

RESEARCH ON KEY POINTS OF QUALITY INSPECTION OF AERIAL PHOTOGRAMMETRY RESULTS AND QUALITY IMPROVEMENT MEASURES

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ABSTRACT:

In recent years, the quality control of surveying, mapping and geographic information engineering has attracted much attention because of its importance. On the basis of the quality control of the first phase of the 927 project and the western surveying and mapping project, in response to the supervision needs of major national surveying, mapping and geographic information projects, this paper is based on the needs of surveying and mapping supervision, characteristics, development status, this paper analyzes the limitations of traditional surveying and mapping supervision in national major surveying and mapping geographic information projects, and proposes an improved surveying and mapping supervision method, namely the concept of surveying and mapping technical supervision. The research determines that the content of technical supervision is divided into two parts: quality management control and stage achievement quality control, and analyzes its application characteristics. Through the application and effect analysis of technical supervision in actual projects, the advantages and feasibility of technical supervision are verified, which can effectively overcome the limitations of traditional surveying and mapping supervision. The research content of this paper can guide the development of the corresponding quality control work, and provide a reference for the quality control of major national projects.

1. INTRODUCTION

From the beginning of the 20th century, according to the needs of the project quality control and the requirements of relevant departments (Li, et al., 2001; Feng, et al., 2006), the project supervision was gradually introduced into the surveying and mapping geographic information engineering quality control work, forming the current surveying and mapping supervision, Tan Mingjian and Yang Bogang (Tan, et al., 2006; Yang, et al., 2007) scholars have discussed the significance, content, methods and methods of surveying and mapping supervision, including Liu Tiankui, Shi Weibin, Wang Yugang (Liu, et al., 2001; Shi, et al., 2020; Wang, et al., 2011). The application of surveying and mapping supervision in specific projects has been studied, but the main body still follows the idea of engineering supervision of the Ministry of Construction (Wang, et al., 2002; Liu, et al., 2012).

This model is limited by objective factors such as funds and personnel. In recent years, there have been no new breakthroughs. There are major national surveying and mapping geographic information projects with large volume, strong mobility, long cycle and wide distribution, such as western mapping projec(The implementation of surveying and mapping supervision in western China 1:50,000 topographic map mapping project), island (reef) surveying and mapping (927) project, national modern surveying and mapping benchmark system infrastructure construction project is also in the degree of attempt and exploration, and has not been promoted and applied on a large scale.

On the basis of expounding surveying and mapping supervision, this paper will combine years of quality control experience to study and analyze the limitations of surveying and mapping supervision in the quality control of major national surveying and mapping geographic information work. This paper

innovatively proposes technical supervision as a new quality control method, proposes completely different supervision content and organization mode, effectively solves the difficult problem of surveying and mapping supervision, and discusses the feasibility and advantages of this method through its practical application in major national projects.

2. TRADITIONAL SURVEYING AND MAPPING SUPERVISION AND ITS APPLICATION LIMITATIONS

2.1 Contents of traditional surveying and mapping supervision and Achievements

Traditional surveying and mapping supervision is mainly organized in accordance with the way of project supervision, its supervision content mainly includes quality control, safety control, progress control and investment control, the western national mapping project adopts this method. In view of this part has been studied by many scholars in detail, I will not repeat this article.

At present, some small surveying and mapping geographic information projects, because their operation area is relatively fixed, the operation team is relatively stable, and the time span is limited, which also provides strong conditions for the development of surveying and mapping supervision. Traditional surveying and mapping supervision can effectively achieve the full coverage of the production process, through the supervision personnel to the whole process tracking inspection of the operator, the very good supervision effect is desirable.

Through surveying and mapping supervision, the route deviation can be found in time in the production process of the project. Any link shall not enter the next link without the signature of the supervision personnel. Strict supervision measures will eliminate various quality problems before

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acceptance, which has remarkable results in ensuring the quality of the project.

2.2 Analysis of the application limitations of traditional surveying and mapping supervision

Surveying and mapping supervision as an effective whole process of quality control measures, in the "fixed", "local" surveying and mapping project played an effective role, but in the national major surveying and mapping geographic information engineering, has not been widely used and promotion, due to some objective factors in the application process of surveying and mapping supervision, it has the following limitations.

(1) The limitation of funds on the scale of surveying and mapping supervision

To ensure that the above-mentioned content can be implemented, for national-level major surveying, mapping and geographic information projects, the time is generally tight and the task is heavy, because The team is scattered (usually an operation group consists of 3-5 people and is not fixed), and the scope is wide (generally covering the whole territory of my country). A large number of supervisors are required to carry out supervision work on site with the same operation group throughout the whole process, and sufficient manpower, material resources and financial resources are required for guarantee. From the "Surveying and Mapping Production Cost Quota (2009 Edition)" and other relevant regulations of the Ministry of Finance, combined with the current market situation, it is difficult to list the full (10%-20% of production cost) supervision costs during the project establishment process, which leads to the embarrassing situation that the supervision work bears many important responsibilities in quality, safety, progress and other aspects and a small amount of supervision funds.

(2) The limitation of surveying and mapping production mode on surveying and mapping supervision

Construction projects generally have the characteristics of fixed construction sites and relatively stable personnel, which provide strong conditions for the development of project supervision. Selecting suitable supervisors can realize "fixed-point" supervision on the construction site. However, the high-intensity mobility of the major national surveying and mapping geographic information projects (high mobility of operating sites) has brought great difficulties to supervision that has been used. Taking the construction of the geodetic datum network as an example, generally hundreds of working groups can be invested in the selection and burial, and then hundreds of working groups can conduct observations, and usually the work site needs to be changed within a few days or even a day. The surveying and mapping supervision in this case requires If you want to realize the whole-process supervision in the conventional sense, it is inferred that any domestic supervision company is incompetent.

(3) Restrictions on supervision institutions and personnel due to professional requirements

At present, my country's surveying and mapping supervision has two forms: government supervision and social supervision. However, no matter which form of supervision, the qualifications, business technical level, talent equipment, and

project management level of the supervision institutions are uneven, and the personal qualities and business abilities of the members of the surveying and mapping supervision institutions are different, and the supervisors of the supervision companies are generally different. In addition, the supervisors of the supervision company generally do not have the professional foundation of surveying and mapping, and the surveying and mapping production and engineering construction are very different. When facing the professional surveying and mapping geographic information project, it is difficult for those who do not have a certain basic knowledge of surveying and mapping to ensure the supervision effect, resulting in the abnormal phenomenon of relying on the technical personnel of the project management party or the production party to carry out actual work and issuing reports in the name of the supervision company on the market, and the quality of supervision cannot be guaranteed.

(4) Qualification conditions restrict professional quality inspection units to join

In the current "Surveying and Mapping Qualification Grading Standard" (2014 edition), the surveying and mapping supervision qualifications are divided into two grades, A and B, and it is clear that the surveying and mapping supervision should obtain the corresponding professional scope and professional sub-items. Class A (Class B) surveying and mapping qualifications in the corresponding professional scope should be obtained for the sub-items of surveying and mapping supervision. Subject to the constraints of surveying and mapping product quality inspection agencies generally do not have surveying and mapping qualifications, this regulation excludes quality inspection agencies from the scope of surveying and mapping supervision teams, so that surveying and mapping supervision as an important means of quality control cannot be undertaken by quality inspection agencies that are good at quality control, and surveying and mapping production units generally have production business transactions with each other, and it is difficult to play a fair and impartial third-party role. performance is adversely affected.

(5) Lack of supervision basis and imperfect content and procedures

At present, many provinces are actively exploring the trial implementation of surveying and mapping supervision. Sichuan Province has clearly stipulated the surveying and mapping supervision work in the "Sichuan Province Surveying and Mapping Geographical Information Market Management Measures" (major surveying and mapping geographic information projects with an investment of more than 2 million yuan must carry out surveying and mapping supervision), Jiangsu Province, through the promulgation of the "Administrative Measures for Surveying and Mapping Supervision in Jiangsu Province", specifies that surveying and mapping supervision includes review of design, personnel and instruments, progress supervision, process quality control and other work content, but there is currently no implementation scope for surveying and mapping supervision at the national level, the work content is stipulated in the standard specifications, resulting in many surveying and mapping supervision work carried out without rules, without procedures, content and other requirements, supervision work is completely in the stage of independent behavior, and even some supervision only has the content of product quality inspection of surveying and mapping projects.

To sum up, it is of great significance to study a supervision mode that can make up for the above limitations and carry out professional quality control for major national surveying and mapping geographic information projects. The author puts forward the concept of technical supervision based on the quality control experience of many national surveying and mapping projects that he has participated in and drawing on the advantages of traditional surveying and mapping supervision.

3. TECHNICAL SUPERVISION OF SURVEYING AND MAPPING AND ITS APPLICATION CHARACTERISTICS

3.1 Research route of surveying and mapping technology supervision

According to the requirements for supervision of major national surveying and mapping geographic information projects, combined with the current domestic surveying and mapping unit funding, existing institutions and personnel and other actual conditions, in order to overcome the limitations of traditional methods, the author is sorting out and analyzing the western surveying and mapping project (National West 1: 1:1 50,000 Topographic Map Blank Area Surveying Project), Island (Reef) Surveying and Mapping (927) Phase I Project, and National Modern Surveying and Mapping Reference System Infrastructure Construction Phase I Project Quality Control Based on the survey results of surveying and mapping, marine, earthquake), the concept of surveying and mapping technical supervision was proposed, and the quality control work of a project led by the Chinese Academy of Surveying and Mapping was actually carried out, and the methods and methods of technical supervision were continuously improved, and finally the research content of this paper was completed.

3.2.2 Contents of surveying and mapping technical supervision

The technical supervision of surveying and mapping is undertaken by qualified surveying and mapping quality inspection agencies, and the content of technical supervision includes two parts: quality management and quality control of stage results.

(1) Quality management

Implemented by listening to reports, on-site interrogation, and data review. It mainly inspects the establishment of quality management institutions, the formulation of technical quality management systems, the operation of technical quality management systems, and the configuration of personnel and equipment.

Check whether a quality management organization is set up, including related documents such as organization setting, responsibilities, authority, adjustment, etc., check whether the organization configuration meets the prescribed conditions and requirements, and whether the division of functions between the organization and other departments is clear.

Check the rationality, completeness and operability of the quality management system, and whether it conforms to the overall quality management regulations of the project. And through the review of the relevant technical quality control written records of the production unit, check the implementation of its quality management and inspection work,

and check whether the work is carried out effectively in accordance with the established quality management system.

Check whether the number of input quality control personnel and their majors meet the conditions for carrying out project quality control work. Check whether the division of responsibilities of quality management and inspectors at all levels is clear, and whether first-level inspections or second-level inspections are effectively carried out in accordance with the division of responsibilities. The surveying and mapping measuring instruments used in the inspection project shall be verified (calibrated) by the legal metrological verification (calibration) agency and used within the validity period; whether the self-inspection of the instruments and equipment shall be carried out in accordance with the regulations during operation; the new important software used for engineering production shall be as required. Tested and passed.

(2) Quality control of stage results

In the census of geographical conditions and monitoring of geographical conditions, process inspection is an important quality control method. After learning from the process inspection mode and the concept of surveying and mapping supervision, a phased result inspection mode that is not tracked in the whole process is adopted, focusing on the impact of The key links and key achievements of the quality of the results can greatly improve the effect of surveying and mapping supervision

It is implemented by listening to reports, on-site interrogation, spot checks on results, and data review. The main inspection content includes three parts: production process, process results and technical problem handling.

Check the conformity of the production technical route of each achievement with the technical design, whether there are countermeasures for the deviation of the technical route and pass the verification or audit, and select the key links of the project construction for on-site supervision and inspection. The process results include the components of the final results of the project and the process products in the production process, and check their quality compliance. According to the internal quality control of the construction department or the construction unit, this part of the content is subject to spot checks by combining internal and external industries.

Mainly check the effectiveness of the technical problem handling mechanism established by the construction department or construction unit to ensure that problems can be solved in a timely and effective manner. The handling of the corresponding problems in the project production process shall be recorded with corresponding written materials. The corresponding materials for technical problem handling reflect the efficiency of the technical problem handling mechanism to a certain extent, and are important reference materials for the development of this technical supervision content.

3.3 Surveying and Mapping Technical Supervision Methods

The above-mentioned surveying and mapping technology supervision content adopts the inspection mode that combines internal and external industries, completes the inspection of quality management related content through the review of relevant internal industry materials, and urges the quality management system of the production task undertaking unit to

be sound and implemented in accordance with the requirements; for the quality of stage results Control, through field inspections, side station inspections, internal inspections, etc., to complete the inspection of process results. This inspection requires organization and development during the project production process, so as to verify the correctness of the technical route as soon as possible.

3.4 Application characteristics of surveying and mapping technology supervision

The proposal of surveying and mapping technical supervision is a powerful measure proposed in combination with the existing market conditions under the premise of ensuring the quality control of the project. Compared with the traditional surveying and mapping supervision, it has the following characteristics.

(1) It is convenient to ensure the independence and professionalism of supervision work

Technical supervision is generally undertaken by a quality inspection agency with the qualification for surveying and mapping results. As a professional third-party quality inspection agency, compared with the surveying and mapping supervision unit entrusted by the production unit, its technical supervision work can ensure independence and is not independent of the production unit. The impact is completely responsible for the quality of the project. In addition, the technical supervision work highlights the technical level inspection in the production process, and is undertaken by institutions with professional knowledge reserves and business experience in surveying and mapping quality inspection, which can overcome the shortcomings of conventional supervision units lacking quality control experience and even low professional quality in surveying and mapping.

In short, technical supervision is proposed and undertaken by a special quality inspection agency, because of its independence and professionalism, it is more conducive to the implementation of project quality control measures.

(2) It is convenient to realize the quality control of the whole process

Technical supervision is a powerful tool for the quality control of the whole process of the project. Through technical supervision and implementation of the quality control of the whole process, problems existing in the project construction can be discovered early and rectification work can be carried out as soon as possible, so as to avoid problems left over to the acceptance stage of the results and cause irreparable losses to the progress and quality of the project. said, it is very important. In the process of technical supervision, the quality control of the whole process is realized through key technical links, and the supervision force is deployed in the key links in the production process, which can reduce personnel and time redundancy and improve supervision efficiency. Under the limited human and financial resources, expand the coverage of the operation group and control the production technology route as a whole. In addition, the technical supervision checks the content through the establishment of the quality management organization, the formulation of the technical quality management system, the operation of the technical quality management system, and the configuration of personnel and equipment. , to supervise the quality control of the production unit from the source, and the supervision mode that focuses on the technical route and takes

into account the production management can better realize the quality control of the whole process.

(3) It is convenient to improve the connection between technical supervision and achievement acceptance

For major national surveying and mapping geographic information projects, quality control runs through the entire production process, and it is a basic requirement to strive for consistency in various quality control methods, such as the two-level inspection and one-level acceptance system in the field of surveying and mapping. The quality inspection agency undertakes inspections at all levels according to unified standards. All inspections at all levels verify the problems found at the upper level, and finally jointly do a good job in quality control. Professional quality inspection personnel carry out technical supervision work. On the one hand, they can intervene in the production process in advance, understand the quality of the project in advance, and avoid the light in the inspection and acceptance process; on the other hand, in the process of technical supervision, technical supervision The work transmits the quality inspection requirements, so that the production side can understand the focus of the quality of the results, avoid major technical route deviations, or discover major quality problems early in the supervision process, so as to avoid the irreparable impact on the project progress caused by the legacy of inspection and acceptance.

In short, through this model, technical supervision and achievement inspection and acceptance can promote each other to effectively connect and ensure the unity and pertinence of project quality control.

(4) It is convenient to greatly save human and financial costs

Under the circumstance that the national major surveying and mapping geographic information project has a wide scope and heavy tasks, a large amount of manpower, material resources and financial resources must be guaranteed to carry out the whole process of surveying and mapping supervision, and the current market supervision funds are seriously out of balance. The proposal of technical supervision is not to blindly pursue the vertical coverage of the production process, but to carry out quality control in the vertical key technical links of the production process. The supervision of the operation team ensures the effectiveness of supervision on the basis of greatly saving manpower and financial costs.

4. CASE ANALYSIS OF SURVEYING AND MAPPING TECHNOLOGY SUPERVISION

4.1 Case introduction

At present, in a major national surveying and mapping benchmark project , for the first time, technical supervision has been taken as one of the main measures for quality control. Taking the construction of the earth control network and the elevation control network in this project as an example, the application and effect of technical supervision in the project implementation process are expounded.

Focusing on the technical supervision content mentioned above, this project determines the following supervision principles

1) Technical supervision is carried out according to the type of results and according to the progress of the project.

- 2) Technical supervision should cover all construction units and all types of achievements.
- 3) The technical supervision should select key technical links to carry out inspections. The key technical links contained in each type of achievement are shown in Table 1.

Outcome Type	Key technical links
Earth Control Network	Site selection, foundation pit excavation, pier body pouring, pier body maintenance, burial data selection, data observation, data processing, data sorting
Elevation Control Network	Point selection, foundation pit excavation, prefabrication of markers, point burying, field observation, data processing, and initial value measurement data collation

Table 1. Division of key technical links of construction achievements

4.2 Analysis of the effect of technical supervision

In the process of project implementation, the technical supervision work adopts two modes of internal and external industries, and selects the level in different key technical links or the GNSS geodetic control points as the object of technical supervision for inspection, so as to find out the quality errors or hidden dangers in the production process. and achieve the following results:

(1) Early detection of tendentious quality problems

By expanding the horizontal coverage of the production process, during the supervision period, according to the differences in the teams invested by each unit, different operation groups were selected as the objects of technical supervision, and during the supervision, it was found that the selection of points, the burial of points and other aspects did not meet the project requirements. Case.

For the quality problems found, the technical supervision members require the production unit to rectify or rework on the spot. If traditional quality control measures are used, it is difficult to meet the coverage of a certain number of operating units under the condition of limited funds, and if the production unit applies for inspection Later (generally, the observation task of the next process has been carried out when the inspection is selected), and it is found through quality inspection and acceptance that the rectification and rework will also involve the rework of the observation task of the next process, which will have an inestimable impact on the project progress.

(2) Cooperate with the project implementation team and the overall technical team to do a good job in all-round quality control of the project

In the process of carrying out technical supervision of the project, in order to coordinate the overall quality control of the project, the following measures are mainly adopted. First, the technical supervision implementation unit synchronously feeds back the quality problems in the supervision process to the project office, and divides the labor into the implementation team and the implementation team according to the nature of the problem. The technical team has played a role as a bridge; secondly, in the process of technical supervision, members of the project office are invited to carry out the corresponding work together, so as to promote the project management party to understand the quality of the production line, timely answer technical questions, dynamically adjust the project progress or

take early measures. Measures are taken to avoid the situation that it is difficult to make up for quality problems in the inspection and acceptance of results.

(3) Give full play to the advantages of effective connection between technical supervision and results inspection and acceptance

In view of the fact that technical supervision and achievement acceptance are undertaken by the same unit, through communication, training and other measures in the technical supervision link, the key points of the quality of the results are clarified to the production unit, and the quality problems that have occurred in similar projects in the past have been transmitted, which has promoted the production unit. Doing the pertinence of our own internal quality control reduces the probability of similar quality problems recurring. In addition, in the results acceptance link after the project production is completed, the rectification of the quality problems found in the technical supervision process is mainly verified, and the pertinence of the results acceptance is also improved simultaneously.

To sum up, as an important measure of quality control, technical supervision has been successfully applied in this project and achieved remarkable results. While achieving the project quality control objectives, it also met the relevant requirements of the Ministry of Construction for project supervision.

4.3 Quality Control Effectiveness

The project has been launched since the beginning of 2019. The five task undertaking units completed the first batch of results for inspection in June 2020, submitted the official results for inspection, and completed the quality assessment in March 2021. For the quality of this paper, the elevation benchmark network is used. An example to illustrate the effectiveness of quality control.

From April to October 2019, according to the production progress, organized multiple batches of technicians to go to Yunnan, Tibet, Sichuan, Guizhou and other places to select points and excavate foundation pits for five different operating units, marker prefabrication, point burial, field observation and other links, select different operation groups to carry out technical supervision in the production process, focusing on the rationality of point selection, the correctness of prefabrication size, the correctness of foundation pit size, observation The method is standardized to carry out inspections, and the problems found on the spot are directly required to be reworked, and all inspection problems are communicated to other units.

Through the specific application of technical supervision in this project, under the circumstance that the amount of supervision funds is limited, major technical route deviations in the production process were discovered and corrected in time, and a series of important quality indicators were achieved in the acceptance stage of the project results: project rework rate 0% , the quality of the results is 0% for class A errors and omissions, 0.01% for class B errors and omissions, the excellent and good rate reaches 100%, and the quality score has been improved as a whole, ensuring the national elevation benchmark construction level.

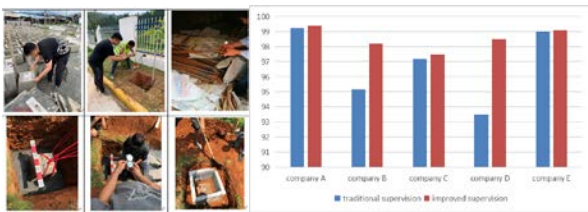


Figure 1 .Technical supervision site (left) and schematic diagram of quality control effect improvement (right)

5. CONCLUSION

Combined with the implementation and effect of quality control measures of major geographic information engineering achievements in surveying and mapping in recent years, this paper analyzes the shortcomings of traditional surveying and mapping supervision, and on this basis puts forward technical supervision and applies it in practical work, and mainly completes the following researches content:

(1) In view of the application of traditional surveying and mapping supervision, combined with the current development status, the limitations of surveying and mapping supervision are studied and a series of conclusions are drawn;

(2) In view of the limitations of surveying and mapping supervision, the concept of technical supervision is proposed, the content of technical supervision is expounded, and the advantages of technical supervision over traditional surveying and mapping supervision are analyzed;

(3) Through the application of technical supervision in actual projects, on the basis of a brief introduction of the project background and supervision principles, the actual achievements of technical supervision in the project are expounded, and the technical supervision is verified in the national major surveying and mapping geographic information projects. Feasibility and importance as an important means of quality control.

Based on the needs and existing problems of surveying and mapping supervision in quality control, this paper puts forward the means of technical supervision, and combines its application in quality control to verify the feasibility, which has certain guiding significance for the quality control of major surveying, mapping and geographic information projects in the later period. However, the proposal and application of technical supervision is still in the preliminary stage, and it needs to be continuously optimized, updated and upgraded in the follow-up work before it can play its role in the national major surveying and mapping geographic information project.

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