Taking Yongji Expressway as an Example to Study the Construction Technology of Water Abrasion Drilling For Pile Foundation of Highway Bridge

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Abstract: In order to understand the research on the construction technology of pile foundation water grinding drill for highway bridge, the study mainly takes Yongji expressway as an example, analyzes the construction scheme, construction principle and construction technology in the application of pile foundation water grinding drill construction technology, and compares the technology with the traditional manual blasting excavation technology to judge the application value of pile foundation water grinding drill construction technology. Through the research, it can be seen that the pile foundation water grinding drilling construction technology is more convenient, and has advantages in safety level, cost and other aspects, which shows that the application value of the technology is higher, it is worth reference.

1. Introduction

Yongji expressway is subordinate to the seventh vertical in the traffic construction planning of "seven vertical and nine horizontal" highway in the northwest of Hunan Province, which provides a huge variable for the provincial traffic construction in Hunan Province. However, due to the large scale of the expressway, many different environments will be encountered in the construction, and different construction needs will be generated in different environments. Under this condition, the construction needs of the actual environment must be combined to select the construction Technology. Accordingly, in the construction of a certain section of the expressway, because this section needs to cross the residential area, the use of artificial blasting excavation technology may bring safety hazards, and the corresponding pile foundation water grinding drilling construction technology has become the best choice. In this regard, with the help of the expressway to study the pile foundation water grinding drilling construction technology, the functionality and advantages of this technology can be described for the construction of other highways Provide reference[1-2].

2. Analysis on the application of water grinding drilling technology in the construction of pile foundation of Yongji Expressway

2.1 Construction scheme

In the construction of a section of Yongji expressway, due to the narrow terrain and dense population in the residential area, it is impossible to use the traditional large-scale drilling machine pile forming technology for construction, which can be excluded in the scheme selection first. Secondly, compare the construction technology of manual blasting excavation and water grinding drilling with each other, both of which meet the terrain conditions. However, due to the dense population in the residential area, if blasting is carried out, it will inevitably bring safety hazards, which is not pleasant to see in any construction. Therefore, at the end of scheme selection, the construction technology of water grinding drilling for pile foundation becomes the final construction scheme [3].

2.2 Construction principle

The water grinding equipment in the construction technology of pile foundation water grinding

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drilling mainly consists of drill barrel and motor. In the application, the motor is turned on first to drive the drill barrel to operate. At the same time, the drill barrel is manually drilled along the direction of hole forming and wall protecting until the core is penetrated. Secondly, use the air pick to knock the core in the middle. This step circulates until all the cores are broken and cleaned, so that the hole can be formed [4-5]. Fig. 1 Schematic diagram of water grinding and drilling equipment.

Fig. 1 Schematic diagram of water grinding and drilling equipment

2.3 Construction process

The construction technology of pile foundation water grinding drilling can be divided into six steps, and the specific contents of each step are shown below.

(1) Step 1

Setting out shall be carried out on site according to the design drawings, and the center of pile foundation shall be marked accurately. Since the setting out work is usually carried out manually, the setting out error may occur due to the influence of artificial instability. For such problems, it is recommended to measure and check all the setting out after the completion of setting out. If it is found that a setting out exceeds the maximum operation error value, it must be adjusted in time. In addition, under the condition that all setting out errors are up to the standard, it is necessary to lead out the core pile from the center of pile foundation to the surrounding area, and at the same time, protect the core pile with concrete, so as to avoid damage to the center of pile foundation caused by subsequent construction.

(2) Step 2

Firstly, confirm the pouring position of the well platform, and clean the position at the same time before pouring. Secondly, in the process of pouring, the scale of the well platform should be strictly controlled, that is, the diameter of the well platform is usually 20cm larger than the pile diameter and about 15cm higher than the original ground (if there is water around, the height of the well platform can be 30cm higher than the original ground). Finally, the elevation of the shaft platform shall be measured to control the elevation of the pile bottom.

(3) Step 3

The excavation shall be carried out around the setting out results of pile foundation, and the excavation depth and diameter and other parameters must be consistent with the design value. After excavation, the retaining wall construction is required, i.e. the cast-in-place concrete is used for pouring, the thickness is generally 0.15cm, the form is eight lap joints, and the lap length shall not be less than 0.05m. In addition, the cast-in-place concrete strength in the retaining wall construction is generally C15 ~ C20, C25 concrete is selected in Yongji expressway.

(4) Step 4

First of all, drill the free surface, that is, drill along the coring point on the pile foundation hole wall. In the process, ensure that the coring ring is tangent to the inner wall of the lock mouth, so that the free surface can be formed after Coring (see Figure 2). Secondly, core drilling is carried out at the radius of pile foundation. After completion, the rock mass of pile core is divided into three equal parts, and the rock mass is broken by silent expansion agent at each equal separation position.

Finally, the internal rock mass can be broken again by air pick.

Figure 2 case free face

(5) Step 5

This work should be carried out on one side of the pile hole. After completion, insert the steel wedge into the slag side, then manually hit the steel wedge to break the rock mass, and finally manually clean the broken rock mass to complete the final slag removal work.

(6) Step 6

A platform between pile holes shall be built by using the protective core pile, and a line with the length consistent with the design standard shall be hung in the middle of the platform, and a heavy object shall be placed at one end of the line (not too heavy), and then the vertical line shall be lowered slowly, so as to judge whether the pile hole meets the design requirements according to the contact condition between the vertical line length and the hole bottom and the vertical level. Fig. 3 is a schematic diagram of vertical line detection.

Fig. 3 Schematic diagram of vertical line detection

3. Comparison of pile foundation construction technology by water grinding and artificial blasting

3.1 Theoretical advantages

According to the relevant theories, the pile foundation water abrasive drilling construction technology has three advantages over the artificial blasting technology, that is, the pile foundation water abrasive drilling construction technology has a wide range of use, especially in densely populated or similar environment; the pile foundation water abrasive drilling construction technology hole quality is easier to control, while the blasting hole is inevitable to have a large error; the pile foundation water abrasive drilling construction technology has no explosives Participation, so security and economy have more advantages.

3.2 Case evaluation

According to the technical evaluation records of Yongji expressway, the application value of the pile foundation water abrasive drilling construction technology in the case is higher. Table 1 is the case evaluation record.

Table 1 case evaluation record

Assessment item	Water drill	Blast
Construction efficiency	About 0.8 ~ 1.3m/d	About 0.5~1m/d
Over excavation control	Coefficient 0.09	Coefficient 1.35
Vibration	Nothing	more
Noise	Nothing	more
Economy	1000Element /m	1500Element/m
Safety	Security	At risk

4. Conclusion

To sum up, this paper analyzes the application performance of the pile foundation water abrasive drilling construction technology in Yongji expressway, the results show that this technology has obvious advantages compared with other technologies, and describes its construction scheme. Through the research, it can provide reference for other expressway construction.

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