upper part and the lower part of the embedded parts are fixed at the same time to reinforce the embedded parts so as to improve the accuracy of the vertical pipeline; use the swim lane diagram to clarify the respective responsibilities and construction contents of the civil construction and installation construction at each stage, and strengthen management to improve efficiency.
2. Characteristics of Construction Method

We have carried out the secondary design on the positioning of embedded parts, refined the positioning data of embedded parts, and then made the embedded positioning template by the optimized drawings. The positioning template can be used multiple times continuously, reducing waste.

Produce simple fixtures for embedded parts, so that the embedded parts will not be skewed or offset when pouring concrete, ensuring the embedded parts are in the correct position. Only in this way can ensure the vertical accuracy of the subsequent pipeline and improve the installation quality of the pipeline.

The application of the swim lane diagram to the installation of pipeline can visually show the respective responsibilities of the civil construction workers and installation workers and the contents of the handover during the various phases of construction, which is conducive to the orderly implementation of the work, effectively increasing the management and construction efficiency.

3. Process Principle

In accordance with the traditional method of pipeline installation, the verticality of the pipeline can still be guaranteed; however, this method requires very strict requirements on the position of embedded parts. Therefore, before the installation of pipeline, the secondary design will accurately mark the position of each embedded part (as shown in Figure 1). In this way, the specific location of the embedded parts can be visually seen, and it is not easy to miss, which greatly improves the construction efficiency of the embedded parts.

From the first floor, the position of the embedded parts is accurately positioned, and the precise position of the embedded parts of the upper floor is determined by a laser plummet. Corresponding to the optimized drawings, a standard embedded positioning template is prepared. According to the position of the positioning template, the positioning of the embedded parts is accurately drawn, so that the position of the embedded parts of each layer is accurate, to ensure the verticality of the pipeline installation.

The concrete around the embedded parts must be compacted during construction. Therefore, it is necessary to ensure that the position of the embedded parts is accurate and fixed, and no skew or offset occurs. The method for fixing the embedded parts is to fasten the lower part of the embedded parts on the template by using the nail through the fixing hole of the embedded parts, and at the same time, fix the upper part of the embedded parts with a simple fixture. This will ensure the accuracy of the embedded parts.

The swim lane diagram can clearly show the phases and departments of each process. The swim lane diagram can be used in the process flow of pipeline installation. It can intuitively describe the responsible person and the logical relationship between the steps of the pipeline installation. The swim lane diagram helps civil construction and installation work cooperate with each other for pipeline installation.
4. Operating Points

4.1. Preparatory work before installation
According to the drawings of the design unit, the types of fixtures determined by the construction unit, and the size requirements for the decoration, the pipeline installation diagram for the kitchen and toilet shall be drawn to determine the pipeline orientation and the installation position of the embedded parts. The construction management personnel make a presentation to the construction team to explain the pipe installation method and standard, the use of different embedded parts and the fixing method, clearly state the allowable error range of the embedded parts, and emphasize the coordination between civil construction and installation. Pipes, embedded parts and other ancillary products entering the site are carefully inspected to meet the corresponding quality standards and technical requirements.

4.2. Precise positioning of embedded parts
The secondary design of the construction drawings will accurately mark the position of each embedded part, and then the laser plummet is used to position the embedded part. The positioning template can determine the exact position of the embedded part according to the fixed point of the embedded part and the positioning axis of the construction layer.

The positioning template is based on the secondary design drawings. The positioning template includes the axis, the position of each embedded part, and the position of the hanger base used to fix the branch pipe. The positioning template uses 0.8-1mm thick epoxy resin insulation board, with a certain stiffness and strength.

The axis of the positioning template is overlapped with the axis of the structure, and the location of the embedded part is marked with a white mark on the building template. When positioning the mark, the positioning template cannot be offset. After marking, check the position of the embedded part again with the laser plummet.

4.3. Fixing method of embedded parts
As shown in Figure 2, according to the mark made by the positioning template, the corresponding embedded parts are selected for fixing.

The bottom of the embedded part has the fixing hole, and the nail passes through the fixing hole to combine the embedded part with the building template. The upper part of the embedded part is fixed to the reinforcing bar by a simple clamp. The simple clamp consists of four sets of wire and a piece of board that matches the size of the embedded part. Four groups of wires twisted on the steel bar around the embedded parts, then the embedded parts are covered with wooden boards, and the four groups of wires ligation on the boards. The embedded part fixed on the template is shown in Figure 3.

After fixing, the embedded parts must not be loosened, deflected, or deformed, and the position of the embedded parts shall be checked to ensure the accuracy of the position. When pouring the concrete, make sure that there are special persons to care for the embedded parts, so that the embedded parts are not offset or damaged. The embedded parts after pouring concrete are shown in Figure 4.
4.4. Application of swim lane diagram
With the development of new technologies and new technologies, the coordination between different departments in the construction process becomes more and more important. Swim lane diagram can clearly show what activities occurred in what department. The swim lane diagram can intuitively describe the logical relationship between the steps of the pipeline installation and the responsible person, so that the civil construction and installation construction work together to complete the pipeline installation. The swim lane diagram of the pipeline installation is shown in Figure 5.

4.5. Pipeline installation
Measure the pipe size according to the secondary design construction drawings. The procedure for pipe connection during construction is: preparation→ pipe section treatment→ insert test→ brush adhesives→ pipe bonding→ curing. When the riser is connected with the embedded part, firstly apply adhesive on the nozzle of the riser and the interior of the embedded part, and the riser is inserted vertically until the mark. After installing the main pipe, riser pipe and branch pipe respectively, the hangers were fixed, and finally, the closed water test and pigging test were performed.

5. Quality Control and Safety Measures

5.1. Quality Control
GB50268-2008 Code for construction and acceptance of water supply and sewerage pipelines must be strictly enforced.

When the material enters the site, the materials department and the quality department shall unite to strictly control the quality, check the model and specifications of the materials, and carry out the inspection and acceptance according to the standards.

Embedded parts must be protected at all stages and should be replaced immediately after damage is found.

Before the construction, the construction personnel should be trained accordingly. The construction personnel should learn the construction scheme and be familiar with the installation procedures and quality requirements of the embedded parts.

5.2. Safety Measures
Special personnel should be assigned to keep safe facilities, and other construction workers are strictly prohibited from setting up safe facilities. The safety devices used in construction equipment should be inspected to ensure complete and effective.

Adhesives used for bonding pipes are flammable materials and should be kept away from sources of ignition and heat. The bottle should be covered immediately after the adhesive is used.

The materials used for the construction, including pipes, embedded parts, adhesives, etc., should be stored in designated warehouses, and the safety management of the warehouse should be done.

When using adhesives, construction workers should wear protective gloves, protective glasses, masks, etc. If there is wind, they should stand upwind to avoid contact with the skin.
When dealing with the section of the pipe, the construction personnel should wear masks to prevent the inhalation of pipe dust.

| Preparatory stage | Civil construction | Installation construction |
|-------------------|-------------------|--------------------------|
|                   | The civil designers design the construction drawings according to the requirements of the pipeline designers. | Pipeline designers put forward technical requirements for civil engineering design. |
|                   | Civil engineers design and review drawings. | Pipeline installers and civil construction personnel review drawings together to prevent omissions and errors. |

6. Conclusion

6.1. Social benefits
The construction method was successfully applied in the construction process, and the construction quality was excellent. The construction project was highly evaluated and approved by the construction unit. The precision of embedded parts is strictly controlled during construction, so that embedded parts can fully exert anti-seepage effect and improve the quality of pipeline installation. After the completion of pipeline installation, various tests were successfully passed, which fully ensured the use of the pipeline, reduced the annoyance of residents and achieved good social benefits.

6.2. Economic benefits
Compared with traditional construction techniques, this technology has been optimized to accurately grasp the position of embedded parts and the amount of pipe materials. During construction, construction workers pay attention to protect the embedded parts of finished products, reducing the waste of pipes caused by reserved holes, and at the same time, this technology improves the anti-
seepage performance and greatly reduces the post-maintenance costs. The civil construction and installation construction clearly define their respective responsibilities at each stage, cooperate with each other, improve work efficiency, and effectively shorten the construction period.

References
[1] Chengyu H, Weidong S and Aihua Z 2013 Construction Technology Prefabricated construction of U-PVC drainage pipeline in kitchen and toilet (Beijing City:Journal of Construction Technology Press) pp 87–89
[2] Zemin S 2013 Water Supply and Drainage Application of PVC water stop in residential toilet (Beijing City:Journal of Water Supply and Drainage Press) pp 85–87
[3] Qing Z, Jiwen D, Huoan Y, Chi M and Chuan T 2011 Sichuan Architecture Kitchen and toilet drainage embedded parts and its application (Chengdu City:Journal of Sichuan Architecture Press) pp 210–211
[4] Han Y 2017 Housing and Real Estate Analysis of Water Supply and Drainage Design of Modern Residential Buildings (Shenzhen City:Journal of Housing and Real Estate Press) p 40
[5] Donglin W 2017 Door and Windows Research on construction technology of waterproof and seepage prevention in construction (Beijing City:Journal of Door and Windows Press) p 40