Discussion on Construction Technology of Prestressed Reinforced Concrete Pipeline of Municipal Water Supply and Drainage

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Abstract: Prestressed reinforced concrete pipe has the advantages of good bending resistance, good anti-corrosion, anti-seepage, low price and so on. It is very common in municipal water supply and drainage engineering. This paper mainly explore the analyze the construction technology of the prestressed reinforced concrete pipe in municipal water supply and drainage engineering.

1. Introduction
Water supply and drainage works plays an important role in affecting the stability of the city in modern urban construction, municipal construction has always attached great importance to water supply and drainage works. With the continuous development of construction technology, municipal water supply and drainage works has a number of new construction materials, equipment and construction technology, which laid a good foundation for the implementation of water supply and drainage works. Prestressed reinforced concrete pipe is a very common construction material in municipal water supply and drainage engineering, which directly affects the actual operation of the project. It is of practical significance to discuss the construction technology of prestressed concrete pipe.

2. The construction preparation

2.1 Technical Preparation
Before the construction of the municipal water supply and drainage project, the construction unit needs to carry on the strict examination to the construction drawing, formulate the scientific and reasonable construction organization design plan, combine the concrete construction technology with some difficult part to organize the technical work; the construction unit should investigate and analyze how to deal with the laying of the pipeline as well as the existing pipeline structure of the plane position, elevation and other detailed, marked out it in the construction drawings; organize the relevant staff to do the construction of the transfer pile and re-test work, layout of the pile reasonably; give detailed investigation of the soil geological, groundwater, to carry out backfill density test and pipe water pressure test, design the construction of the mortar mix ratio; do site cleaning work, clear the construction area of garbage, waste residue, root and others. The obstructions are cleaned and buried or disposed of in accordance with the area under construction supervision, and debris removal shall not harm the natural environment.
2.2 Material Preparation
Prestressed reinforced concrete pipe design strength must be more than 40MPa, the impermeability of the pipeline should meet the pressure test standards, have a good crack resistance to meet the requirements of anti-cracking pressure indicators; pipe jack and socket surface should smooth, there aren't honeycomb, nicks, peeling and other defects, the surface of tube outside there is no hollowing, cracks, dew and other undesirable phenomenon, the protective layer should be intact. All the signature, model, factory certificate and other signs should complete, clear and perfect; cement strength must meet the project quality standards, before entering the battalion must give a qualified certificate inspection and sampling inspection of cement for each batch, testing of cement strength, stability and other related performance indicators.

2.3 Measuring the line
According to the construction design requirements, check the pipeline depth, diameter, soil conditions, calculate the width and depth of the slot, at the same time check the measurement of the construction pipeline and the original pipeline, set the trough on the edge of the mouth position on the ground and lay a good foundation for the slot work; need to set the pipe elevation, center line, slope board before and after open the slot, we need to maintain the level when buried the top of the slope board. Piping the center line to the slope of the board; in order to prevent the measurement error, after each measurement need to compound it to the next level of the point to check; before the line excavation we need to design pipeline accordance with the coordinates. According to the planned slope and the center line to both sides of the release of the mouth line; excavation process using theodolite, level gage and other control the direction and depth of excavation; after excavation use the total station to release the bottom of the well center pile or pipelines, and according to the design height and structure width release elevation and the base line.

3. The construction process of prestressed reinforced concrete pipe

3.1 Earth excavation
In the process of earth excavation, the method of artificial excavation and mechanical excavation is used to cooperate with each other. The excavation is mainly excavated, and the artificial excavation is concentrated in the whole slope and the bottom clearing work. The excavation process must be strictly in accordance with the relevant design requirements to ensure that the groove width is easy to backfill operations and the installation of the socket, the excavation width is equal to the width of the structural base and the width of both sides of the face, the width of each side of the face must be more than 300mm. The use of mechanical excavation, at the end of the ditch it need to stay about 200mm thick soil in the next process before the start of the manual use of artificial excavation; in order to facilitate follow-up operations, after trench earth excavation the best stacked on the side of the groove. And maintain more than 1m spacing at the edge of the groove, the height of the pile cannot exceed 1.5m, cannot cover the rain mouth, fire hydrant, measurement signs, ground covers and others, in addition to the reserved back to fill the soil, the remaining excavation of the earth needs timely use dump truck transport to the designated spoil, to avoid a large number of accumulation in the construction site, affect the follow-up construction; trench excavation to the bottom of the bottom elevation, inspect the construction supervision department, quality inspection departments and other timely, elevation and all meet the requirements of the design drawings, to be able to carry out follow-up construction.

3.2 Pipeline installation
There are lots of installation methods of prestressed reinforced concrete pipe. It is commonly used for the main socket-type flexible interface concrete drainage pipe installation, flat-based reinforced concrete pipe installation, four-in-one installation, pad method installation and several other installation methods. There are some differences in the construction process of various installation methods. This paper focuses on the analysis of socket-type flexible interface concrete drainage pipe
installation method.

3.2.1 Installation preparation. After the completion of the excavation of the base trough, we will do the bottom inspection and drilling. If found the soil layer, soft soil layer is thick, the bottom of the tank elevation is deep, we need to deepen treatment. The use of artificial brazing method can be used to drill, the diameter of it is 25mm, length is 20mm, drill bit for the 600-hammer-like, with a brazing weight of 10kg, need to do a good job recording work, into the 300mm, record the number of hammering, brazing point record number must be consistent with the brazing point plan layout. After the drilling of the sanding work we need to use special symbols or color pen to different levels of soil in the record to separate them, the special hard and soft point location marked in the brazing point on the layout plan for the late analysis of the work laid. If there is a mixed soil or a soft foundation in the construction, it is necessary to deal with it in a timely manner. If the moisture content of the dredger is close to the optimum water content, the depth of the excavation is 150mm (including 150), it need timely trenching the original soil backfill compaction, backfill water content should be as close as possible to the best water content, rammed, soil compaction degree and the original natural foundation with the density as close as possible. In addition, it can also be treated with lime soil, but also need to ensure that the backfill soil compaction degree is more than 95%; if the tank bottom contains more groundwater, or soil moisture content of the ground itself is relatively high, not suitable for compaction. So we need to use other means of backfill compaction; poor drainage of the foundation may affect the quality of the project, if the foundation soil disturbance depth is less than 100mm, we need do timely use of gravel or natural graded sand and gravel treatment, 100 ~ 300mm, the lower hard, Can be used to fill stone, pebbles, sand and gravel treatment.

The entire project implementation process needs to ensure that the tube section of the specifications, appearance quality, performance and other parameters are related to meet the relevant national standards, the installation of the section before the timely inspection of whether the appearance of hollowing, cracks, protective layer off and other defects, if there is a need for timely repair; flexible interface rubber material must meet the relevant norms, a professional pipe manufacturers to provide supporting for the appearance of no defects; pre-stressed reinforced concrete installation before we need to wear the mouth, the mouth of the working surface clean, and in the working area of the rubber ring surface brushing a layer of non-corrosive lubricants.

3.2.2 Installation process. The specific process shown in Figure 1:

Pipe under the tube uses high-strength nylon lifting belt for hoisting, accurate to find the tube body center of gravity, the next tube the tube makes section of the mouth toward the direction of the water, so as to avoid when the bumps make pipe damage. The pipe and the pipe installation process cannot disturb the pipeline foundation, so as not to affect the quality of the entire project; pipe in place, need to place two sets of wedge-shaped concrete blocks on both sides of the pipeline to avoid the pipeline rolling in the groove. Adjust the pipeline elevation and flow surface center to ensure that the pipeline plane position and longitudinal elevation to meet the design standards, there is no dislocation of the bad phenomenon; each section of the pipeline in place, need to do timely pipe to live, so as not to offset. Check the pipeline counterparts, to avoid the wrong port; pipe installation need to control the tube in the end of the elevation deviation, center deviation, and so on. To ensure that the adjacent tube at the end of the wrong mouth is less than 3mm.

Before the installation of the pipeline, we need to dig a joint at the interface of the work of the pit,
the depth of more than 200mm, to ensure that the pipe joints when the pipe is in a vacant state.

In the process of counterparts, the first pipe in the mouth, the debris clean up, evenly coated with a layer of non-grease lubricant, the apron cannot have the remaining adhesive; and then set the adhesive on the socket. In this process need to ensure that the seal apron smooth, good sealing, there is no distortion of the situation. When installed, the apron is evenly rolled to the predetermined position. After the external force is relaxed, the backfill distance should be less than 10mm. When installing, the apron can be bent into a flower or heart-shaped into the socket slot to ensure that the apron can be tight of the fit in the slot, there is no warping or twisting.

Use gantry brackets to do the top interface, tied the wire rope in the installation of a solid pipe, pulled into the tube after the mouth, the back beam frame, use inverted chain wire rope tied tight, both sides at the same time Pull the chain, after the mouth, set the apron socket will be pulled into the socket, the process needs to promptly correct the location of the apron, so as not to move the apron; installation process, the top pull speed need to be as slow as possible, It is necessary to arrange for the person to check the circumference of the apron, if the apron is not uniform need to stop the top pull action and adjust the location of the apron to ensure that the location is accurate and then pull until the predetermined position; Sealing apron may be exposed, jump wells, twist and other undesirable phenomenon, it need timely adjustment, you can use the probe into the socket gap to check the location of the apron is accurate; After the installation of each section of the pipeline, we need to check and correct the height of the pipe, the axis of the location of proofreading, the tube on both sides of the body in time to be fixed; pipe laying is completed, in order to avoid the laying of the pipeline before the move, you can use the chain machine wire rope to lock it in the back of the pipeline.

3.2.3. Pipeline closed water experiment. After the completion of pipeline installation, the groove backfill need to do closed water or closed air test, check the pipeline sealing. The closed water test was carried out after the masonry of the wellbore. The closed water test pipe was blocked with a brick pipe at both ends and maintained for about 3 to 4 days before the water test was carried out. In the course of the test, it is necessary to control the water level reasonably. It usually needs to be about 2m above the upstream of the test section. During the test period, the pipeline, well depth and pipe plug are strictly checked to observe whether there is leakage. If these undesirable phenomena are not found, Pipeline in the water soak 1 ~ 2d after the closed water test again. Prestressed reinforced concrete pipes allow a certain amount of seepage, but the pipe specifications are different, allowing the amount of seepage is also different. Closed air test is mainly used for dry areas, this article will no longer described it in detail.

3.2.4. Groove backfill. Prestressed reinforced concrete pipe concrete strength, closed water test results can reach the corresponding standard after the trench backfill. In the backfill process, the earth excavated in the base tank is preferred. However, if the original soil contains a large amount of organic impurities or itself is soil, the sludge cannot be used as a filler, and the optimum moisture content of the backfill is determined by a certain test. The Backfilling process, to ensure that both sides of the pipe backfill work at the same time, so as to avoid the pipeline offset, backfill using artificial methods to consolidate; pipe joints under the work of the pit with gravel or coarse sand backfill, use artificial way to consolidate. Drainage direction, layered backfill, the bottom of the trench and the top of the tube must be used within a certain range of artificial filling, more than 500mm thickness can be used to fill the way; backfill tamping real time to ensure that both sides of the pipeline at the same time. Pipeline displacement 500mm within the scope of the use of thin shop light compaction, so as not to damage the pipeline; pipe on both sides of the ramming surface height difference should always be controlled below 300mm. When using a roller to ensure that the rolling overlap thickness of more than 200mm. It is necessary to ensure that the compaction of the trench backfill meets the relevant design criteria. Backfill process, need to do a good job of pipeline protection work, to avoid damage to the pipeline or the center line deviation situation. At the same time the port of the pipeline needs to use eye-catching color of the package step to avoid debris or soil into the pipeline.
4. Conclusion

Prestressed reinforced concrete pipe is very common in municipal road construction. This paper mainly discuss and analyze the installation process of municipal water supply and sewerage pipeline in several aspects: construction preparation, tunnel excavation, pipeline installation, pipeline closed water test and pipe groovinge, only for the relevant engineering construction staff of this part of the work to provide a reference.

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