Application embodiment of civil construction technology of electric power system substation

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Abstract. In the rapid development of social economy, the power system as a guarantee of residents' normal life and work infrastructure, substation belongs to the overall system operation of the transfer station, practical project construction level affects the overall power system engineering operation quality, determines the social development of electricity safety and operation efficiency. From the perspective of overall development, the civil engineering construction of power engineering substation is the focus of the construction unit. In order to give full play to the application role of the power system and ensure the safety of the normal life of social residents, the technical personnel of the enterprise should fully grasp the key points of the civil engineering construction of the substation, pay attention to the actual situation, and determine the basic project construction scheme. Therefore, on the basis of understanding the current status of power system and substation civil construction, according to the construction technology applied in the construction of practical projects, taking the substation project of a regional power system as an example, this paper mainly discusses the application of civil construction technology of power system substation.

Keywords: Power system; Substation; Civil construction; Construction technology; transformer.

1. Introducion

As a basic part of power system operation, the quality of practical operation directly determines the quality of power supplied by the system. Therefore, how to use scientific construction technology to improve the level of civil construction of substation during construction management is the core issue that scholars in various fields study and discuss. In essence, substation refers to the transformation area of voltage and current during the operation of a power system, which is an important place for receiving and distributing electric energy. Substation in a power plant is a booster substation, which can feed back the booster voltage of electric energy provided by generators to the high voltage grid. Generally speaking, the interior design of the substation is very compact and reasonable. According to the functional requirements, the central control room, capacitor room, high and low voltage distribution room and duty room will be set up respectively. At present, in order to ensure the safe and stable operation of the whole power system, the civil construction requirements of the substation are gradually improved. The construction units should continue to optimize the existing construction technology under the high standard of rigorous specifications, so as to ensure the power system to develop in the direction of scientific and intelligent innovation. Because substation plays a key role in the overall power system, work quality and operation efficiency have a very deep influence on the power system, so the construction unit should master the basic characteristics of substation civil engineering and related design requirements, master the technical means of civil construction, scientific treatment of the project construction management problems, in the process of development of urbanization in our country, To provide adequate electric energy for social residents.[1-3]

According to the practice survey study, at present, substation construction in the power project of our country mainly embodies the following characteristics: First, occupies an area too large. The construction of power system substation project needs coordination and cooperation in many aspects, among which the biggest feature is that it covers a large area and contains more buildings inside. These buildings not only have their own relevant functions, but also have a certain correlation with each other, which will have a certain impact on the field construction process. It

should be noted that buildings with different functions have different impacts on the construction of the project, and the construction projects included are inconsistent; Secondly, the landform difference is large. As the civil construction of substation itself has the characteristics of a large area, the site construction will be limited by certain industrial conditions, so the construction and management of relatively remote areas are usually selected. But the topography of these remote areas will also have a certain impact on the construction of substation. For example, if the topography of the area is suitable for substation construction, the project can be designed directly according to the project requirements during construction management. But if the topography of the area does not meet the needs of the site construction, then the construction unit should consider all aspects of the factors, which will inevitably increase the difficulty of the overall construction management; Finally, the technical connotation and construction cost are too high. Substation construction requires the active cooperation of multiple units and departments, and ensure that the internal staff has a high level of technology. Especially in dealing with some complex construction problems, some unit employees will improve the requirements of modern science and technology and application products, which also leads to higher and higher project construction costs.[4-6]

Therefore, on the basis of understanding the current situation of power system and substation civil construction in the new era, this paper defines the main content of substation civil construction technology according to the current mastered system operation requirements, and then discusses the application performance of relevant technical means according to practical cases, in order to provide technical support for urban construction and development in the new era.[7-9]

2. Methods

2.1 Transformer Installation Technology

Because the transformer installation in the substation is highly professional and technical, professional installation methods and excellent technical products should be used during the work, so as to ensure the installation quality of equipment from the basis. At the same time, it is necessary to improve the ability and quality requirements of transformer installation personnel, ensure that they lay solid theoretical knowledge and rich work experience, can complete the installation work in strict accordance with the national and industry requirements, to avoid unnecessary safety risks during use. It should be noted that there is a big difference between the installation and construction of modern transformer and the traditional sense of installation and construction, the difference between the two is mainly reflected in the internal structure of the equipment, so the staff should check the transformer in detail when installing, only in the case of no damage to the equipment products, can be installed and detected normally.[10-12]

2.2 High pressure test

First, the scientific use of insulating oil. High voltage test belongs to live operation, which is highly dangerous during the working period. Therefore, in order to protect the safety of staff and technical equipment, insulation protection must be done during the test to ensure the normal operation of high voltage live test. Secondly, vacuum treatment transformer. When vacuum treatment transformer, to carry out oil so as to lay a good foundation for subsequent construction. At the same time, potential safety risks should be identified as early as possible by local live test, and the overall high voltage test scheme should be scientifically adjusted according to the test results, so as to reduce unnecessary safety risks as far as possible and comprehensively improve the safety performance of the test operation. Finally, after finishing the high pressure test, the staff should integrate and analyze the experimental results and relevant data to accurately judge whether the pressure withstand value of insulating oil is within the specified range, and pay attention to the application role of modern processing technology, so as to reduce the error probability of manual accounting.

2.3 Secondary Renewal Technology

In the application of secondary renewal technology in the substation, we need to pay attention to the following problems: first of all, in the selection of protection secondary renewal device, can not use the internal equipment broken contact point, otherwise it is easy to cause the technical equipment trip or short circuit phenomenon, can not give full play to the protection function of the secondary renewal device; Secondly, in the daily use process, if the relay plugging and unplugging operation is to be completed orderly, the power must be cut off before processing, and the whole process needs to be recorded and supervised by professional personnel, so as to prevent unnecessary safety accidents and ensure the normal operation of the substation. Finally, before the formal use of the secondary renewal technology, the staff should carefully detect and analyze the application quality of the relevant technical equipment, study and judge whether the connection mode of the ground wire meets the requirements, in order to avoid hidden safety hazards during the work.

2.4 Daily Device Monitoring

On the one hand, before the formal production work of the substation, the staff should verify, analyze and effectively adjust the construction scheme according to the terrain, geomorphology and other features within the region, comprehensively improve the basic way of line assumption, to ensure that the design drawings and the equipment connection mode of the site construction has the consistency; On the other hand, during the operation of the substation, if there is any bad phenomenon such as stop operation or abnormal operation, the staff should timely shut down the technical equipment, arrange later maintenance personnel to check the fault location and main causes, and then formulate effective treatment plan and record the fault area, so as to provide an effective basis for the subsequent management of technical equipment.

3. Result analysis

Based on the understanding of the current technical means of civil engineering construction of power system substations, this paper takes the civil engineering of 110kV substation in a certain area as an example. After making clear the main economic and technical indicators as shown in Table 1 below, this paper master the requirements of the construction management of substation civil engineering in detail, and then integrate the study of the application effect of the technical means of civil engineering construction. This provides an effective basis for the development of power system in the new era.[13-15]

Table 1 Analysis of main economic and technical indicators

serial number	project		unit	quantity
1	Coverage area within the fence of the station area		m²	1565.2
2	Length of cable trench in station		m²	30
3	Road area in the station		m²	420
4	balance of cut and fill	excavation	m²	20817.6
		fill	m²	3722.1
5	Length of war zone fence		m²	164.2
6	Total building area		m²	1228.48
7	Site hardening area		m²	600

From the perspective of site construction management, the outdoor structure design of the substation should meet the layout form of the distribution device, the importance of the project and the basic conditions of the construction environment. At the same time, the service life and the structure form should be designed scientifically to ensure that the structure form of the equipment support and the structure form are coordinated. And the design service life of the architecture and equipment support should meet the requirements shown in Table 2 below:

Table 2 Minimum design service life requirements of substation architecture and equipment support

Type of structural support	Substation voltage grade		
	≤100%V	220kV	330-500kV
General substation framework	25	25	50
Substation framework of important hub	25	30	50
Equipment support	25	25	50
Note: The design service life of temporary structures shall not be less than 5 years.			

After mastering the requirements of infrastructure, the construction unit put forward the following management measures: First, in the factory preparation stage, the construction unit should focus on the site construction of technical materials, work cycle, personnel information, project quality and other content, and then develop a detailed and perfect plan. At the same time, in the selection of technical materials to the relevant departments to review management, only through the review requirements can be applied in the field construction. In addition, the construction team structure should be organized to supervise each other's work quality, and technical management should be carried out in strict accordance with the construction procedures as shown in Figure 1 below:

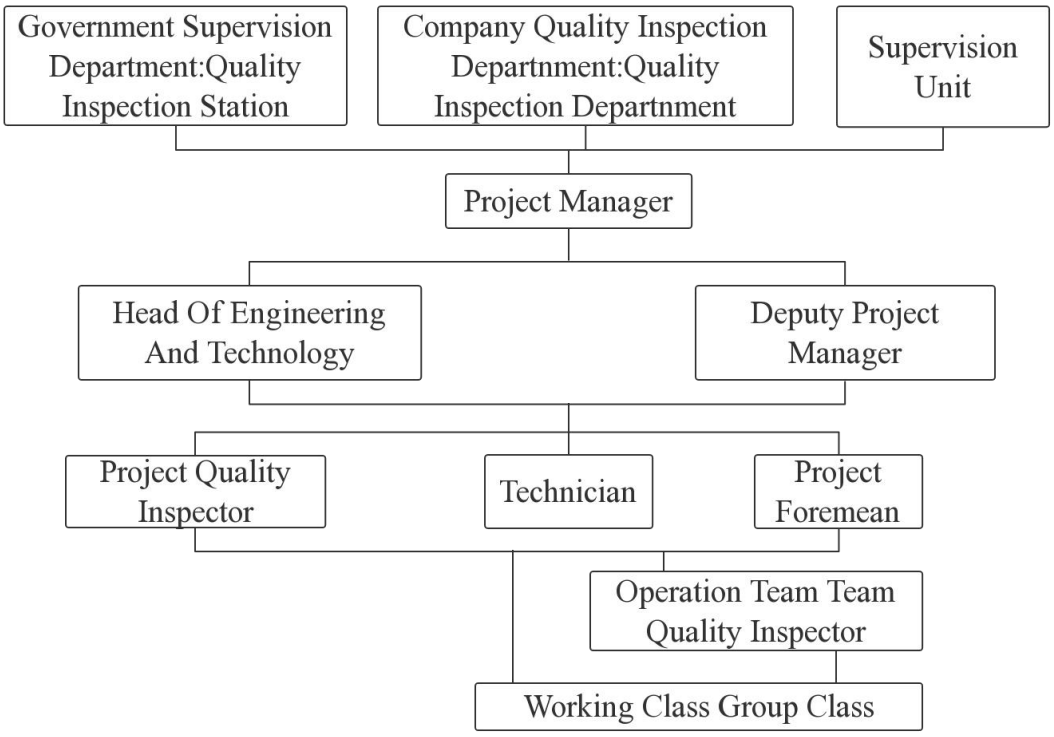

FIG. 1 Technical management structure of substation civil construction

Based on the analysis of the figure above, we can see that all the work belongs to the preparatory work before the construction of the civil engineering of the substation. The employees of the participating units are required to correctly understand the preparatory work in strict accordance with the construction requirements. Only in this way can the project construction management achieve the expected effect, and the life, property, health and safety of the substation staff be fully protected.

In addition, the construction unit also made the substation construction control platform based on GIM three-dimensional design model, as shown in Figure 2 below:

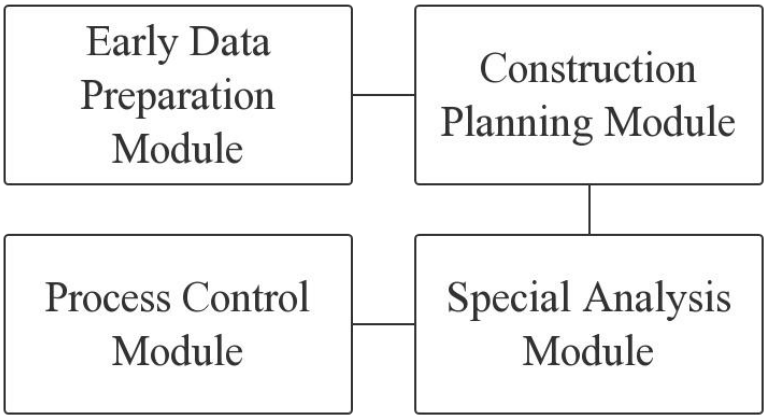

FIG. 2 Platform structure diagram of 3D design model

According to the above analysis, the overall design is mainly divided into three modules: First, the preliminary data preparation module. This module design is mainly used to import gim file information, can master the project information, equipment inventory, three-dimensional design data, final design results and other content in the in-depth study; Secondly, the construction planning module. This module design is mainly used to provide equipment and materials, construction plan, process planning and other contents for the subsequent site layout and process planning; Thirdly, special analysis module. The design of this module is mainly used to study vehicle passability detection, collision detection, construction deduction and other contents. Finally, the process control module. This module design is mainly used to assist the construction process management, including risk analysis, progress reporting, information query and other contents.

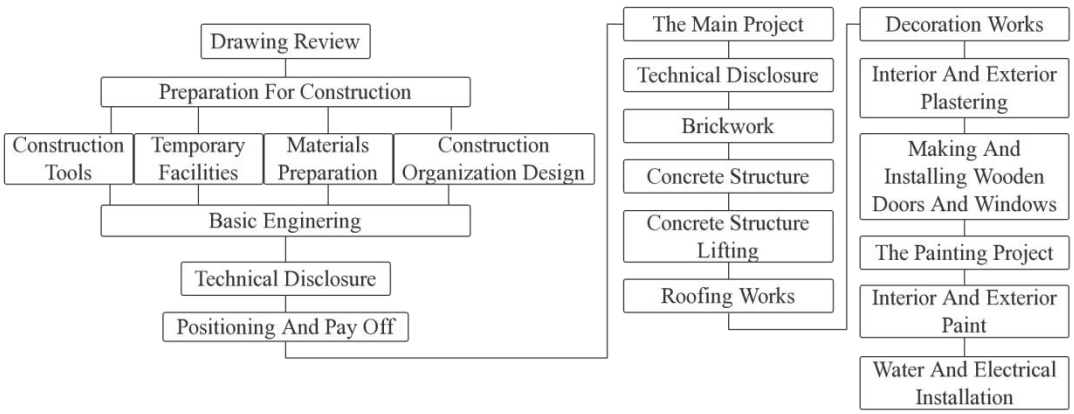

FIG. 3 Project construction flow chart

After mastering the existing construction technical means, the construction unit shall carry out operation processing according to the construction process as shown in Figure 3. After processing according to the link of drawing review, preliminary preparation, basic engineering, technical

disclosure, positioning and setting off, it is found that the quality and efficiency of the substation civil construction project meet the expected requirements, which provides technical guarantee for the safe operation of the power system in the new era.

4. Conclusion

In conclusion, the rapid development of power industry of our country is proposed based on social progress and economic innovation, therefore, when optimizing the improvement of power system substation civil construction technology, we should combine the comprehensive analysis of social economy and development trend of science and technology, and improve the quality and efficiency of civil construction through the reasonable use of scientific and effective management system and rich professional technical means. Only in this way can we guarantee the safe and stable operation of our electric power system.

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