Study on supervision and control methods for construction inspection of UHV transmission lines

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Abstract. With the introduction of global energy interconnection, the UHV transmission lines become more and more important as the backbone of the global energy internet. With the continuous construction of the UHV project in recent years, new requirements have been put forward for the new requirement for speed and quality of UHV project. It is very important to ensure engineering inspection and test activities are carried out in an orderly and orderly manner. Supervise engineering inspection and test results can reflect engineering quality level and it is also an indispensable part of the construction of UHV.

1. INSPECTION PROJECT OF UHV TRANSMISSION LINE PROJECT

1.1 Main inspection items
The main inspection items include: sand, stone, cement, water, concrete mix ratio, steel bar, steel welded joint, steel mechanical connection test and other raw material witness sampling test; concrete test block, low strain or sound wave transmission, tests on finished products such as single pile vertical compressive static load test and so on; rebound method, drill core Special inspection such as law, inspection of safety technology for large cranes, such as truck cranes, hydraulic connection test of ground wire and strength test.

1.2 Special inspection project
Special inspection items include: 42CrMo foot bolt witness sampling test; mechanical equipment and equipment inspection, including motor winch, hoisting wire rope (rope sleeve), hand hoist, sling, cableway tractor, light and small hoisting equipment, hoisting rod (landing arm), hoisting trochlear (turning trochlear) Shackles, anchor, ground anchor, traction machine, tension machine, fiber rope, twisted wire rope, traction board, line trolley, bending connector, rotary connector, net sleeve connector, clamp wire device, double hook tightener, press machine, high altitude operating car, high altitude basket, truck crane and so on; rotary drill rig, safety inspection of new mechanical equipment for landing double horizontal boom. High strain test for single pile cast-in-place pile foundation.

2. Main problems of UHV transmission line engineering inspection
The test reports of sand and stone are lack of crushing value, cement testing report is lack of detection of chlorine ion and alkali activity¹, there is a lack of chlorine ion and alkali activity detection in the cement testing report, and the collapse degree, cement dosage and water cement ratio in the concrete mix ratio test report are not consistent with the specifications and design requirements.² The
compressive strength of concrete will only be issued 3 days, 7 days compressive strength test report or strength value does not meet the specification requirements. the steel inspection report lacks the weight deviation detection. Because of the high performance of 42CrMo anchor bolt, it may appear that the hardness of the test (three point mean value) HRC exceeds the standard, and the test report has not issued the conclusion of the qualified or not. The random sampling and retention test blocks of the construction units cause the samples not to be representative; the test block maintenance does not conform to the requirements of the standard, resulting in the inconsistency between the test report and the solid quality, the compressive strength value in the test block report is too high or too low, which makes it impossible to evaluate the concrete strength.

High strain, low strain, sound transmission, single pile vertical compression static load test report does not meet the requirements.

If the use of the application scope of the special inspection, such as the rebound method, the drilling method, the high strain test of the single pile foundation and the high strain test, is not correct, the quality of the finished product of concrete pile will be destroyed. There are many machines used in the construction site of UHV transmission lines, but we can see many violation of rules and regulations such as some machines and tools lacks of type tests and proof materials. The inspection of large machinery and equipment is not standardized including new mechanical equipment such as rotary drilling rig, landing double horizontal arm holding pole and so on.

3. Supervision and control methods for inspection of UHV transmission lines

The test of UHV transmission line is one of the effective means to ensure the quality and reliability of the project. It is also the basis for evaluating the quality of the engineering entity. Once the test of the UHV transmission line engineering inspection has problems, it will bring safety and quality risks to the engineering construction. It is of great significance to improve the safety of the engineering construction and the quality of the finished products to reduce or even eliminate the problems in the inspection test of UHV transmission lines in the process of testing for UHV transmission lines.

3.1 Strengthen management

The professional supervision engineer should strengthen the review. We must strictly examine the qualification of the control laboratory and conduct on-site inspection of the laboratory capacity. Strengthen the control of the main raw materials. 42CrMo foot bolt witness sampling inspection is first carried out in 1000kV Ximeng-Shandong UHV transmission line project. Due to a certain degree of hardness exceeding the standard, the anchor bolts will be easily broken. If the hardness exceeds the standard, the test report should be resampled or issued, otherwise it should not be used in the project.[3]

3.2 Performing witness sampling procedures

The professional supervisor should follow the process of sampling and the process of inspection, and take the sampling and scaling measures to the raw materials that can not be sent to the inspection in time, so that the material can truly reflect the essential quality of the project. According to the code for acceptance of construction quality of concrete structures[4], in order to ensure the validity of the test block indwelling, the supervision personnel should strictly request the construction unit to take sampling and indwelling in accordance with the standard, and the 3 specimens in each group should be sampled from the same car, and the test block box should be selected according to the coarse aggregate size, and the methods and times of the brazing should be standardized.

3.3 Program management


The professional supervision engineer shall strictly control the process according to the requirements of the technical specification for pile foundation inspection. The number of high strain testing for the high strain pile of UHV transmission line is 5% of the total number of piles, and the number of low strain or acoustic transmission detection is 100%. The supervision engineer should strictly control the procedure, and strictly prohibit the construction of the next procedure for the pile foundation without the detection report which does not meet the requirements.

### 3.4 Special test range

Professional supervision engineers should make clear of the testing methods of rebound test and core drilling test, to ensure the accuracy and effectiveness. The rebound test should be made clear and checked for the basic requirements, the requirements of the measured area, the requirement of measuring point, the value of rebound value and the value of carbonization depth, the calculation of rebound value and the calculation of the strength value of concrete. The core method should be used to deal with the number of core, the position of the drill hole, the compressive core sample of the concrete, the test of the compressive strength of the core sample and the test data. The analysis and judgment are made clearly.

The strength report of the test block is not provided during the acceptance of the project, or the number of the strength in the report is too high or too low, rebound strength and core drilling test can be used to check the strength of foundation concrete. Taking the rebound test as an example, the method of supervision and control should be paid attention to: the rebound test is applicable to the compressive strength of ordinary concrete. The rebound test should not be used if there are many internal and external differences. Someone who uses rebound test for engineering testing shall pass professional training approved by the competent department and hold corresponding qualification certificate. When the strength of the foundation concrete is tested in the field, the technical specification for testing concrete compressive strength by rebound test should be strictly followed.

### 3.5 Supervision and control of special test method

The high strain testing of the single pile foundation is widely used in UHV Engineering, in order to ensure that the basic body will not be damaged during the test process. The professional supervision engineer should supervise the production and maintenance methods of the high strain detection and protection cap for the single pile foundation, it is required that the construction units should strictly follow the technical requirements of the notice issued by the State Grid. Before the cap is made, the pile should be tested with low strain, and the test blocks are made synchronously and maintained in the same condition when the protective cap is poured. High strain detection can be carried out after the strength of the protective cap reaches the design strength of the pile.

### 3.6 Safety inspection of construction machinery

According to "basic requirements for design and test of transmission line construction machinery and tools" and "notice of the ministry of communication of the State Grid on further strengthening safety management of construction machinery for UHV communication projects". The construction unit should make detailed management of the incoming construction machinery, make clear the inspection cycle and project, and carry out the maintenance inspection according to the regulations. The construction unit should make detailed management of the incoming construction machinery, make clear the inspection cycle and project, and carry out the maintenance inspection according to the regulations.

### 3.7 Review of new and large mechanical equipment

For the purchase of new mechanical equipment, handover and acceptance shall be carried out according to appearance inspection, carefully check the specifications, models and technical parameters. Purchase or lease new mechanical equipment, require the construction unit to provide the certificate of manufacturer's and product of qualification, the certificate of product qualification,
factory test report, handover acceptance certificate, installation instructions, safety operation regulations and so on. When the supervision project department reviews the inspection data of new machinery and equipment, who fail to pass the inspection will not be allowed to enter the construction site. If the inspection of new machinery is not qualified, it can not be used. Safety inspection should be carried out in the course of operation, special inspection should be carried out at least once a month, and construction project department should be supervised to carry out special inspection at least once a month.

For the truck crane, although it is not tested according to the requirement of special equipment, but it should still provide the corresponding safety technical inspection certificate, should not enter the construction site without inspection or test, supervise the construction unit should establish the periodic inspection and maintenance records of the crane, and strictly carry out the lifting machinery entrance and safety.

4. summary
The inspection of the UHV transmission line project gives the project supervision a great responsibility. In order to ensure the supervision of the supervisor is appropriate, the supervision unit will give many trainings to their supervisors. At the same time, in order to ensure the safety and quality of the project, there also will be many tests about safety and quality of engineering for these supervisors. Security is the most important thing, if we are not safe, we will have noting at all.

References
[1] JGJ 52 - 2006 standard and quality standard for sand and stone for common concrete [S].
[2] JGJ 55 - 2011 code for design of mix proportion of common concrete [S].
[3] GB/T 3077 - 1999 alloy structural steel [S].
[4] GB 50204 - 2010 code for acceptance of construction quality of concrete structures [S].
[5] JGJ 106 - 2014 building foundation inspection technical specification [S].
[6] GB/T 50107 - 2010 standard for inspection and assessment of concrete strength [S].
[7] JGJ/T 23 - 2011 rebound method for testing concrete compressive strength technical specification [S].
[8] DL/T 875 - 2004 basic requirements for design and test of construction machinery for transmission line [S].