

Research on Construction Technology of Combined Omni-directional High-pressure Jet Pile

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Abstract: With the vertical and horizontal expansion of urban underground space, there is an urgent need for the construction technology of underground building structures, and the application of underground diaphragm walls as basement support design is becoming more and more common. The application theory of the high-pressure rotary jetting pile as a water stop for the ground connection wall joint has great application potential in practical engineering. This paper analyzes the process principle, characteristics, process, operation points and economic and social benefits of the combined all-round high-pressure jetting pile construction technology, and demonstrates the advantages of this method in specific applications from multiple perspectives. The method adopts a three-axis mixing pile driver and a conventional omnidirectional high-pressure rotary jet pile equipment to form a new type of construction machine. It is a kind of micro-perturbation grouting construction technology, which can quickly penetrate the complex underground geology and avoid the impact of hole collapse on drilling. Strong controllability, can effectively protect the safety of surrounding buildings and municipal facilities.

Keywords: High pressure rotary spray, Construction method pile, Water stop measures, Combined type.

1. Introduction

In recent years, my country's economic strength has been continuously improved, and urban construction has also developed rapidly[1-3]. The application of underground space in cities has become more and more extensive. There are also various water-stopping measures, and the application of omnidirectional high-pressure rotary jetting piles as water-stopping for ground-to-wall joints has become common. However, due to the relatively complex underground conditions, the underground diaphragm wall becomes deeper and deeper in order to block the groundwater, and the holes are easily collapsed, which causes great difficulties to the construction[4-6]. Conventional MJS construction cannot meet the requirements of this kind of geology, which requires a kind of reinforcement and water-stop measures with micro-disturbance, strong controllability, and can ensure quality and safety in complex geology, and the construction depth can reach 60-70m[7-9].

The combined omnidirectional high-pressure rotary jetting method of pile construction can solve this problem very well. This method adopts a three-axis mixing pile driver and conventional omnidirectional high-pressure rotary jetting pile equipment to combine into a new type of construction machine. It is a kind of micro-perturbation grouting construction technology, which can quickly penetrate the complex underground geology and avoid the impact of hole collapse on drilling. Strong controllability, can effectively protect the safety of surrounding buildings and municipal facilities[10].

2. Process Principle and Characteristics

Combined all-round high-pressure rotary jetting method pile construction technology adopts the three-axis stirring pile frame and the power head + drill pipe of the traditional all-round high-pressure rotary jetting method pile driver, the main engine of the three-axis stirring pile driver and the

traditional all-round high-pressure rotary jetting method. The empty platform is organically combined, and the original 40-50 sections of 1.5m omnidirectional high-pressure rotary jetting drill pipe is extended to 2 sections of 35m drill pipe, forming a pile that can retain the traditional omnidirectional high-pressure rotary jetting method. There is a new type of equipment that can quickly lower the drill pipe to a depth of 60-70 meters underground. It adopts a unique porous pipe and a front-end forced slurry suction device to realize forced slurry discharge in the hole and monitoring of the pressure in the ground. By adjusting the forced slurry A construction method that reduces the possibility of surface deformation, building cracking, and structure displacement, and reduces the impact on the environment.

2.1. Process Principle

As shown in Figure 1, the combined omni-directional high-pressure rotary jetting method pile construction method adopts the three-axis stirring pile frame and the power head + drill pipe of the traditional omni-directional high-pressure rotary jetting method pile driver, the main machine of the three-axis stirring pile driver and the traditional omnidirectional pile driver. The high-pressure rotary jetting method is combined organically to operate the empty platform, and the original 40-50 sections of 1.5m all-round high-pressure rotary jetting method pile drill pipes are lengthened to 2 sections of 35m drill pipes, forming a system that can retain the traditional full-scale drill pipe. The azimuth high-pressure rotary jetting method is a new type of equipment that can quickly lower the drill pipe to a depth of 60-70 meters. The unique porous pipe and front-end forced slurry suction device are used to realize the forced slurry discharge in the hole and the ground floor. Pressure monitoring is a construction method that reduces the possibility of surface deformation, building cracking, and structure displacement by adjusting the amount of forced slurry to control the pressure value in the soil, reducing the impact on the environment.



Figure 1. Process principle

2.2. Process Characteristics

1. The three-axis mixing pile frame is combined with the conventional all-round high-pressure rotary jet pile control background: the three-axis pile driver is modified, the three-axis drill pipe is removed, a new guide frame is installed on the three-axis frame, and a new one is added. The winch controls the lifting and lowering of the guide frame. At the same time, the conventional omni-directional high-pressure rotary jet construction method pile driver power head + drill pipe is separated from the omni-directional high-pressure rotary jet construction method pile host. The power head and the drill pipe are connected to the three-axis guide frame, and the omni-directional high-pressure rotary jet construction method pile host is connected to the three-axis operation platform.

2. Small impact on the surrounding area: This construction method adopts forced slurry discharge in the hole, and the noise and vibration during construction are small. It is a construction method with less pollution, and has less impact on surrounding buildings and underground pipelines. It is more suitable for cities with high building density. used in.

3. The effective construction depth is deep enough: the advantages of the combination of the three-axis stirring pile foundation and the omnidirectional high-pressure rotary jet construction method of the construction method, that is, the construction can be carried out in complex geological conditions, and the depth can reach more than 70m.

3. Research on Construction Technology Application of Combined All-Round High-Pressure Jetting Pile

This construction method is mainly suitable for ultra-deep, complex underground environment, and under the geological conditions of easy to collapse holes during the drilling process, the omnidirectional high-pressure rotary jet construction method piles are used for water stop and foundation pit reinforcement works.

3.1. Process Flow

The combined all-round high-pressure rotary jet construction method mainly includes: measuring and laying out the line, drilling rig in place, drilling rig lead-in hole, lowering the drill pipe, setting various parameters, jet

grouting to the design level and other processes.

3.2. Operation Points

3.2.1. Construction Preparation

1 Equipment assembly: one three-axis mixing pile driver, one conventional all-round high-pressure rotary jet pile driver. Remove the drill pipe of the mixing pile driver, disassemble and install the drill pipe and power head of the omnidirectional high-pressure rotary jetting pile driver to the pile frame of the three-axis mixer, and simultaneously connect the main engine of the omnidirectional high-pressure rotary jetting pile driver to the three-axis mixer. The shaft mixing pile driver controls the platform, lengthens the shotcrete drill pipe in advance, and then the equipment debugging is completed.

2 Material preparation: cement. Before the construction of the project, check whether the cement and other materials entering the site have the factory certificate and retest report, and check whether their technical performance meets the requirements of the relevant quality standards.

3. Technical preparation: Before the construction of the project, the construction technical scheme shall be prepared according to the design and construction drawings, and the project technical person in charge shall make detailed construction scheme and technical disclosure to the on-site construction management personnel and operating workers.

3.2.2. Positioning and Paying Out

According to the drawings, mark the coordinates of the location of the omnidirectional high-pressure rotary jetting method piles, and then use the total station to locate the coordinates on the site, mark the points with lime (or insert red flags), and ask the supervisor for acceptance; review every day during the construction process. Once, to prevent positioning errors caused by disturbing the stakeout points during construction.

3.2.3. Drilling Hole

The construction geology of this project is dominated by sand layers, and the design depth is super deep. It is particularly important for how to ensure the verticality of the pre-drilled holes after the lead-in hole and prevent the hole from collapsing and reducing the diameter. Then put the lead hole machine in place, use the geological drilling rig to lead the hole, and use the circulating mud to protect the wall, the mud specific gravity is between 1.05-1.2, the general lead hole diameter is about 200mm, the error between the hole center and the pile center is less than 50mm, and the depth is greater than the design. The depth is more than 1m, and the verticality error is less than 3/1000. See Figure 2 and Figure 3 for details.



Figure 2. Geological Drilling Rig



Figure 3. Lead hole depth acceptance

3.2.4. Pile Driver in Place

As shown in Figure 4, after the drilling rig is completed, the all-round high-pressure rotary jetting method pile driver should be immediately moved to the pile-forming position, and the drill pipe should be vertically aligned with the center of the hole to ensure the stability of the pile driver during the process. degree and verticality.

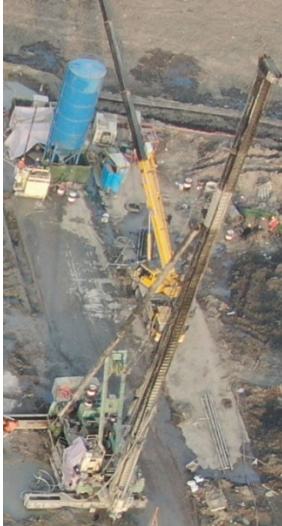


Figure 4. The pile driver is in place

3.2.5. Running the Drill Pipe

In this project, the 64m pile of the all-round high-pressure rotary jet construction method avoids the time process of the drill pipe being lowered, which leads to too fast refilling of the sand layer in the hole, filling the hole and affecting the lowering of the drill pipe. The first drill pipe is spliced 35m on the frame in advance, The remaining drill pipes are connected on the ground into 9m sections. After the pile driver is in place, connect the drill bit and the pressure monitoring display in the ground, and clear it when the drill bit has no load. As shown in Figure 5, start to lower the drill pipe. After the first section is completed, quickly install the second section on the pile frame according to the 9m-long section, and lower the drill pipe to the designated position within 20 minutes.



Figure 5. MJS drill pipe lowering

3.2.6. The Drill Pipe Is Lowered to The Design Specified Elevation

After the drill bit reaches the predetermined depth, start zero calibration, so that the “0” scale of the power head, the nozzle, and the white line on the drill pipe are in the same straight line, and then set various process parameters, including swing angle, lifting speed, number of revolutions, etc. For the control table of technical parameters of combined construction of piles with ultra-deep all-round high-pressure rotary jetting method in sandy soil, see Table 1.

Table 1. Construction parameter table

| No. | Content | Parameter | No. | Content | Parameters |
|-----|-------------------------|-----------------------------|-----|--------------------------|--------------|
| 1 | Pile diameter | 2000mm | 9 | Drilling water pressure | 10~30MPa |
| 2 | water-cement ratio | 1:1 | 10 | Pile angle error control | $\leq 1/100$ |
| 3 | grout pressure | ≥ 40 MPa | 11 | boost speed | 25min/m |
| 4 | Cement slurry flow rate | 85~100L/min | 12 | Step itinerary | 25mm |
| 5 | main air pressure | 0.7~1.05MPa | 13 | Step lift time | 37.5s |
| 6 | main air flow | 1.0~2.0Nm ³ /min | 14 | Rotating speed | 3~4rpm |
| 7 | Back suction pressure | 0~20MPa | 15 | Inland pressure | 1.0~1.8 |
| 8 | Backflow water flow | 0~60L/min | 16 | Cement dosage | 1.7T/M |

3.2.7. Start Shotcrete

After setting the parameters, first turn on the return gas and the return high pressure pump. After confirming that the slurry discharge is normal, open the sludge discharge valve, and turn on the high pressure cement slurry pump and the main air compressor. After reaching the specified pressure

and confirming that the pressure in the ground is normal, start the shotcrete lifting, and the lifting speed is 25min/m. At the same time, the internal pressure is automatically adjusted according to the depth of shotcrete through the control table, which can ensure the normal discharge of waste slurry during shotcrete. Figure 6 Omnidirectional high-pressure rotary

jetting method pile starts to be shotcrete.



Figure 6. MJS drill pipe lowering

3.2.8. Shift to Next Pile

After dismantling the drill pipe, wash and maintain the drill pipe in time. After the shotcrete reaches the designed pile top elevation, it is mechanically displaced and the next pile construction is carried out.

3.2.9. Control Measures During Construction

1 During the construction process, use the engineering quality control table to implement process control over the entire construction process and each process, so that the responsibility of each process can be assigned to people.

2 The pile position deviation should not be greater than 50mm, and the verticality error of the lead hole during the construction process is strictly controlled within 3/1000.

3. During the rotation and lifting of the drill pipe during the pile formation, the shotcrete must be continuous and uninterrupted. If the shotcrete is interrupted due to special reasons, the drill pipe should be lowered by 50cm when the shotcrete is resumed to avoid broken piles.

4 The proportion of the slurry must be strictly controlled, and a special person shall be assigned to be responsible for

random inspection of the quality of the slurry, and the unqualified slurry shall be treated as waste slurry.

5 Make detailed records of construction process and various technical parameters.

6. Equipped with necessary machine repair equipment, spare parts and consumable materials, and do a good job in daily maintenance during the operation stage to ensure the normal operation ability of the main engine equipment during the construction period and ensure the smooth progress of the construction.

4. Exploration of Construction Control

4.1. General Provisions

1 The construction quality inspection and acceptance of the combined all-round high-pressure rotary jetting method pile is divided into construction process control and pile quality acceptance.

2 The control content of the combined all-round high-pressure rotary jet pile construction process shall include material quality, material consumption, construction pile position, construction length range, drilling accuracy, jet pressure and flow, coaxial high-pressure air pressure and flow, slurry Water-cement ratio, drill pipe moving speed and rotation speed, spray angle (swing spray), control value of pressure in the ground, monitoring data of surrounding environment, etc.

3 The quality acceptance of the piles constructed by the combined all-round high-pressure rotary jetting method shall check the integrity, strength and impermeability of the pile body (if there are impermeability requirements); when the composite foundation is designed, the vertical bearing capacity inspection shall be carried out; acceptance shall be carried out. It should be carried out in batches according to the construction section.

4. The quality acceptance of the piles constructed by the combined omnidirectional high-pressure rotary jet construction method shall be core-pulling inspection 28 days after the construction is completed.

Table 2. Construction quality control requirements

| Check item | | management standard | Inspection Method | Frequency |
|-----------------|--------------------------------------|------------------------------|--|------------------|
| 1 | pile position | ±50mm 以内 | tape measure | each pile |
| 2 | Angle error | Center the bubble | Bubble (inclinometer spot check) | each pile |
| 3 | pile length | Design pile length +200mm | Number of drill pipes, size confirmation | each pile |
| 4 | Grout | | | |
| | injection pressure | 40MPa | pressure gauge | often |
| | injection volume | 85~100L/min | Flowmeter | |
| | proportion | 1.5±0.02 | Hydrometer | 1 time per shift |
| | main air | | | |
| | pressure | 0.7 ~ 1.05MPa | pressure gauge | often |
| | Air volume | 1.0 ~ 2.0m ³ /min | Air flow meter | |
| | drill pipe | | | |
| | Number of revolutions | 3 ~ 4rpm | stopwatch angle meter | often |
| | promotion speed | 20min/m | | |
| | Shake angle | ±180° | | |
| | suck water | | | |
| | injection pressure | 0 ~ 20MPa | pressure gauge | often |
| jet flow | 0 ~ 60L/min | Flowmeter | often | |
| Inland pressure | Set value (upper limit, lower limit) | pressure gauge | often | |
| 5 | Mud discharge | Sludge status | Visually | often |

4.2. Construction Process Control

1 Before construction, materials such as cement, admixtures, and admixtures should be checked and accepted, and the product quality assurance certificate should be checked. Samples should be submitted for inspection according to relevant regulations, and relevant materials should be archived and reported to supervision.

2 The proportion of grout is strictly controlled, and a special person is responsible for spot-checking the quality of grout, and the amount of cement must meet the design requirements.

3 The pilot hole must be leveled at the beginning. After the

drill pipe is in place, check the air bubbles and the situation between the drill pipe and the lower chuck.

4 Strictly control the pressure in the ground during the shotcrete process, and do not exceed the upper and lower limit values. Immediately take corresponding measures in case of abnormal conditions.

5 The allowable deviation of pile construction with combined omnidirectional high-pressure rotary jetting method shall meet the requirements of Table 2.

6 The allowable deviation of the pile construction of the combined omnidirectional high-pressure rotary jet construction method shall meet the requirements of Table 3.

Table 3. Permissible Deviation of Combined Omni-directional High-pressure Rotary Jet Pile Construction

| No. | Inspection item | Tolerable deviation or allowable value | Inspection quantity | Inspection method | |
|-----|------------------------------------|--|--------------------------------|--|--------------------------------------|
| 1 | Construction pile position | 50mm | per pile | Steel ruler measurement | |
| 2 | Construction length range | pile end | ±100mm | per pile | Measure drill pipe length |
| | | pile top | +100mm, 0mm | per pile | Measure drill pipe length |
| | | Pile diameter | 50mm | per pile | According to the set parameter index |
| 3 | Drilling accuracy | 1% | per pile | Theodolite or inclinometer to measure drill pipe | |
| 4 | jet pressure | According to the set parameter index | per pile | View pressure gauges and automatic numbers display recorder | |
| 5 | jet flow | According to the set parameter index | per pile | View flow meters and automatic data display recorders | |
| 6 | Coaxial high pressure air pressure | According to the set parameter index | per pile | View pressure gauges and automatic data display recorders | |
| 7 | Coaxial high pressure air flow | According to the set parameter index | per pile | View flow meters and automatic data display recorders | |
| 8 | cement consumption | not less than the design value | per pile | View the mixing record or view the flow meter and combine the specific gravity of the slurry | |
| 9 | Slurry specific gravity | ±0.02 | 2 random inspections per shift | Mud Gravity Measurement | |

7 After reaching the age of 28 days, the unconfined compressive strength and permeability coefficient shall be tested by the method of coring, and the number of corings shall be 2%, not less than 5. The 28-day unconfined compressive strength of the solid added is >1.0MPa.

8. The operation team shall do a good job of handover, and the construction of the whole pile shall not be interrupted during the construction of the whole pile. If it must be interrupted in case of emergency, the operator shall immediately report to the production manager and technical person in charge through the constructor or directly.

9. Do a good job in technical disclosure, clear division of labor, and unified scheduling.

4.3. Quality Acceptance

4.3.1. Pile Quality Acceptance

The acceptance of pile quality can be checked by excavation inspection, coring, load test or partial excavation water penetration inspection.

4.3.2. Inspection Point of Pile Quality Acceptance

Pile quality acceptance inspection points shall be arranged at the following locations:

- 1 The parts of the building with heavy load;
- 2 on the curtain line;
- 3 Parts where abnormal conditions occur during

construction;

4 The complex geological conditions may affect the quality of the parts.

4.3.3. Bearing Capacity Inspection

When the vertical bearing composite foundation is completed and accepted, the bearing capacity test shall adopt the composite foundation load test and the single pile load test.

5. Construction of Construction Security System

5.1. Construction Safety Guarantee System

5.1.1. Security System

1. Establish a sound production safety responsibility system at all levels, organize a safety production network with the participation of project managers, project engineers, safety officers, construction workers and team leaders, formulate safety technical measures for major types of work, and strengthen safety technical disclosure and special Work safety education and training.

2 According to the safety management standards of the Ministry of Construction, strictly implement the "Building Construction Safety Inspection Scoring Standards" (JGJ59-2011) and "Technical Specifications for Temporary Electricity Safety at Construction Sites" (JGJ46-2005)

standards for construction electricity, and regularly hold safety meetings and Regularly organize inspections, and the alarm bell rings, forming a new atmosphere of safe production.

5.1.2. Electric Safety Measures

1 Bare wires shall not be erected on the construction site, and it is strictly forbidden to pull and connect them randomly, and it is not allowed to bind them directly on the metal bracket.

2 The metal casing of all electrical equipment must have good grounding or zero-connection protection.

3 All temporary and mobile electrical appliances must be equipped with effective leakage protection switches.

4 The selection of power lines and equipment must limit the safe current carrying capacity according to national standards.

5 Use a safe voltage in a very humid place or a work place with good electrical conductivity such as a metal frame.

6 There should be eye-catching electrical safety signs on site, and electrical equipment without effective safety technical measures shall not be used;

7. The switches, fuses, sockets, etc. in the distribution box are well-equipped, the wiring and equipment are neatly arranged, the crimping is firm, the operation surface is free from the exposed electric current, and the electric box shell is provided with grounding protection.

8. Each circuit is equipped with a leakage switch, the power and lighting are controlled separately, and a single-phase three-eye unequal distance safety socket is set separately, and a leakage switch is set.

9 The distribution box at the construction site must be set overhead, and the height of its bottom from the ground is not less than 0.5m.

10 The shell of the electric welding machine should be in good condition, the terminals on the primary and secondary sides should be protected by a protective cover, and the power supply on the primary side should have a rubber-covered cable, and the length should not exceed 5m.

11. All on-site lighting shall use soft rubber sheathed wires and have leakage switch protection. The metal bracket of the mobile iodine-tungsten lamp shall have reliable grounding (connect to zero) and leakage switch protection, and the distance between the lamps and lanterns shall not be less than 2.5m.

5.1.3. Mechanical Safety Measures

1 The bearing capacity of the mechanical walking road meets the requirements;

2. The bearing capacity of the foundation of the mechanical parking stand meets the requirements. If it does not meet the requirements, measures such as laying steel plates shall be taken;

3 The inspection and acceptance of machinery and equipment must be organized when entering the site, and only if the requirements are met, the security materials and certificates of conformity are complete and valid;

4. Operators who belong to special types of work should hold certificates for employment. Those who are not of special types of work must have three-level education and pass the examination before they can take up their posts;

5. Special personnel are responsible for the maintenance of machinery and equipment to ensure the normal operation of machinery;

6 For unresolved matters, please refer to "Technical Specifications for Inspection of Construction Site Machinery and Equipment" JGJ160-2016.

5.2. Construction Environment Guarantee System

5.2.1. Environmental Protection Measures Around

5.2.1.1 Environmental data collection

Before the construction of combined MJS piles, the following surrounding environment and other materials should be understood:

1 The structure and foundation condition of the adjacent buildings;

2 The type, material, joint type, burial depth, construction technology, usage status, etc. of the surrounding pipelines;

3 Protection requirements for protected objects.

5.2.1.2 Environmental Monitoring

During the construction, environmental monitoring should be strengthened, and the pressure control coefficient in the ground should be modified according to the monitoring data. If there is an abnormal situation, the construction should be stopped immediately, and the construction technology and parameters should be adjusted.

5.2.1.3 Treatment measures

Slurry treatment should be carried out during construction, and waste slurry should be managed centrally to prevent spillage and be transported out in time; when site conditions are limited, slurry filter press equipment should be used to filter waste slurry; slurry is strictly prohibited from being discharged into municipal pipelines.

5.2.2. Management of Waste

1. The centralized storage and treatment of mud meets the requirements; for solidification treatment, the recycling rate reaches more than 80%.

2. The recycling rate of building material packaging shall reach 100%, and the classification rate of toxic and hazardous waste shall reach 100%.

3 Construction solid waste must meet the requirements of "Technical Specification for Sanitary Landfill Treatment of Domestic Waste" (GB 50869-2013) and "Law of the People's Republic of China on the Prevention and Control of Solid Waste Environmental Pollution".

4. For the waste generated by the project department, carry out garbage classification treatment. Select a qualified contractor, sign the "Environmental Protection Agreement for Waste Removal and Transportation" with it, and transport the sealed garbage truck to the specified disposal site. Toxic and hazardous wastes are entrusted to the hazardous waste removal, transportation and consumption units approved by the local Environmental Protection Administration for processing.

6. Analysis of Construction Economic Benefit

6.1. Economic Benefits

1 Convenience and speed: conventional all-round high-pressure rotary jetting method pile construction, each section of shotcrete drill pipe is 1.5m, shotcrete speed is 25min/m, it takes 38 minutes to lengthen a drill pipe, and a 25-ton truck is required to hoist the entire drill pipe. Cooperate throughout the spraying process. The combined omnidirectional high-pressure rotary jetting method is used to install the drill pipe on the three-axis frame in advance. The height of the frame is 36m, and the first section of the drill pipe can be installed on the frame in advance by 35m. The remaining drill pipes are

extended to a section of 9m. After the drill pipes on the three-axis machine are lowered, a 25-ton crane will be used to install the remaining drill pipes in place at one time, and there is no need to occupy the crane during the entire shotcrete process.

2. Fast lowering speed of drill pipe: The pile length of the all-round high-pressure rotary jet construction method in this project is 64m. The conventional all-round high-pressure rotary jet construction method requires 43 sections of drill pipe. A total of 210 to 340 minutes is required for the connection of the pile and drill pipes. The first section of drill pipe (35m) in the pile construction of the combined omnidirectional high-pressure rotary jet construction method is extended on the pile frame in advance during the lead-in, which can be completed within 5 minutes, and the remaining 29m, a total of 4 sections, can be completed within 15 minutes. All the piles can be laid down within 20 minutes, which is at least 180 minutes earlier than the conventional all-round high-pressure rotary jet construction method, which greatly reduces the risk of hole collapse due to too long drilling time.

6.2. Social Benefits

1 The biggest advantage is that it has less impact on surrounding structures and is highly controllable.

2 The waste pulp is discharged in an orderly manner, the discharge location is more selective, and the pollution to the surrounding environment is small, which is easy for site management and civilized construction.

3 The single pile has a large section, good pile quality and high strength.

4 Various forms, suitable for complex and difficult environments.

5 Information control, easy to guarantee the quality of piles.

6 The construction of ultra-deep piles can be carried out.

7. Application Examples of Construction Technology

The Alibaba Jiangsu headquarters project was developed by Chuanyun Network Technology (Nanjing) Co., Ltd. It is located in Jianye District, Nanjing City, in the financial and cultural center area, adjacent to the Financial City, Nanjing Shenglong Huijin Center, and Youth Olympic Village. It is a large-scale complex integrating office buildings, large-scale commercial buildings and high-end apartments.

The Quaternary loose layer of the project site is Holocene gray soft-flow plastic clay soil and sandy soil, and the underlying bedrock is silty mudstone. The geotechnical layers revealed within the exploration depth are divided into 5 major engineering geological layers, of which the first layer is mainly artificial landfills in the near future; the second layer is mainly composed of new and recent soft soil, and the third layer is mainly sandy soil (About 40-50m thick); ④ layer is pebble gravel layer; ⑤ layer is silty mudstone.

The enclosure structure of the foundation pit is in the form of three-axis stirring pile groove wall reinforcement + underground diaphragm wall + MJS construction method pile water stop, the diaphragm wall width adopts 1000mm, 1200mm thickness, the design requirements of the omnidirectional high pressure rotary jet construction method pile are as follows:

1. All-round high-pressure rotary spraying method is used for the joints of the underground diaphragm wall groove section to stop the water. The diameter of the pile is not less

than 2000mm, the depth is the same as that of the diaphragm wall, and the 180° swing spray is used, and 42.5 ordinary Portland cement is used. It is required to have no side for 28 days. The ultimate compressive strength is greater than 1.0Mpa.

2 The reference values of the working parameters of the all-round high-pressure rotary jetting method are as follows: water-cement ratio 1:1, shotcrete pressure greater than or equal to 40MPa, shotcrete volume 85~100L/min, air pressure 0.7MPa, air flow 1.0~2.0m³/min, The lifting speed of the drill pipe is 25min/m, and the pressure in the ground is controlled by a coefficient of 1.0~1.8 (it can be adjusted and controlled according to the geological conditions; the initial cement dosage is 1.7t/m (semi-circle).

Before construction, our project technicians prepared a special construction plan, supervised the whole process of construction, and strictly controlled the construction quality. The construction method is fast, convenient and economical, and can effectively solve the leakage problem between the ground and wall joints. At the same time, the adjacent subway construction has no impact, the construction method is advanced, and it has a great application prospect.

8. Conclusion

In summary, the development of the construction technology and technology of the combined all-round high-pressure spraying pile has greatly promoted the development and exploration of urban underground space in my country. It can quickly pass through the complex underground geology to avoid the impact of hole collapse on drilling, and it also has the advantages of conventional omnidirectional high-pressure rotary jet piles. It has little impact on surrounding buildings and structures, and has strong controllability, which can effectively protect surrounding buildings. and safety of municipal facilities. Fast, convenient and economical, it can effectively solve the leakage problem between the ground and wall joints, and at the same time, it has little impact on surrounding buildings and structures, and has strong controllability. The adjacent subway construction has no impact, and the construction method is advanced.

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