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# Analysis on Construction Methods and Technical Research Composite Bearing Capacity Foundation of Joint Fractured Rock Mass in Transmission Line in Xinjiang Area

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## Abstract

Aiming at the joint fissure sandy mudstone (rock) foundation developed in joint-fissures of transmission line project in Xinjiang, there is no precedent has been studied and applied according to the similar theory, the composite anchor foundation is designed and constructed in Xinjiang. Through the preliminary geological selection, the experiment of digging compound foundation was carried out on the Gobi Desert in Tuscaloosa, Xinjiang. This article focuses on introducing the construction of specific operations by elaborating the preparatory work and techniques and methods. The specific operations as follows: First, the undisturbed structure of the mud is perforated with a special machine, and the slag and holes are cleared after drilling. Then the concrete is poured after the anchor is laid. Finally, the test results show that the construction of the composite load-bearing foundation is feasible in Xinjiang

## Keywords

Transmission line, Anchor foundation, Construction quality, Joint fractured rock mass, Experimental research.

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## 1. Introduction

Anchor composite foundation is a cement mortar or fine aggregate concrete in the mudstone hole cementation, which makes the anchor and rock body combine to form a new foundation of the whole. On the one hand, the rockbolt composite foundation utilizes the characteristics of high strength and low deformation of mudstone and can withstand large vertical tension and pressure; On the other hand, the rock bolt composite foundation has remarkable economic and social benefits, such as superior mechanical properties, little materials, simple construction and small environmental damage. Choosing a good method is particularly important to ensure the quality of construction. So, the construction method of anchor composite foundation is introduced to guide the construction work.

## 2. Preparation before the composite foundation of joint fractured rock mass

The person in charge of construction technology needs to be familiar with the design drawings and documents and learn relevant rules and regulations; Anchor steel, position plate and process template according to the design drawings; Design the fine stone concrete mix ratio according to the design requirement; Verify the center of the pile when positioning and inform the design unit immediately if there is any discrepancy. The person in charge of construction technology needs to conduct a comprehensive and meticulous technical interview with all staff to ensure that workers understand and clarify the relevant contents.

The excavation and borehole of the bolt composite foundation shall meet the following three requirements:①The integrity of mudstone structure should not be destroyed;②The stone powder in

the hole, floating soil and loose living stones should be cleaned; ③ Bolts should be installed immediately after the rock is perforated, and pouring concrete to prevent the hole wall weathering.

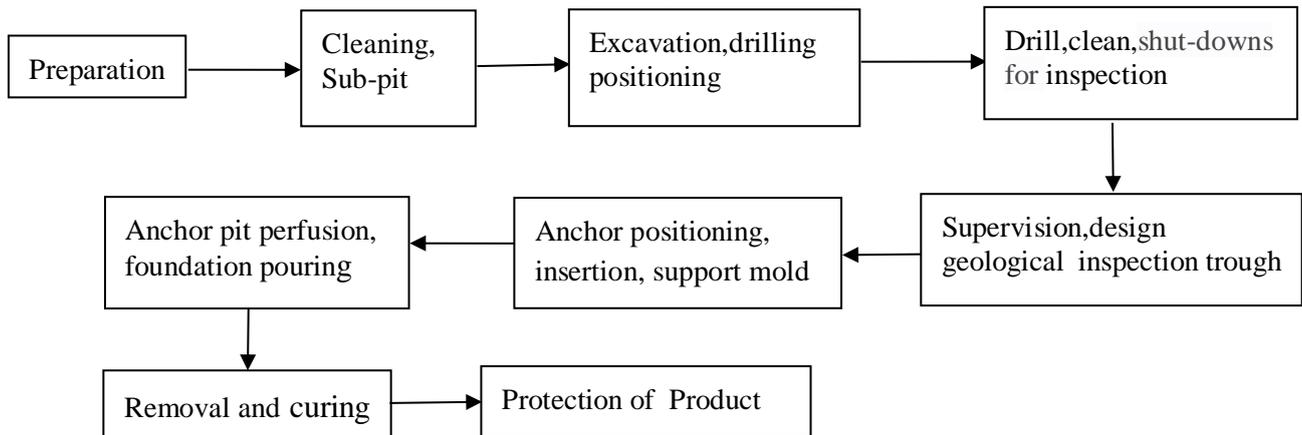


Fig. 1 Construction flow chart of Anchor composite foundation

### 3. Construction of the basic surface cleanup and foundation points pit

According to "Basic Construction Instructions" (basic construction drawings) to clean the construction of the basic surface, the construction unit can not be expanded to open aspects, and prohibit the destruction of the whole body of the rock mass below the base surface.

The site should be reserved before excavation, and the equipment for drilling, grouting and flushing and the effluent sewerage should be treated validly to prevent pollution of the environment. After the formation level are cleaned up, check the base elevation and the sub-pit measurement. Firstly, check the construction drawings, sub-pit manuals and tower list, measure groundwork pit according to the tower number given on the detailed list. Check again before and after two adjacent gear span should be divided pit, confirmation and design of distance, direction and the review pile foundation in the direction of the tower leg, began formal pits in certain circumstances; and the protection of the center pile and pile direction. The span between two gears should be reviewed again before sub-pit measurement. Then the direction of the pile and the base of the tower legs should be checked and you can start to measure groundwork pit if no error. Finally, the center pile and pile direction should be protected.

When the sub-pit is measured, power transmission tower cross section base must be retested, and review the follow-up tower length, short leg configuration and terrain is consistent, if found to be not consistent with the design department should be promptly linked. Special attention should be paid to the relationship between foundation pit and gully pit during the sub-pit measurement, if the sub-pit is directly pitched or too close to the gully, contact the design department in time so that measures could be taken. The foundation pit of the whole corner tower is carried out according to the principle that all corner tower foundation pits (unless otherwise specified) of inner angular bisector coincidence principle according to the tower cross arm and the central line of the line.

### 4. Excavation and drilling rig positioning

After the pit is completed, the excavation of the foundation pit can be started. First on the part of the construction to clean before foundation pit excavation. Then the elevation of the construction surface and fundamental root diagonal and excavate size to verify. Finally, the excavation is carried out according to the size of the sub pit. The foundation of digging is made by artificial excavation (In the latter part of the project excavation and rotary drilling rig excavation a combination of methods, rotary drilling rig in the excavation process, there must be someone responsible for checking the size of the pit). You should check once for each dig 500mm-1000mm to ensure that dig digging part of the size is accurate. there need artificial trimming for bottom of the pit When digging into the depth of the design. The test of hypoxia need to do before entering the pit for deeper foundation pit. There are no

more than two people in each pit, and one of them is in charge of safety supervision. The staff should trim strictly in accordance with the size of design drawings given, please always pay attention to the situation of the pit, and prevent the collapse of the cave-in or rock from falling back into the pit. The wooden ladder should be used when going up and down the pit and it is not allowed for the staff to rest in the pit. It is forbidden to stack and discard soil within 2 meters of pit mouth to ensure the safety of construction personnel.

After the completion of the foundation excavation, mark the position with lime base and the position of the hole is marked with the positioning pile. Assemble the rig according to the instructions of the rig and align the center of the rig with the central sign of the hole and use the theodolite or the ball-drop instrument to control and adjust the drilling rig so that the drilling rod of the drilling rig is perpendicular to the ground and then fix the drilling rig; Proper drilling types and drilling methods should be used and the weight and stiffness of drilling tools should be matched in case it affects the drilling speed and the slagging, give full play to the efficiency of drilling tools to obtain high-precision drilling; The equipment's installation of all parts is checked by professional technicians, and the drill bit is selected and installed according to the hardness of mudstone. After proper operation, the equipment can be switched on.

## 5. The hole of drilling and cleaning

The drill rod should be kept vertical when drilling, so as to ensure that the mud hole is normal. And you need to observe and inspect the drill footage, if appears soil, groundwater, subdrain, karst cave, sunken pipe, cultural relic, grave and so on, stop drilling instantaneously and inform the design units and related departments to process; The bore diameter and length of drill of anchor foundation should be satisfied the requirements of design drawings and the appropriate drilling method adopted to ensure the accuracy, so that the subsequent anchor stock insertion and grouting operations can be carried out smoothly.

During the drilling process, mudstone strata should be verified. If there is a big difference between the actual formation and the design strata, the designer should be promptly reported so that measures can be taken to reinforce or change the drilling position.

Proper drilling tools and drilling methods should be adopted in different mudstone layers to ensure that the hole wall does not collapse during the grouting process when inserting anchor stock. The drilling diameter should meet the design requirements without causing excessive disturbance of the hole wall.

Drilling water should adopt clear water not mud or other suspension, it will weaken the anchor bolt. The waterless drilling method should be adopted When the drilling water has an adverse effect on the foundation. It is necessary to pay attention to the condition of the underground water level. If the groundwater is flowing out of the drill during the construction process, the grouting should be used to stop it to prevent affect the anchoring force of the anchor.

The hole diameter and the deflection should be measured timely during the drilling process, and the drilling process parameters and operation process should be constantly adjusted, the borehole bottom deviation scale should not be greater than the length of anchor 3%.

If there is sediment or clay attached on the inner wall of the borehole, the anchoring force of the bolt will be lowered, so, it is necessary to clean the hole wall with clean water. The gas cleaning method should be adopted when the water has bad influence on the foundation. In order to collect residual rock and clods the length of the anchor rod hole should be increased more than 50cm and the time of clear hole should be at least 10min.

The hole should be sealed temporarily after cleaned to prevent the sand and stones pollute the hole.

## 6. Design, geological test trough, installation of anchor bars and concrete pouring requirements

It must be inspected and confirmed by design and investigation unit after pore-creating.

Before the installation of anchor bars and concrete pouring, the process will not allowed to enter the next until after inspection and acceptance by construction and supervision project department. And there are several requirements:①the buried depth of the anchoring tendon shall not be less than the design value, ②When pouring concrete, it should be stratified pouring ramming dense, and according to the provisions of pouring the basic concrete to maintain;③The amount of concrete poured in the hole shall not be less than the specified value of the construction design;④The strength test of pouring concrete should be based on the test block under the same condition, and the test block should be taken from each group.

## 7. Anchor stock insertion, formwork support and concrete pouring

In order to prevent the forming foundation pit from being exposed for further weathering, the anchoring stock insertion and the concrete pouring should be carried out as soon as possible after the cleaned. The anchor pit that is close to each other is suitable for once, and the anchor bars are placed at the same time, the location is completed by the positioning plate. The concrete should be segmented perfusion to prevent the "string pulp" due to cracks through, and there is also possibility that anchor rod could not be placed to the designed elevation. The type and specification of the anchor bars should be checked before the construction and the displacement should be controlled by the template, As with the method of foundation pits, the accurate position of the anchor bolt is controlled by design based semi root open and semi diagonal , and then leveled to ensure that the anchor bolt center is in the center of the pit. Plastic thin film should be laid on the pit and pit walls before the formwork is supported. The height of the suspension is about 0.5m, and it supports or clings to the wall of the pit. The template should be at least 50mm ~ 100mm below the soil layer. In the process of concrete pouring, the template must bear the action of various external forces. The template must meet the following requirements:①The measure of foundation and mutual position must be correct;②With sufficient strength, rigidity and stability;③splice tightly, no slurry.

The concrete can be poured after the formwork is strengthened. In the process of concrete pouring, measures should be taken to fix the spacing of the anchor to prevent the concrete pouring and vibration to make its position deviation occurs.

The mix proportion of concrete and mortar should be determined by the pre-construction test to ensure that the slurry has good fluidity. Mixing water should not contain substances that affect the normal condensation and hardening of cement. No sewage shall be used. The slurry should be configured according to dosage, mixed slurry storage time shall not exceed 120min. During the foundation casting process, a group of test blocks is produced at the same time.

The pouring of concrete has a great influence on the bearing capacity of anchor foundation, and the quality of concrete grouting should be strictly controlled in the construction process. Perfusion and vibration should be carried out simultaneously to prevent the concrete fault in the anchorage section and form the "candied haws on a stick" shaped anchor. Concrete pouring can be layered pouring and vibration, but anchor piles and pile caps must be completed one-time pouring, can not be poured in batches. The base elevation should meet the requirements and the surface of the foundation outcrop should be smooth.

The screw thread part of anchor stock should be protected before pouring to prevent concrete slurry pollution. Check and record the amount of filling to ensure that the actual amount of irrigation is not less than the amount of calculation. After drilling the soft rock, it should be immediately poured to prevent the hole wall weathering.

## 8. Form removal and maintenance

The basic outcropping shall not have any defects such as leakage reinforcement, cavern and concrete dot surface. If any, it should be treated according to design requirements and specifications. After form removal, covered with plastic film, water and maintenance, buried with soil, and flat on the base.

The curing time of concrete shall not be less than 28 days, and the upper structure can be assembled after the curing period meets the requirements.

## 9. Protection of product

Anchor bolts and foundation surfaces are not allowed to collide. Subsequent processes require isolation protection. It should be observed the "Specification for Winter Construction of Building Engineering" in winter. Refer to the later basic construction instructions for matters not mentioned. Main reference: *Tension model test study on grouting bolts of fractured rock mass foundation for transmission for transmission lines.*

## 10. Conclusion

Transmission line projects in Xinjiang are mostly built on the Gobi Desert. The geology is multi-layered, mostly composed of upper loose sandstone and lower sandy mudstone (rock). In this geological condition, the traditional form of construction work consumes human, financial and material resources enormously, and the construction cycle is prolonged. The anchor composite foundation has the advantages of less material, simple construction and less environmental damage, and if the construction technology in this respect can be further strengthened in the later stage, the economic and social benefits can be enhanced significantly.

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