Hindawi
Journal of Sensors
Volume 2023, Article ID 9805236, 1 page
https://doi.org/10.1155/2023/9805236

Retraction

Retracted: Construction and Quality Control of Subway Wet Loess in Concealed Tunnel Based on Particle Swarm Optimization Algorithm

Journal of Sensors

Received 19 December 2023; Accepted 19 December 2023; Published 20 December 2023

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] W. Wang, X. Zhang, and X. Liu, "Construction and Quality Control of Subway Wet Loess in Concealed Tunnel Based on Particle Swarm Optimization Algorithm," *Journal of Sensors*, vol. 2022, Article ID 3655202, 13 pages, 2022.

Hindawi
Journal of Sensors
Volume 2022, Article ID 3655202, 13 pages
https://doi.org/10.1155/2022/3655202

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Research Article

Construction and Quality Control of Subway Wet Loess in Concealed Tunnel Based on Particle Swarm Optimization Algorithm

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Received 11 August 2022; Accepted 3 September 2022; Published 16 September 2022

Academic Editor: Yaxiang Fan

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To reduce urban pressure, urban rail transit has become an effective way to reduce traffic congestion, mitigate traffic accidents, reduce environmental pollution, and improve commuting efficiency. Subway as the main means of urban public transport travel, in recent years by people's favor, although the construction industry of rail transit is developing rapidly and the industry scale is expanding, but because the construction of rail transit construction projects is very difficult, especially in the wet loess within the concealed excavation tunnel, but also frequent accidents, and the quality of the project is not easy to guarantee, so the underground railroad wet loess within the concealed excavation tunnel construction technology is poor. Therefore, it is especially important to study the construction technology and project quality management of underground railway concealed tunnel in wet loess. In this paper, based on the in-depth study of the basic principle of quantum particle swarm optimization calculation and the realization of key engineering technologies, the particle swarm optimization algorithm is programed using MATLAB software, and the coding scheme, operation specification, and operation parameters are designed. Then, combined with the particle swarm optimization algorithm and assisted MATLAB software, the main analysis of the construction and quality control of wet loess in concealed tunnels of subway projects was carried out, mainly by systematizing the relationship between the three major elements of subway project schedule, cost, and management and the construction and quality control of wet loess in concealed tunnels of a subway, and concluded that the construction and quality control of wet loess in concealed tunnels of the subway needed schedule. It is concluded that the construction and quality control of subway wet loess tunnel requires stable schedule, adequate cost budget, and management personnel.

1. Introduction

In real life, there are different solutions for many things, as well as in scientific research, and it is especially important to find the most optimal algorithm. Finding the optimal algorithm to achieve optimal results in engineering or management activities is sometimes a very important research direction, for example, how to determine the selection parameters in some engineering and technology sciences and in some economic and technical management disciplines. The list of how to maximize the use of all resources of a limited scope of human beings in limited resource allocation activities, so that the process of program allocation in a program fully satisfies all the basic needs of life of all people and at the same time obtains good and considerable economies of scale was created; in all other relevant areas involving the field of human activity, the list is endless. In fact, these group mathematical problems are often first set up as a set of mathematical models through a series of numerical transformations containing certain mathematical procedures, which are eventually abstracted into some of the basic mathematical logical constraints or conditions of the system using the transformed models, finding any set of them with a specific set of parameter-valued variable

conditions or constraint functions, so that some other of them can achieve some kind of desired in the course of the problem system. The maximum performance or a minimum performance is in fact a group problem optimization. The particle swarm optimization swarm algorithm is also a relatively new conceptual meaning of the group intelligence nature of the optimization swarm algorithm. Its technology and its main algorithm performance characteristics are mainly the principle structure of the algorithm which is relatively simple and has less parameter constraints, convergence algorithm speed, and the need to study the relevant field of knowledge threshold less. This series of algorithms has been successfully and widely used in many related fields such as generalized function optimization, neural network training, and combinatorial algorithm optimization research and has achieved good results. Due to its simple principle and fast algorithm, particle swarm optimization algorithms are widely used in various research fields, such as mathematics, chemistry, computer technology, and engineering. Although particle swarm optimization has developed greatly in the past decade, both theoretical analysis and practical application are still not very mature, and there are still many problems worthy of research, but the particle swarm optimization algorithm has also solved many technical problems in related fields, and the quality control and research in the field of subway tunneling has been slightly achieved [1].

Due to the increasingly developed market economy in China, the accelerated urbanization process has led to the rapid growth of urban population, road congestion, and people's travel problems are also big problems faced in today's cities. Rail transit is popular among the people because of its low pollution level, small footprint, low construction investment, and high transportation capacity. It has begun to occupy an increasingly important position in the field of urban transportation. However, the difficulty of rail transit construction and the high requirements for technical standards have made the management of rail transit construction quality increasingly very difficult. And rail transit development has become a major strategic project in China's urban modernization process, playing a crucial role in the development of China's local economy and society. Under the constraints of resources and environment, China's urbanization needs to take the route of intensive and compact development, which is both the need of the real environment and the inevitable requirement to achieve sustainable development. The development of metro is to achieve economies of scale in urban infrastructure and effectively reduce the income gap between regions. The subway is an important part of urban public transportation and has the attributes of a public good. The development of metro has a certain consumer noncompetition and a strong public good. Large cities, especially megacities, should give full play to the quality advantages, convenience, and punctuality of metro transportation, maximize the cost performance advantages of urban rail transportation, effectively control the speed of urban motorization, and play a key role in the economic development of urban transportation systems. With the increased government investment in subway projects, the development of subway construction projects in China can be described as extremely rapid, but the difficulty of subway construction is great, especially in the process of wet loess in concealed tunneling; safety accidents occur frequently and the quality of the project is difficult to be reasonably assured, so the construction and quality control of wet loess concealed tunneling in subways is particularly important [2].

In this paper, it is on the basis of the basic principles and implementation techniques of quantum particle swarm optimization algorithm, the particle swarm optimization algorithm is programed using MATLAB software, and the coding scheme, operation specification, and operation parameters are designed. Then, combined with the particle swarm optimization algorithm and assisted MATLAB software, the main analysis of the construction and quality control of wet loess in concealed tunnels of subway projects was carried out, mainly through the systematic analysis of the relationship between the three major elements of subway project schedule, cost, and management and the construction and quality control of wet loess concealed tunnels of subway, and concluded that the construction and quality control of wet loess in concealed tunnels of the subway needed schedule The conclusion of stable, cost-optimized, and management in place is developed and discussed.

2. Research Background

This section introduces the development of particle swarm optimization algorithm and the development and literature review of quality control of metro project construction management. It lays the foundation for the following research.

2.1. Particle Swarm Optimization Algorithm. After more than ten years of research, the particle swarm optimization algorithm has made some great progress in both engineering applications and computational performance optimization research [3]. The functional changes are mainly reflected in dealing with constraints and optimization problems; for example, Liu et al. used particle swarm optimization to deal with optimization computation problems based on constraints of equations with parameter equations; for example, Cao et al. used particle swarm optimization to deal with geometric constraint problems; for example, Wang et al. used particle swarm optimization to solve discrete optimization solutions of geometric constraint problems; Lu and Sun et al. tried to use particle, and Zhao et al. have also experimented with particle swarm optimization to solve the stochastic loader problem of spacecraft; and Lu and Sun et al. have tried to use particle swarm optimization to study and solve the optimal attitude control problem of manned spacecraft during solar panel extension. The optimal attitude control problem proposed in the dynamic control problem; and Li and Zhang, respectively, have tried to use particle swarm optimization to optimize the dynamic quantization factor in the fuzzy controller parameters online to ensure that the final obtainable equilibrium fuzzy controller parameters in the dynamic optimal control value problem; Guan et al. have separately proposed or studied and completed a nonlinear particle swarm dynamic optimization based on model predictive control and independently. The results of the

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experiments have shown that the optimal control method is mainly applied to nonlinear, particle swarm rolling optimal control algorithm can also be applied to the control system of urban intelligent loop traffic intelligent coordination at the same time; the effect is also a relatively good. For example, the particle swarm optimization algorithm can also be widely used in the optimization of complex or multiobjective process systems. The algorithm was applied to the dynamic multiobjective optimization of a flow-plus-batch bioreactor with satisfactory results [4]. A total of 21 individuals, including Xiaoming Zhang, used the particle swarm optimization algorithm applied to the multiobjective optimization of hydrological model parameters with good results and significantly better deadlock resolution than other available methods. It is also clear from the above example analysis that from the latest research in computer application theory, the particle swarm optimization algorithm is being used by scientists to help solve those increasingly complex physical problems, and at the same time, the optimization improvement methods of the particle swarm optimization algorithm structure will become more and more complex and refined, and the optimization algorithm performance has indeed been improved to a great extent, but the main improvement in the performance of the optimization algorithm. The task is not yet finalized. How to achieve more efficient and accurate and more intuitive and concise intuition to improve the algorithm itself computing performance should still be a current hot spot of algorithm research [5].

2.2. Engineering Quality Control. Foreign experts and scholars have an early start on the research of engineering quality management. In 1966, American scholar Armand Feigenbaum first proposed the concept of "quality management" [6]. Quality management is based on cost control, meeting the standards and requirements of users, carrying out a series of market and industry, design, manufacturing, and operation services through a series of studies, and finally forming an effective and unified total quality management system. From the perspective of quality management methods, the development of quality management has gone through four stages, a development process of traditional management stage, quality inspection stage, statistical quality management stage, and total quality management stage. In the traditional quality management and quality inspection stage, the American scholar Taylor created the scientific management theory [7]. The scientific management theory will refine the division of labor, set standards by professionals, check manufacturing and dedicated personnel by professionals, and introduce quality inspection instead of the original operator quality management. The subdivision of functional management structure, screening products, separating qualified and unqualified products, strictly controlling the production process, and preventing quality flow have positive implications for improving product quality. However, quality inspection also has its limitations, as it can only be done at a later stage. With the development of society, new quality management methods have emerged. American scholars Hugh Hart through the theory and time research established the project management early quality problem prevention and quality management late quality inspection of defect prevention theory. In research methods and materials from the quality control process, foreign scholars have established some relatively sound theoretical systems. The whole process quality control is equally divided into five aspects: planning, experiment, construction, inspection, and overall error correction, focusing on the management function of people [8]. John Christian puts forward the concept of quality control and quality control measures, according to the requirements of users and project quality requirements, the implementation of project quality control in each stage, the implementation of project tasks in stages, the control of construction, and quality, construction, technology, and quality system improvement. Sharif and other scholars pointed out that it is easy to find quality problems in the construction process; these quality problems should be foreseen in advance, not delayed to the final acceptance of quality, engineering quality control should focus on the following aspects: people, machinery, materials, methods, environment, from small to large, from micro- to macroquality control. Think that the construction of information sharing features is of great help to the project construction, through the prophase project quality control, construction process control, and engineering projects late control to guarantee the quality of the project, so as to guarantee the quality of the project, make full use of the construction of information technology, and improve the quality of project construction.

In large infrastructure construction, especially in the subway construction under the background of rapid development, project quality management in our country concrete scientific measures must be adopted to constantly improve the quality of the project management level, must find a more scientific evaluation methods, and judge the practicality, and applicability of the quality management system will also be improve quality management level important segment. Duohongxia and Huang Zhibin believe that in order to strengthen and improve construction quality management, and the level of construction quality management system should adopt the method of hierarchy analysis, evaluation, and fuzzy comprehensive evaluation. After Song Ziyuan proposed the establishment of the evaluation index system, the analytic hierarchy process was used to calculate the weight value of each link of the project system, the comprehensive evaluation model of project quality was established, and the comprehensive evaluation method of the operation effect of the project quality management system based on the dimensional analysis method was put forward. He says more and more stringent quality control standards and mechanical and electrical domain of urban rail transit "new materials, new equipment, new technology," increasing the difficulty of quality control; he offered to quality control the behavior of the group as a starting point, from the listing method, analysis diagram, figure, configuration of visual expression figure, and quality control, quality control methods, such as systematically analyze and control the construction quality control process, were used. In China, subway construction is invested by the government and managed by state-owned enterprises, among which mechanical and electrical engineering is an important part of

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the investment. In terms of the quality management of various engineering projects, after the implementation of total quality management for a period of time, China has gradually shifted to the ISO9000 series of international standards for quality management and quality assurance, and the quality of mechanical and electrical system engineering has gradually improved. With the development of mechanical and electrical engineering, various effective management tools and methods have been widely used in quality control. The management level has been greatly improved, but there are still some problems. For example, the vector control theory of mechanical and electrical engineering is rarely studied from the perspective of the owner, but usually considered from the design and construction units [9].

3. Research Methods and Materials

This part mainly introduces the concept and main calculation process of particle swarm optimization algorithm needed in this paper, as well as the concept of metro wet loess excavation, and the description of metro project quality management; the research method and modeling tools of this paper are introduced.

3.1. Particle Swarm Optimization Algorithm Concept and Process. In 1995, Kennedy and Eberhardt jointly proposed the optimization of this particle swarm [10]. This particle swarm optimization model is based on a random search algorithm that simulates the random foraging behavior of birds in the animal kingdom. It is assumed that the spatial scope of random search is a fixed area of all birds randomly searching for food, and the particle swarm is the individual of these birds searching for these food [11]. In the optimization problem solution, each particle swarm is a random individual in the finite-dimensional search space, and the current position of the particle swarm is the only candidate solution in each optimization problem to be solved. The fitness function is also another metric function, which represents the advantages and disadvantages of all candidate solutions in the problem solution. The process of random flight of particle swarm is the process of random search of random individuals. In particle swarm optimization, the particle velocity is dynamically adjusted according to the best position of the individual's history and the best position of the population. Particle swarm optimization also has two of the most important properties of velocity and position. Velocity is the maximum speed at which a particle travels, and position is the direction in which the particle travels. The speed and position update formula is as follows:

$$V_{m,n}^{t+1} = w \times V_{m,n}^{t} + a_1 \times \text{rand} \times \left(p\text{best}_{m,n}^{t} - x_{m,n}^{t}\right) + a_2 \times \text{rand} \times \left(g\text{best}_{m,n}^{t} - x_{m,n}^{t}\right), \quad (1)$$

$$x_{m,n}^{t+1} = x_{m,n}^{t} + v_{m,n}^{t+1} \times \Delta_t, \quad (2)$$

where w is the inertial weight, which indicates that the particle is proportional to the velocity of the previous iteration, usually between $[0.4, 0.9]$. a_1, a_2 are learning factors, representing the self-learning ability and social learning ability of particles, respectively. Generally, the value is between $[0, 4]$. $x_{m,n}^{t}$, $v_{m,n}^{t}$ is the fitness function, m is n the fitness function t of the best position in the history $p\text{best}_n$ of the first particle, which is the f fitness function of $f(p\text{best}_n)$ the best position in the history of the first $f(g\text{best}_n)$ particle, which is the fitness function of the current best position in the population. rand is a random number between $[0, 1]$ and Δ_t is the change of time, usually 1 [12].

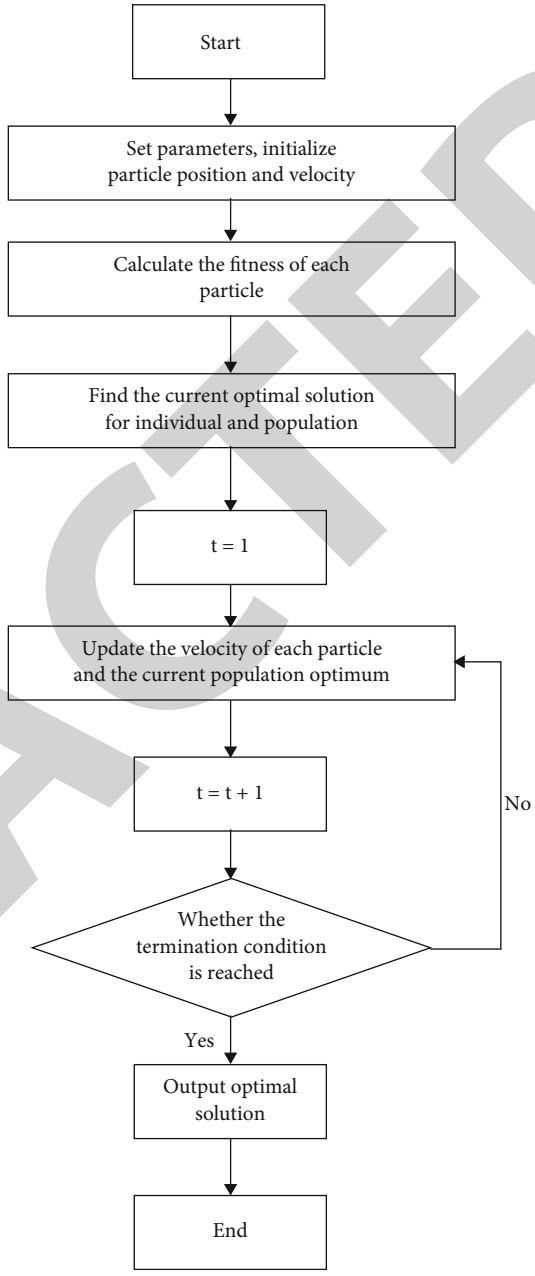

Figure 1: Flow chart of particle swarm optimization algorithm.

Particle swarm optimization flow chart is shown in Figure 1.

3.2. Overview of Wet Loess. Collapsible loess refers to soil of a certain type with uniform soil content, relatively loose structure and special properties with pores [13]. When the rock is

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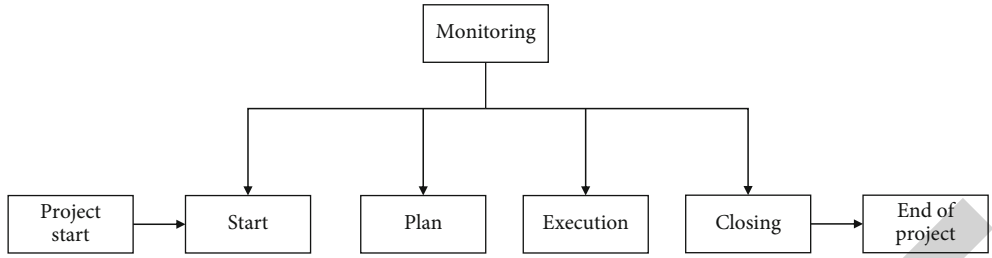

Figure 2: Content of project quality management.

not subject to long time water immersion or not in a long time water completely frozen hardening, the general structural strength requirements are required to be high, and the compressibility is generally poor. When the weathered rock surface structure in the water has a certain proportion of osmotic pressure for the case will be gradually by the pore water fully wet infiltration, the soil structure may therefore occur with rapid water loss and damage and produce a large number of weathered rock additional body and settlement; the strength of the structure will appear more rapid decline. Therefore, in the prevention and control of wet sinking loess sites and other construction of geotechnical engineering construction projects of the building pit support construction technology management links, we should pay attention to the first which should be mainly considered according to the importance of the geotechnical environment of the foundation site of the building; the foundation may be muddy water and wetting and damage to the structure of the potential size and in the actual foundation technology management process should be how to take strict management. Measures and restrictions on the degree of difficulty of construction of the foundation soil are not possible to uniformly and steadily cause settlement; the following comprehensive measures management technical measures to protect and treat and strengthen the foundation to prevent the building foundation settlement on the ground building structure to produce permanent or serious damage to the wet foundation must be followed [14]. In the state of influence of the continuous action of the self-weight stress on the encapsulated soil structure on its foundation, or at the same time due to its influence of other continuous self-weight stress conditions and apparent continuous additional deformation stress continuous action conditions, the soil structure after immersion does not suffer continuous damage deformation effect and also is not obviously produced by other apparent continuous and additional deformation stress continuous deformation conditions which influence its effect. A structural soil is also called continuous wet sink soil, which is one of the special structural soils. Some miscellaneous soils may also have the same kind of wet subsidence sometimes. In China, there are some loess areas with wet sink properties in the northeast, northwest, central region, and the eastern part of the south slope of Sichuan Province, which are widely distributed in the area. Wet sink loess can be divided into completely semi-self-weighted wet sink loess and partly completely semi-self-weighted wet sink loess; part of the older loess is also transformed into part of the unstable wet sink loess. The more dominant variety of loess particle components contained in our wet-sediment loess is coarse powder particles, which accounts for about 50-70% of the proportion of each component to the average total weight percentage of the total mass of particles of all our wet-sediment loess containing materials. 0.1 mm is coarse spodumene particles, about each accounting for about 40.60% of the average weight of its total spodumene particles. 0.05 mm clay grains were less, accounting for about 14.28% of the total weight. The weight of 1 mm fine sand grains was less than 5% of the total weight of the 25 mm medium sand particles. The particle size of the wet sinking loess gradually decreases from northwest to southeast [15].

3.3. Overview of Project Quality Control

3.3.1. Content of Project Quality Management. As an important part of project management, project quality management plays a decisive role in project quality. Project quality management can be divided into enterprise quality management and product quality management, and product quality management must meet the ultimate needs of users [16]. Project management is generally divided into five parts, which are project initiation, project planning, project implementation, project closure, and project monitoring. Project monitoring is in the first four parts to ensure the quality standard of the project from the work of each part, the content of project quality management, as shown in Figure 2.

3.3.2. The Meaning and Framework of Quality Management. Quality management can guide a company in quality planning, quality control, quality assurance, and quality improvement; definition, quality policy, objectives and responsibilities, quality system planning, control, assurance, and improvement are all part of quality management [17]. Throughout the quality management system, it requires the rational organization and management of all aspects of the bank such as planning, personnel, finance, equipment, and environmental protection. After the quality policy is issued by the management, the organization determines the quality objectives and builds a quality management system based on the basic principles of quality management, using a combination of standardized methods and ensuring the necessary human and material resources to carry out quality management activities. In this process, necessary incentives can be used to encourage employees to participate in quality planning, quality control, quality assurance, and quality improvement work in an orderly manner. Quality command and control activities mainly include the development of

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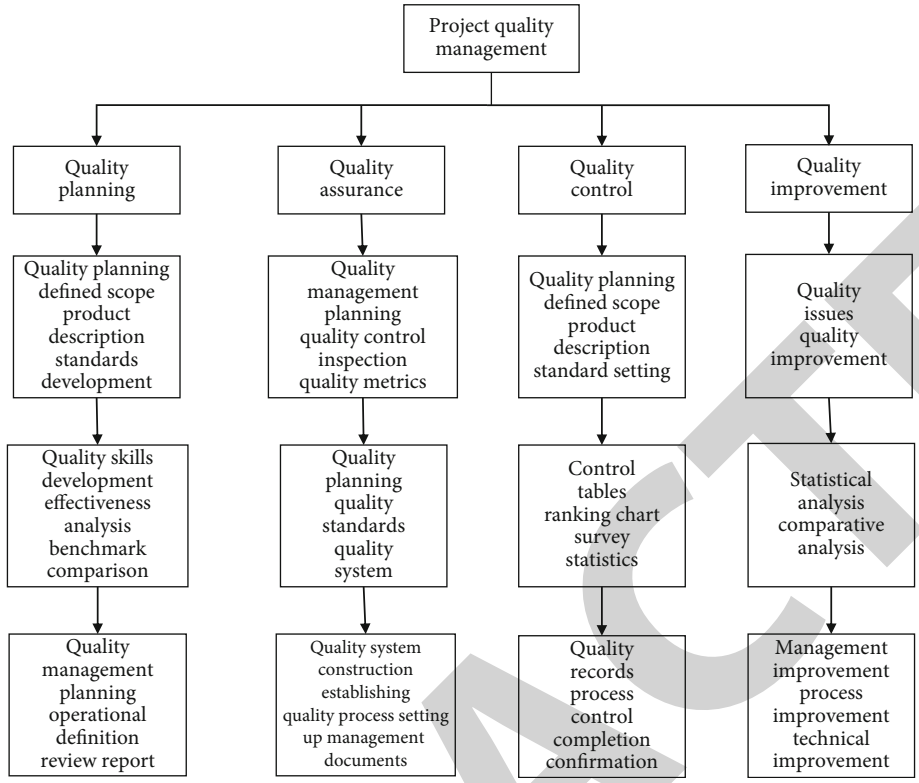

Figure 3: Framework of project quality management.

quality policy and quality objectives and the implementation of quality planning, quality control, quality assurance, and quality improvement. Quality policy is the quality principle and direction of leadership learning, is the guideline of all aspects of quality management, is the performance of leadership quality consciousness, and reflects the quality management objectives and quality culture of the enterprise. Quality objectives are formulated according to the quality policy, which meets the requirements of quality aspects and the requirements and pursuits of continuous improvement of quality management system, and quality objectives are quantitative and can be tested [18]. Quality planning is an indispensable intermediate part of the quality management process. In order to achieve quality objectives, implementation links and resources must be established, including management and work planning, quality planning, and quality assurance measures. Quality control is the process of quality control using certain operational techniques and activities to meet the quality requirements of the product or service, in which the design of the quality control system and the selection of quality control techniques are very important, and in this case, if new factors appear, the causes should be analyzed and corrected in time to form a closed management process [19]. Quality assurance is the implementation of planned and systematic measures in the management system to make the user trust the final product or service to meet the predefined quality requirements. Quality assurance is not fully understood as quality assurance; it is quality control based on quality assurance, so that the user fully "trusts" the quality. Based on the quality control and quality assurance aspects, current problems and deficiencies are analyzed and effective measures are taken to improve quality [20]. The framework of project quality management is shown in Figure 3.

3.4. Research Methods and Tools. In this paper, we mainly use particle swarm optimization algorithm to systematically analyze the relationship between the three major elements of metro project duration, cost, and management and the construction and quality control of wet loess in concealed tunnel of metro. The main algorithm formulas and elements used are as follows:

$$V_{m,n}^{t+1} = w \times V_{m,n}^{t} + a_1 \times \text{rand} \times \left(p\text{best}_{m,n}^{t} - x_{m,n}^{t}\right) + a_2 \times \text{rand} \times \left(g\text{best}_{m,n}^{t} - x_{m,n}^{t}\right), x_{m,n}^{t+1} = x_{m,n}^{t} + v_{m,n}^{t+1} \times \Delta_t. \tag{3}$$

The two formulas here have been described in detail in the above particle swarm optimization algorithm, so without further comment; this formula is used for analysis and discussion in this paper.

The main tool used is MATLAB software for programming and algorithm program design, and this software has the following advantages:

(1) Efficient and flexible numerical simulation calculation methods and numerical symbolic calculation

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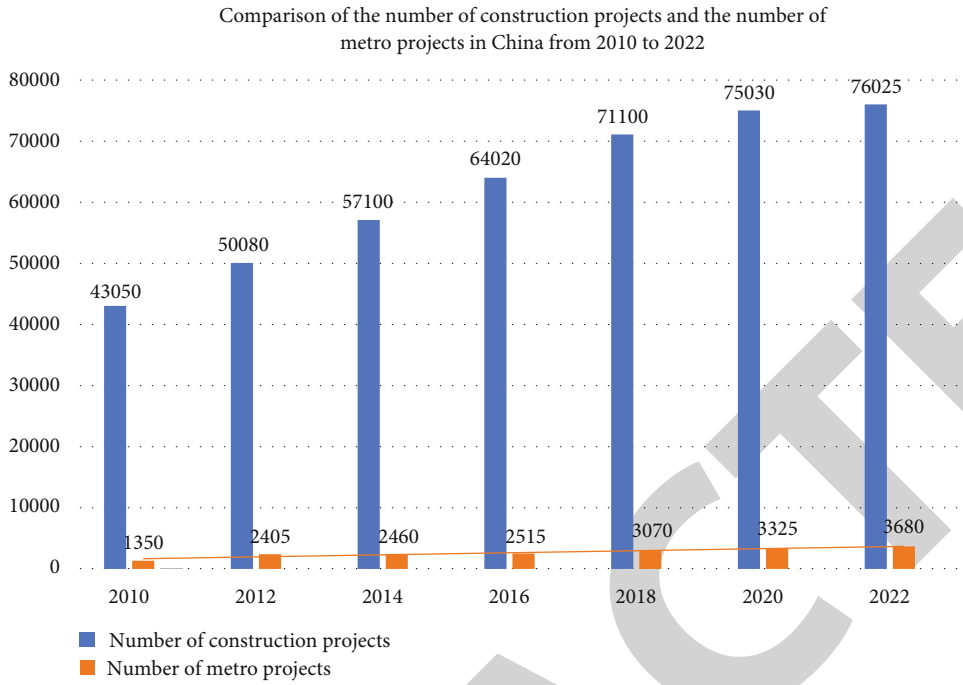

Figure 4: Comparison of the number of construction projects and the number of subway projects in China from 2010 to 2022.

conversion function can easily enable users to completely get rid of the heavy and complex and boring basic mathematical symbolic calculation design and application analysis

(2) A complete and practical set of computer graphics output processing platform functions, realizing the graphic visualization modeling and visual programming processing of calculation and result processing

(3) Friendly interface and natural language close to mathematical expressions, which is easy for scholars to learn and master

(4) In the more complex and rich and diverse functional structure of various comprehensive application system toolbox series software (such as signal processing toolbox and communication toolbox) products, to solve the problem of various system user needs to provide the development of the design of a large number of functions with convenient and practical characteristics of the system application processing tools

4. Results and Discussion

In this part, based on the research of the basic principle of quantum grain group optimization calculation and the realization of engineering key technology in the third part, auxiliary MATLAB software, the main analysis of the construction and quality control of wet loess in concealed tunnel of metro project, mainly through the relationship between the three major elements of metro project duration, cost, and management and the construction and quality control of wet loess concealed tunnel of metro, a systematic analysis and The results are discussed in the following points.

4.1. Experimental Results. A city rail transit line 1 is located in the main north-south passenger corridor of city A. It connects the high-speed railway north station, city square, city center, provincial stadium, commercial and cultural center, international exhibition center, and large passenger hub. 22 passenger stations are designed in the overall planning, including 6 interchange stations and 2 starting and ending stations. Railway line 2 and line 1 form a cross-shaped skeleton in the railway network: 2021 August 10, the construction period of five years, the planned investment amount of 500 million yuan.

(1) With the rapid development of China's economy, the construction of infrastructure is in full swing, and the construction scale of subway projects is also gradually expanding; as China's main urban transportation now, people's demand for subway projects is increasing, the number of construction projects in China in 2010 is 43050, including the number of subway construction 1350, the number of construction projects in 2012 is 500800, the number of subway construction 2405, in 2014 China's construction projects 57100, subway construction projects 2460, to 2022 China's total number of construction projects 76025, the number of subway construction 3680, it can be seen that both construction projects and subway construction projects are growing year by year, where the subway construction projects in the total construction engineering projects also occupies a considerable proportion, as shown in Figure 4

(2) With the increase of construction projects and metro construction, engineering accidents also occur

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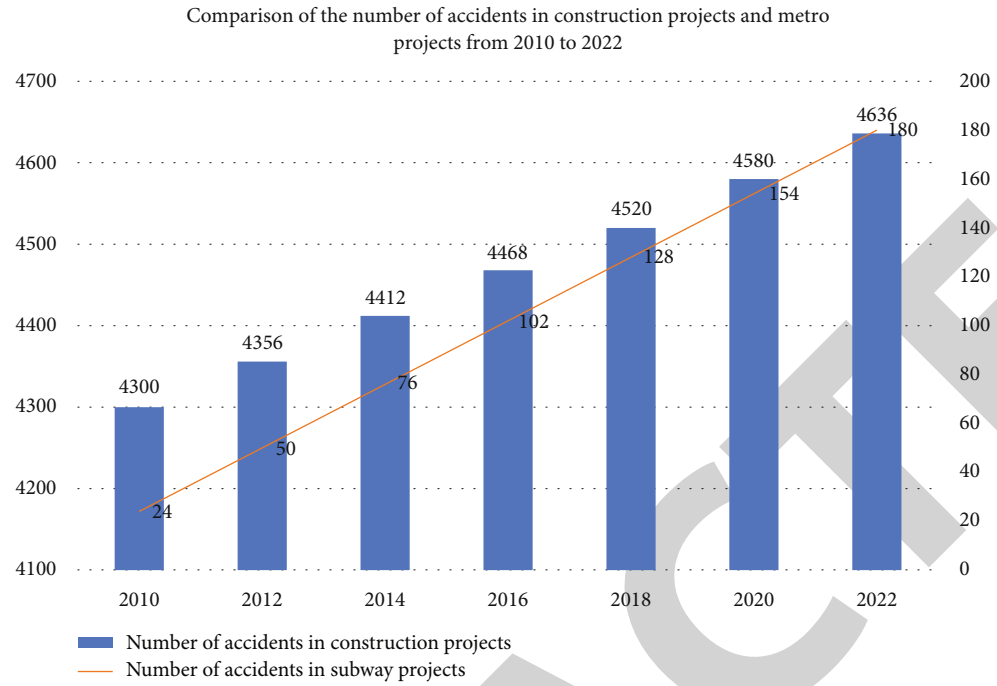

Figure 5: 2010-2022 China's construction projects and metro project accident volume comparison chart.

frequently, so it is necessary to focus on the quality of metro construction to avoid quality and safety accidents. As seen from the figure, the total number of accidents occurred in China's construction projects in 2010 was 4300, and the number of quality accidents occurred in metro construction projects was 24. In 2012, the number of accidents occurred in China's construction projects 4356, the number of accidents occurred in subway construction projects 50, in 2014, the number of accidents occurred in China's construction projects 4414, the number of subway construction projects 76, to 2022, the number of accidents occurred in China's construction projects 4636, the number of subway construction projects 180, it can be seen that with the construction projects in China increase, the construction project engineering safety index has decreased, the number of safety accidents has increased year by year, as the construction project of the subway construction project, construction accidents are also showing only an increase in the trend. Therefore, the quality and safety control of subway construction is especially important and must be given great attention, as shown in Figure 5

(3) The quality of the metro project and the requirements of the project duration are inseparable, purely considering only the requirements of the duration, if the requirements of the duration are urgent, the construction party may be to sacrifice the quality of the project to catch up with the schedule, this paragraph takes an idealized analysis, purely considering only the factors affecting the duration, to find the effect of the duration on the quality of the project. Assuming that the ideal construction period of the subway project is 5 years, the algorithm and modeling software are used to carry out the ideal modeling: if all aspects of the project proceed smoothly and the construction period is 5 years, the project quality is qualified. Through the algorithm and software to shorten and increase the construction period, the following conclusions are drawn: if the construction period is shortened to 4.5 years, the probability of engineering quality accident is 97%; if the construction period is shortened to 4.6 years, the probability of engineering accident is 94%; if the construction period is shortened to 4.7 years, the probability of engineering quality accident is 91%. If the construction period is shortened to 4.9 years, the probability of quality accidents is 85%. It can be seen that the more the ideal construction period is shortened, the higher the probability of quality problems will occur. Therefore, attention should be paid to the control of the construction period in the construction and control to a reasonable range, as shown in Figure 6

(4) The quality of the project is also closely related to the cost, assuming the subway construction project construction cost is 450 million RMB, under all conditions in the idealistic state, all the cost for the subway construction, the subway construction project of the accident probability is 0, and the algorithm and software

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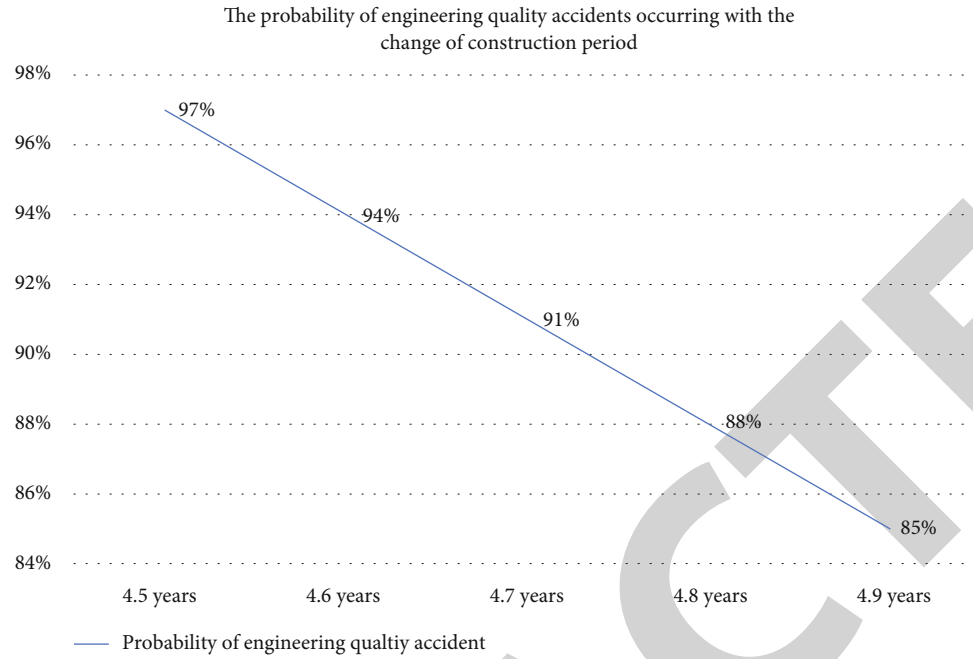

Figure 6: Probability of engineering quality accidents with time limit.

rationalization analysis: Assuming that when the cost of the subway project is reduced from 450 million to 440 million, the probability of subway quality accidents is 89%, 91%, 93%, 95%, and 97%, respectively. Cost reduction will also lead to the decline of engineering quality, easy to cause engineering quality problems, as shown in Figure 7

(5) Quality is closely related to the project management of the project, the assumption that the subway project management personnel 20 people, the project quality problems of probability is 0, the algorithm and software modeling analysis, management personnel number dropped to 18 people, the quality of the accident probability is 97%, managers down to 16 people, and the accident probability is 95%. When the number of managerial personnel decreases to 14, the accident probability is 87%; when the number of managerial personnel decreases to 12, the accident probability is 85%; when the number of managerial personnel decreases to 10, the accident probability is 80%. It can be seen that the number of managerial personnel also has an important impact on subway quality accidents and can not arbitrarily reduce the number of managers, save money, as shown in Figure 8

(6) From the above analysis, it can be seen that the safety and quality accidents of subway construction projects are closely related to the construction period, cost, and number of management personnel, with construction period accounting for 31.5%, cost 35.2% and number of management personnel 33.3% as shown in Figure 9

4.2. Analysis and Discussion. In recent years, due to the poor quality of subway tunnel construction, tunnel collapse, leakage, and other problems are increasingly serious, not only causing economic losses but also affecting the construction progress of subway tunnel. Therefore, it is necessary to strengthen the research on the key technology of subway tunnel construction quality control, master the key technology of subway tunnel construction quality control, and ensure the safety of personnel and the quality of subway tunnel construction. The staff of subway tunnel construction project should improve their quality consciousness, master a lot of key quality control techniques, and promote the smooth development of subway tunnel construction project.

Construction quality control plays an important role in the process of subway tunnel construction. Practice has proved that in the process of the subway tunnel construction, a thorough inspection to the construction environment, the construction unit should strictly control the construction quality of each link, formulate relevant rules and regulations, and make clear a regulation, to ensure the implementation of construction personnel in the process of the subway tunnel construction; the construction risk is higher, the various forms and effect of tunnel support should be paid attention to in order to improve the construction safety of the tunnel and ensure the safety of persons and property. Construction quality control needs to be strengthened. First, the construction unit is responsible for the management of supporting materials, strengthen the quality

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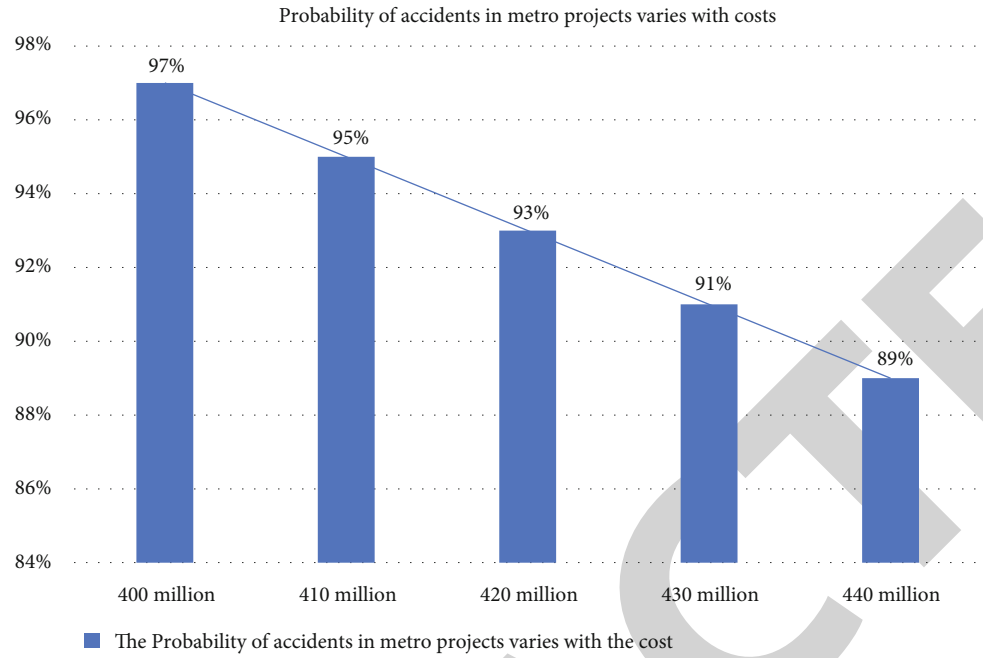

Figure 7: The variation of accident probability of subway project with cost.

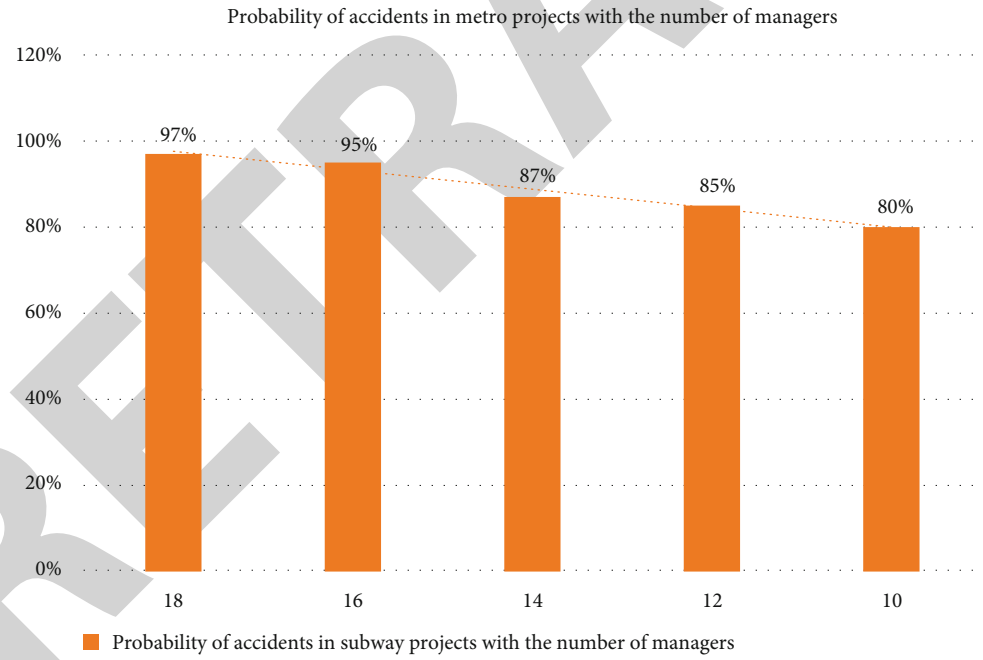

Figure 8: The variation of accident probability of subway project with the number of management personnel.

control of materials, and pay special attention to the inspection after use. The second is to use reinforcement support technology, try cold drawing solidification, check the quality of reinforcement in pavement construction, and transport the reinforcement to the construction site, to ensure that the flatness of reinforcement meets the requirements. The construction quality of concrete must be well controlled. In the construction of the inner wall, we should pay close attention to the height of concrete, so that concrete performance indicators meet the design requirements. The surface of concrete is smooth, without cracks, back tendons, reducing voids, etc. In order to make the geometric parameters of concrete arc section meet the structural requirements, it is necessary to measure the corresponding height of the base. Therefore, more inverted foundations can be poured during construction.

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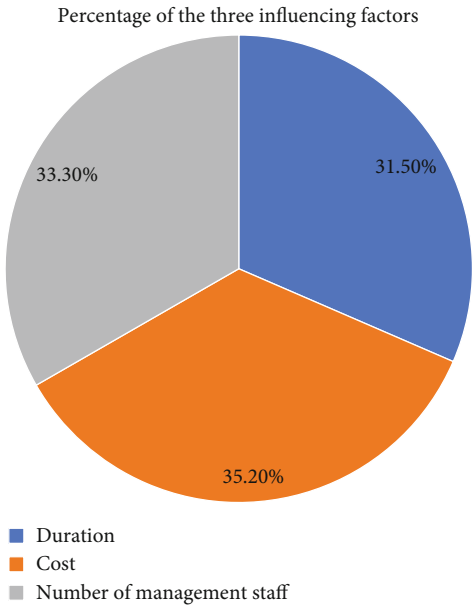

Figure 9: Proportion of construction period, cost, and number of management personnel.

Construction quality control is one of the important tasks of quality management, throughout the whole process of project decision-making and implementation, and in each link according to the quality requirements, strict control, in order to build a high standard, high-quality, efficient construction project. According to the quality management system of the construction enterprise and the overall quality control system of the project of the construction unit, as well as the relevant provisions and requirements of the design unit, a quality assurance ability system of geotechnical engineering professional construction enterprises is established, which takes the construction and management organization management of the construction site as the main task. The establishment of the implementation of quality excellence development goal system, quality control department functions, and its division of labor, quality control, management and other basic system provisions and management of the basic process, construction organization quality planning program and project construction organization design documents, quality control point system and its related control and measures, internal and external management communication and mechanism system and its control operation management measures. Quality certification management process system in the engineering operation process should follow a strict follow the PDCA cycle, plan (plan, stage), do (implementation stage), check (check) steps and action (process stage) steps process principles, through systematic planning and analysis and actual engineering operation practice, to strengthen the source of quality problems management, carry out preconstruction plan and identification of quality common disease factors, through the identification of the factors influencing the quality common problems before construction decomposes the control measures one by one, determines reasonable construction procedures, construction techniques, and technical measures by formulating construction quality control plans, strengthens the inspection of design drawings, especially the buried pipes prone to collision, calculates and checks their spatial locations, makes full use of advanced technologies such as BM technology, transforms two-dimensional drawings into four-dimensional models of buildings, carries out visual disclosure and collision inspection, solidify the technical foundation of construction, identify drawing design problems and optimize improvement in advance, while avoiding hidden quality problems caused by blind construction by construction personnel.

Establish a clear, definite, reward and punishment quality management system, with each division performing its own duties and responsibilities, organized in an orderly manner, setting the project manager as team leader, project director and project production manager as deputy team leaders, and construction, technology, quality inspection, measurement, materials, testing and other departments closely cooperated by the quality management team and supervisory personnel, forming a strong quality assurance system; strengthen the quality supervision and law enforcement of grassroots construction projects force, seriously investigate and deal with all kinds of illegal and irregular acts, and resolutely stop the disorderly transformation of rural houses and public buildings to avoid engineering quality problems and hidden dangers to people's lives and safety.

Industrial workers are the main force of the working class, the backbone of creating social wealth, the backbone of innovation-driven development, and the effective force in implementing the strategy of manufacturing power. Housing and urban-rural construction departments should accelerate the reform of industrial workers mechanism, education departments should vigorously promote the reform of technical schools, and construction enterprises should establish industrial workers training schools to provide specialized training for industrial workers, such as welders, electricians, production workers, assembly workers, preburied workers, grouting workers, and plasterers, through internal training or outsourcing training. Support high-quality development of construction projects based on industrial workers.

Vigorously promote assembly-type construction green building, the use of information technology, standardization, industrialization, assembly technology to replace the traditional cast-in-place mode, the use of modern construction technology can effectively reduce the quality of site operation of uncontrollable quality, environmental uncontrollable, uncontrollable personnel and other factors on the quality of industrial construction, information management, commercialization sales model to improve the quality of the project. The development of green building is China's construction industry in the context of carbon peak and carbon neutral must take the green development path, actively guide the emerging construction industry and intelligent building-related technology fields, joint construction units and design units to carry out the application of assembly-type buildings and green building demonstration projects.

Building construction enterprises should establish quality management-related systems and realize the management of people, machines, materials, methods, environment, and measurement, while adopting a comprehensive management

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model to realize quality process management; actively apply new technologies such as Internet plus, artificial intelligence, etc.; vigorously promote the industrialization and industrialization of construction projects; and promote the transformation of China's construction projects to the direction of refinement, digitalization, and intelligence.

5. Conclusion

In this paper, based on the in-depth study of the basic principle of quantum particle swarm optimization calculation and the realization of key engineering technologies, the particle swarm optimization algorithm was programed using MATLAB software, and the coding scheme, operation specification, and operation parameters were designed. Then, combined with the particle swarm optimization algorithm, auxiliary MATLAB software, the main analysis of the construction and quality control of the wet loess concealed tunnel of the subway project, mainly through the relationship between the three major elements of the subway project schedule, cost, management and the construction and quality control of the wet loess concealed tunnel of the subway, a systematic analysis was made, and the following conclusions were drawn.

(1) Stable schedule: to ensure the construction and quality control of subway wet loess in concealed tunnel construction, it is necessary to ensure that the construction schedule of the project is stable. Through measurement and analysis, if the schedule is advanced, what may be caused is the appearance of the project in order to catch up with the schedule to cut corners, thus causing the corresponding quality problems

(2) Sufficient cost budget: cost and the quality of the project is closely related to the subway wet loess dark excavation tunnel construction and quality control requirements must have sufficient budget costs, in order to ensure that there are sufficient financial resources to purchase materials, to ensure that the project is not because of the cost of compression to cut corners, thus ensuring the quality of the project

(3) Sufficient number of managers: to ensure the construction and quality of the subway wet loess concealed tunnel construction and at the same time need to have sufficient management personnel, because the quality of the project and management are inseparable, sufficient management personnel, can be in all aspects of the project, the project control, reduce the risk factor of the project

In conclusion, this paper based on the particle swarm optimization algorithm of subway wet loess in concealed tunnel construction and quality control, through algorithm and theoretical analysis, concluded that the project duration, cost, and management is extremely important to the subway wet loess in concealed tunnel construction and quality control.

Data Availability

The dataset is available upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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