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Application of Steel Sheet Pile Support Technology in Foundation Pit Construction of Road and Bridge Engineering

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Abstract: ***The use of rigid support technology in the construction process of highway bridges has a significant impact on the stiffness and load-bearing capacity of highway bridge engineers, greatly improving the strength of highway bridges, extending their service life, and increasing investment value. In the construction of construction sites, the construction of ditches for road and bridge foundations is a very important part, as it directly relates to the safety and reliability of the foundation, rather than directly affecting the stability and feasibility of the overall construction plan. Therefore, in this structure, the focus should be on this technology. This article starts with the analysis of steel plate support technology and its advantages in road and bridge construction, explores the specific functions and uses of road and bridge structures, and finally describes their defects.***

Keywords: road and bridge engineering; Foundation pit construction; Steel sheet pile support.

1. INTRODUCTION

With the continuous acceleration of modern urban construction and the rapid development of transportation industry in China, the use of motor vehicles in China has recently expanded to ensure people's livelihood and economic and social development. Bridge and road engineering are increasingly becoming important components of land transportation construction, and their quality and safety are receiving national attention. The foundation of road and bridge construction is the main work of the quarry. The main mining operation has high quality and can effectively prevent safety accidents such as falling and sinking during road and bridge construction. As the backbone of road and bridge construction, steel pole technology is crucial for the quality and safety of facility construction.

2. STEEL SHEET PILE SUPPORT TECHNOLOGY

With the continuous development of modern society, the construction of infrastructure has increased the importance of society. Government agencies have significantly increased their investment in infrastructure and the number of road and bridge projects has increased significantly. However, due to various reasons, the quality of road and bridge design is not controlled, so road and bridge design is used. Insufficient security guarantees pose a serious threat to the safety of life and property of social groups. The use of steel pipe pile technology helps to improve the flood resistance capacity of roads, bridges, and river banks, meeting the requirements of sustainable development. Steel sheet pile support technology is an economical building material that plays an important role. Due to the direct impact of steel plate support technology on the quality of road and bridge construction, advanced construction techniques are needed. The foundation groove steel plate is suitable for using pile support in road and bridge construction. The use of steel plate support technology for road and bridge construction can strengthen project cost management, shorten construction period, ensure quality, and have adverse effects on road and bridge traffic. Reduce the contribution of road and bridge technology to the smooth realization of road and bridge construction goals.

Figure 1 illustrates the development of food production in the country, which can be broadly divided into three stages. In the first stage (1978-1998), grain output surged from 300 million tons in 1978 to 512 million tons in 1998, indicating a consistent trend of rapid growth. The year 1978 marked the initiation of economic reforms and the 'open door' policy in China. Additionally, the implementation of the household contract responsibility system in agriculture effectively bolstered the enthusiasm of farmers. However, during this period, the country faced significant challenges in the form of natural disasters, including the severe drought in the north in 1980 and the flooding of the Liaohe River in 1985. These events led to notable reductions in grain production. In the second stage, 1999-2003, starting in 1999, China's grain output declined sharply, falling from 512 million tons to 431

million tons in 2003 in five consecutive years, a drop of 81.6 million tons, or as much as 5.9 percent. In order to change this situation and stabilize grain production, the government has continued to adopt policies to stimulate grain production and increase farmers' incentives to grow grain. The third stage, 2004-present: In 2004, due to the abolition of part of the agricultural special production tax and the full abolition of the agricultural tax in 2006, China's total grain output rose, increasing by 9% over 2003. By 2013, the total national grain output reached 602 million tons, surpassing the 600 million tons mark for the first time. In 2020, the total national grain output reached an all-time peak of 682.8 million tons, continuing the trend of annual increases for 17 consecutive years.

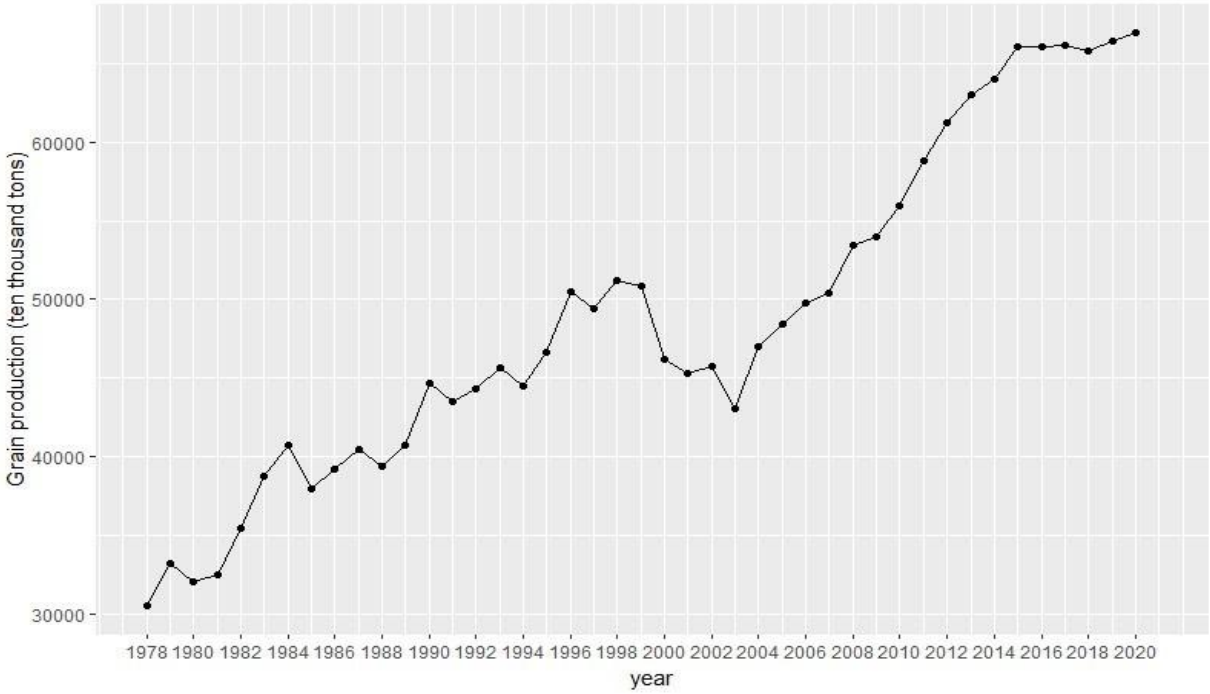

Figure 1: National food production by year

3. APPLICATION ADVANTAGES OF STEEL PLATE SUPPORT TECHNOLOGY FOR FOUNDATION PIT IN ROAD AND BRIDGE ENGINEERING CONSTRUCTION

One of the main application technologies for road and bridge construction projects is the steel core support technology for foundation pits. This technology can improve flood control capabilities while managing underground accidents and traffic accidents. Steel plate is an important building material that can be applied to components such as building walls, steel walls, and retaining walls. Steel plate supports provide significant stimulation during road and bridge construction, and can adapt to different construction conditions. Technical requirements for steel support: During the construction process, appropriate mechanical equipment should be selected according to the different stages of steel production. For example, if the length is less than 12 meters. The steel gathering machine is usually driven by a robotic arm, while the steel gathering machine with a length greater than 12 meters is controlled by a combination of a vibrating hammer and a grate crane [1].

Given the rapid growth of China's transportation industry and the expansion of transportation capacity, many road and bridge projects in China are operating under overload, making the situation in the transportation industry even more severe. Therefore, the quality and maximum design capacity of road and bridge engineering are very important during the construction process. As the foundation of road and bridge engineers, the operation of foundation pits affects the subsequent construction of road and bridge projects. The use of steel pole technology can effectively reduce the cost and time of road and bridge construction, reduce economic and human contributions, scientifically and reasonably reduce the congestion of Transportation engineering, and meet the requirements of high-quality road and bridge engineering. Therefore, the benefits of using steel pole technology for road and bridge construction are obvious.

Domestic scholars have conducted extensive research in recent years on grain production forecasting. In terms of factors influencing food production, these scholars have conducted comprehensive studies, both specific and holistic, to analyze these influences. Jiquan Peng et al. [1] conducted an analysis of the influence of the agricultural mechanization level on staple food production in farm households. They employed instrumental variable methods and a sample selection correction model for their study. The conclusion drawn from their research is that the level of agricultural mechanization significantly and positively affects staple food production in farm households. Tao Peng [2]conducted an analysis of the impact of rural labor outflow on grain production in Henan Province using the Cobb-Douglas production function. The analysis revealed that continuous labor outflow was not the primary factor influencing grain production. Instead, the quantity of fertilizer application, the acreage of grain cultivation and the usage of agricultural machinery significantly impacted grain production. Ruxin Zhao [3] conducted a systematic analysis of the response of grain yield to climate change in Guanzhong, Shaanxi. This analysis encompassed grain yield, climate yield and climate production potential. The results of the analysis revealed a positive correlation between temperature and grain yields in many areas of Guanzhong. An increase in temperature was found to promote grain yield growth in Guanzhong to a certain extent. It was also determined that there is ample room for utilizing climate resources for crop production in Guanzhong and climate change has a beneficial impact on grain yield in the region. Zuli Wang et al. [4] conducted an analysis of the impact of fertilizer application on grain yield growth. The results demonstrated a robust positive correlation between fertilizer application and grain yield. Fertilizer input emerged as a pivotal factor influencing the growth of grain yield. Notably, during the period from 1978 to 2006, fertilizer input contributed significantly, accounting for 56.81% of the growth in grain yield. This contribution was the most substantial among all input factors.

In the realm of research methods, domestic scholars frequently employ various models including the GM (1,1) gray prediction model, linear regression model, neural network and time series model. The GM (1,1) prediction model is primarily utilized for scenarios involving limited data, sequences with inadequate information and short-term predictions due to its notably high prediction accuracy. Pengling Liu et al. [5] conducted an analysis of the factors influencing grain output based on data from Anhui Province. They utilized a gray model to predict grain output in Anhui Province for the next eight years. The results indicate that the factors affecting grain output, in descending order of significance, are technical factors, resource input factors and market factors. Additionally, the prediction suggests that grain output is expected to exhibit an upward trend over the next eight years.

A multiple linear regression model, not only capable of prediction but also of intuitively demonstrating the mechanisms through which explanatory variables influence dependent variables, was applied by Yongsheng Zhou et al. [6] to analyze the factors affecting grain yield. The results indicate that the most pronounced factor contributing to grain yield is planting area, followed by yield per unit area, with precipitation having the least influence on grain yield. Furthermore, the regression equation holds significant economic relevance and offers a more intuitive understanding of the relationships involved.

The neural network model, capable of addressing the limitations of traditional prediction models when fitting nonlinear systems, was employed by Chengcai Zhang et al [7]. They established a grain production prediction model for Henan Province using a BP neural network. This model utilized data from relevant influencing factors of grain production in Henan Province. Notably, within the realm of grain production influencing factors, many current foreign scholars tend to analyze from a micro perspective. J. Timsina [8] conducted an extensive discussion on various factors, such as sowing time, organic fertilizer and agricultural infrastructure, which impact grain yield from a systemic perspective. A. Dobeemann [9] also placed emphasis on examining the interplay between factors like arable land area, grain sowing rate, soil fertility, fertilizer use and rice production. In the domain of grain yield prediction, foreign scholars employ various methods including empirical statistical regression, remote sensing information technology and growth modeling techniques.Petersen [10] employed plant health indicators to construct a multiple regression model for predicting food production. The study demonstrated that the model exhibited a high level of accuracy in forecasting agricultural production. Furthermore, it was applied to predict the yields of various crops in each African country for the year 2018, and the forecasts closely matched the actual yields. Kern et al. [11] utilized Hungarian meteorological data, fertilizer application-related data and normalized water index measurements obtained through remote sensing technology to create multiple linear regression models for various crop yields. The study's findings revealed that the lowest air temperature in May and the highest air temperature had varying promotional effects on different crops. Moreover, the soil water content in July and August had the most significant impact on the final maize yield.

A comprehensive review of the current research conducted by both domestic and foreign scholars on grain yield reveals certain shortcomings in existing methods. Firstly, concerning data, these methods face a challenge due to

the timeliness of the data. Models constructed several years ago may no longer be applicable. Therefore, this paper is founded on the latest data to investigate the factors influencing grain yield in China. Secondly, in terms of models, methods like the gray scale forecasting model and time series model predominantly concentrate on the inherent trends of grain yield, often overlooking external factors. On the other hand, the multiple linear regression model takes into account external factors, but it can sometimes result in significant information loss from the original data due to the need to avoid multicollinearity. Grain yield doesn't conform to a simple linear model; instead, it follows a complex nonlinear pattern. Dealing with the fitting of nonlinear models poses a challenge for multiple linear regression. Additionally, remote sensing information measurement techniques, which are popular abroad, primarily focus on variables like soil moisture and solar radiation. Hence, in light of the aforementioned limitations, this paper takes a comprehensive approach, considering various methodologies, with a primary emphasis on multiple linear regression, support vector regression and the random forest method. Multiple linear regression excels in extracting insights regarding the inherent impact of factors on grain yield. Support vector machines exhibit robust learning capabilities, particularly suitable for high-dimensional data. Random forest, on the other hand, not only facilitates regression prediction but also provides variable importance rankings for output. Consequently, this paper employs the aforementioned methods for research, culminating in a combined prediction.

4. APPLICATION OF STEEL SHEET PILE SUPPORT TECHNOLOGY IN FOUNDATION PIT CONSTRUCTION OF ROAD AND BRIDGE ENGINEERING

The issue of food is a perennial concern that transcends societal developments. In the context of a populous nation, food security becomes a pivotal element for national stability and social harmony, and it remains a paramount concern for our government. The study of crop production holds an indispensable role in human society. A comprehensive examination of crops and their production dynamics, coupled with an analysis of the intricate relationships among various significant influencing factors and crop production, bears immense significance for the advancement of agriculture as a whole. The nation's food production is a multifaceted process influenced by a myriad of factors. The enhancement of food production isn't a one-time occurrence; it involves a complex interplay of numerous elements that substantially impact production outcomes. Thus, it is imperative to delve into a thorough examination of these factors and understand their pivotal roles in shaping the landscape of food production. China's current grain production has displayed a consistent year-on-year growth pattern. However, there remains a substantial disconnect between the total demand for food and the overall grain production. This stark contrast underscores our nation's significant reliance on foreign sources for food, highlighting an urgent need to bridge the gap between production and demand effectively. The inherent lag in grain production statistics necessitates the crucial role of grain production prediction on the eve of the harvest. In contrast to traditional methods reliant on past planting experience, the application of scientific prediction techniques holds promise. Such methods can empower the government to swiftly and accurately formulate policies that benefit the agricultural sector, bolstering farmer enthusiasm for production. Additionally, they facilitate proactive decisions regarding food distribution across regions, fostering social stability and promoting the balanced growth of the market. Furthermore, these techniques enable in-depth analyses of the multifaceted factors influencing food production, providing valuable guidance for the agricultural sector's development. In turn, this contributes to increased income and enhanced food production, aligning with our national goals.

4.1 Construction preparation stage

(1) Understand the specific content of the construction plan

Before construction, the Construction Division covers the manufacturing process of steel poles, with a focus on fully understanding the specific materials used in construction to ensure that technical specifications comply with regulatory requirements. Should be consistent with the drawing requirements. It can ensure the geological conditions of the site and ensure that the design parameters of the lower steel plate meet the design requirements.

(2) Prepare sufficient construction machinery and equipment

When managing the foundation of roads and bridges, appropriate maintenance and upkeep of mechanical equipment should be carried out, and installation personnel should be equipped to ensure the normal entry and exit of various large engineering machinery. A fixed width lane and a reasonable schedule to ensure that all types of mechanical equipment enter and exit the building correctly. Due to the large number of underground pipelines and obstacles in the area where the highway bridge project is located, construction machinery must carefully record the distribution of various obstacles and pipelines. The design of support piles greatly affects the normal operation of

underground pipelines.

(3) Reasonably set up drainage channels within the construction site of road and bridge projects

According to the construction data of road and bridge foundations, steel ball bearings must be firmly fixed. At the same time, to avoid excessive accumulation on the construction site, the blocks must be equipped with a drainage system. In general, drainage pipes are mainly installed on both sides of the factory channel, and appropriate anti flow measures to avoid large-scale sedimentation.

4.2 Construction process of steel sheet piles

When using the stack, there are several steps to follow. The general procedure is as follows. The first step is to lay the line. Therefore, it is necessary to determine the construction site of steel piles based on the wiring management network and the distance from the bracket to the construction site. The second step is to access the main file by checking the file options. The first step is to adjust the worktable tiles to make the construction area as flat and even as possible, so as not to interfere with the movement of the machine. The final steps include sealing the pipe, sealing the bottom with silicone, extracting water, digging a well, laying the board support and cover plate. Pour concrete, and then the steel ball is compressed and restored [2].

4.3 Steel support arrangement

The steel support system is an important component of the steel pile support structure in road and bridge construction. When combined with steel suspension beams, it can effectively support the steel support structure. Usually, steel poles are installed with steel beams, and steel beams and poles are fixed with brackets. Spacer bolts are used to fix between structures. If the structure itself meets specific design requirements, various types and specifications of pins can be selected to ensure effective matching between structures. The assembly of the steel seat is completed by lifting, making the steel beam and wall support close together. This is beneficial for the assembly and construction of the tie and the strength of the power supply device. Assist in quality control of steel ball bearing manufacturing in road and bridge construction projects. When creating a steel rod connection, the parts need to be Tight junction to determine the actual measured length of the steel rod. After assembly, external axial force must be applied at the front to reduce unnecessary internal displacement and adjustment, ensuring that the steel support components are designed for a close interaction between the steel support, steel waist beam, and column. The standardization of steel plates has greatly improved the construction quality of supporting piles in road and bridge engineering.

4.4 Steel sheet piles entering the site

River piles are the main building materials when the Minghe Pile foundation technology is used to build roads and bridges. Therefore, when entering the site, it is necessary to strictly control and correctly carry out lifting and turning work. In the field of engineering procurement, it is necessary to choose material suppliers with good reputation and material quality in the market, and purchase building materials with quality that meet engineering requirements. When the steel box arrives at the site, quality control behavior and certificate of conformity will be checked, but both are necessary. After obtaining all qualifications and the materials arrive on site, we need to verify the quantity and quality of the materials through spot checks. Examples of inspection methods include the following aspects: firstly, the surface of the steel probe is smooth and flawless; 2、 Whether the material details are reasonable and meet the design requirements. There are welded steel parts and forced opening. It is possible to forcibly fix the hole by removing the welded part without affecting the structure. In the third quarter, material properties were tested, including tensile and bending materials, and the ductility and strength of steel plates were tested. The construction of roads and bridges carrying steel roofs requires the selection of at least one type of steel piles. For tensile and bending tests, ensure selection types of 50 ton steel pile materials.

4.5 Lifting and stacking of steel sheet piles

The construction of steel pile supports for road bridges requires standard lifting and stacking of steel plates to ensure the smooth progress of construction work. Generally, during settlement. Use suitable piles in flat areas with small shapes and install steel ball piles according to the classification of construction use. During the stacking process of steel balls, they should be sorted and stacked in layers based on length, specifications, model, etc. The conveyor is placed on two adjacent steel layers. Check the distance between adjacent sleepers to avoid affecting

the load-bearing capacity of the loader. The construction of steel gourds is usually completed through point-to-point gourds. To standardize lifting operations and ensure safety, it is necessary to control the lifting amount within the optimal range, avoid lifting accidents, and maintain the normal development of steel plate safety structures such as construction projects, roads, bridges, etc. Have a negative impact [3].

4.6 Steel sheet pile driving and enclosure construction

There are two types of steel ball transmission: grid transmission and split transmission. The so-called screen method is to insert steel balls into the ground along the Orbit insertion, complete the construction of about 15 steel balls at a time, and build a screen wall. In order to effectively control the verticality of the steel plate, it is necessary to first insert the two halves of the plate into the ground and then surround it. The foundation can ensure the verticality of the steel plate, effectively reduce structural defects, and avoid the structure of adjacent metal plates. The corner was hammered into the foundation. Although this method has high structural efficiency and short rolling path, it cannot guarantee verticality. Therefore, there is a possibility of deviation errors during steel ball collisions, making it difficult for construction personnel to take effective response measures. In this design, the screen method is used to strike a stack of steel plates with a vibrating hammer and complete the deposition process multiple times. The construction party must determine the number of steel bars on both sides of the foundation ditch based on the position of the corner piers and the size of the main dam. After the steel plates are erected and closed, carefully measure the height of the chimney top and cover, and accurately calculate the height of the cabinet body. Ensure that the depth of the trench does not exceed the height of the guardrail. When the depth of the foundation trench reaches the height of the guardrail, guardrail construction should be carried out in a timely manner.

4.7 Removal of steel sheet piles

After the cover work is completed, the steel ball bearing should be removed. In the early stage of demolition, a layer of embankment should be added and compacted in the inner area of the fence. It is necessary to check the thickness of the building foundation 1m below the steel support. At this stage, the steel brackets are removed sequentially from top to bottom. The disassembly operation must first remove the inner connector, then remove the lower half, fill the ground, remove the upper half of the connector, and then remove the steel ball. When placing the pipe pile, first clamp one end of the pipe pile with a Pile driver and vibrate it for about 1 minute. When the soil layer around the steel plate becomes loose and the friction between the ground and the steel plate decreases, carefully remove the steel plate. During the traction, the construction personnel must understand the condition of the Pile driver. If the tractor is too high and overloaded, the towing operation should be stopped. The vibration lasts for 1-2 minutes. When the soil layer becomes loose, the traction operation can be resumed. Repeat the above steps to smoothly uninstall the process. The requirements for cranes during demolition operations are high. As the vibration of the eliminator increases, the crane gradually increases its load. Therefore, when lifting, attention should be paid to the lifting speed and vibration amplitude. Then it was deleted. The entire process should be carried out as slowly and smoothly as possible, without rushing for success. After the dismantling of the steel pipe pile is completed, the remaining holes must be filled with an embankment, and the backfill material can be stone carvings, etc. [4].

4.8 Foundation pit backfilling

After painting, pipelines, and steel balls are completed, they should be quickly approved and filled in in a timely manner
Basic cavity. The quality manager must carefully check the quality of the rewinding primer. In addition, the soil moisture should be checked for approximately 1 second. Before backfilling the foundation pit, the water and all possible objects inside the pit should be cleaned, and then the foundation holes should be sealed in layers, and the thickness of each layer should be checked to be about 1 millimeter. 200 millimeters. Durability meets construction requirements. When removing the pile from the steel plate, it is necessary to use a mesh excavator and a vibrating hammer to cut the pile from the steel plate. When the soil is disturbed by the forced vibration of the vibrating hammer, the adhesion with the surrounding soil decreases, and the resistance of the mass block decreases. Use edge vibration at this stage. The side pull method makes it easy to pull out the steel probe. When dismantling steel pipe piles, the remaining soil pits must be filled in a timely manner and heavy sand must be used as the material.

5. NOTES ON THE APPLICATION OF STEEL SHEET PILE SUPPORT TECHNOLOGY IN FOUNDATION PIT CONSTRUCTION OF ROAD AND BRIDGE ENGINEERING

With the rapid development of society and economy, China's road and bridge technology has developed rapidly. Deep ground support is an integral part of leg design. To meet construction requirements, accelerate construction progress, and shorten the construction period, it is necessary to strictly select support methods based on the actual situation of the construction site. The reasonable use of steel pipe piles for bridge trench foundation can effectively improve the stability and engineering quality of the foundation shaft, and the use effect is significant. Food security is crucial for national stability and social harmony. Being a populous country, China's government has traditionally prioritized food security, making it a top concern in their rural revitalization strategy. Due to the time lag in the production of statistical reports, timely grain production forecasts are essential. This paper analyzes various factors influencing grain output and elucidates their mechanisms. Seven key indicators, including grain sown area, effective irrigated area, total power of agricultural machinery, rural electricity consumption, fertilizer application, number of people employed in the primary industry and affected area, are identified. Using R software, three models-principal component regression, random forest and support vector regression-are established based on historical data to predict China's grain production. Each model has its strengths and weaknesses. To enhance reliability, an inverse variance method combines the three models, resulting in a more robust and scientifically grounded combined model. The results indicate a low average error and strong fitting accuracy for the combined model, offering valuable insights into predicting China's grain production. In conclusion, this paper summarizes its findings and outlines areas for future research.

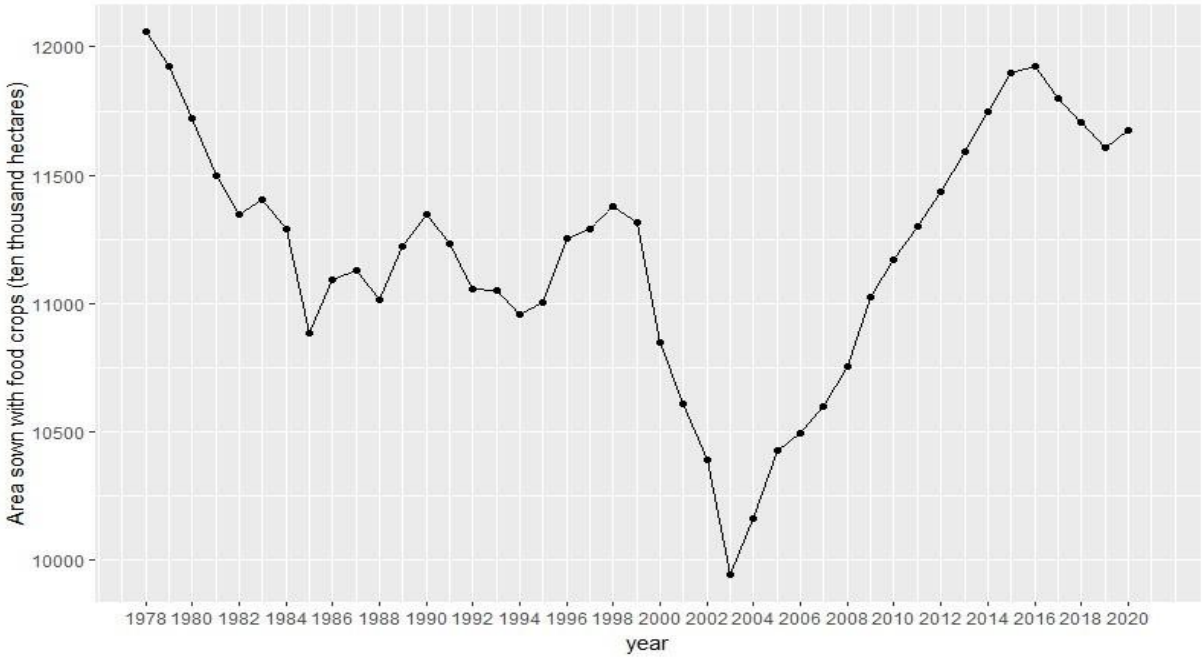

Figure 2: Changes in the national area sown with grain

As shown in Figure 2, which reflects the national trend in the area sown to grain. The grain sown area, which refers to the land actually cultivated within a specific region, is a critical resource for agricultural production and a key factor in ensuring continuous grain production. Land, as the most fundamental condition for food production, plays a fundamental role in food production. Modeling and predicting food production based on the grain sown area hold significant guidance value.

5.1 Pay attention to displacement monitoring during the construction process of steel sheet piles

The motion tracking during the steel plate production process cannot be ignored. Some motion monitoring tools and equipment are standard production unit level and Total station. Due to the inherent characteristics of the trench depth, it has been decided to slightly shorten the observation time interval and increase the tracking density. The function of leveling equipment is to control the height during the drilling process, prepare the ground and monitor

the soil during the construction process. The entire station is used to control the horizontal movement of steel balls at various construction sites. In fact, the most important thing is to ensure the level and disassembly of the stack body are suitable for timely evacuation or use [5].

5.2 Pay attention to operational issues during the construction of steel sheet piles

In actual construction, once piles of steel plates are transported to the construction site, the primary task for engineers is to calibrate, classify, count, and record them. The selection of splicing parts is also important. In fact, it includes several vestibular technologies that require high environmental requirements. To avoid errors when ordering steel plates for transportation or insertion, it is also possible to calculate or paint based on the insertion position of the stop sleeve. Before disassembly, apply a small amount of lubricant to facilitate handling and disassembly. During debugging and operation, the slope of each pile should be continuously monitored and measured, and the slope should not exceed 2%. The Penetration depth is usually between 0.05 and 3.00 m. If the slope becomes too steep, it cannot be corrected with lace. The only way is to pull it out and hit it hard. It is currently unclear whether this will waste energy and reduce work efficiency.

5.3 Scientifically control the excavation depth and slope of foundation pit engineering in road and bridge projects

Construction tools must undergo technical testing in advance and correctly check the drilling slope and trench depth. If a foundation pit collapse or abnormal monitoring data is found, the construction of the foundation pit should be immediately stopped to prevent large-scale collapse of the foundation pit project, And take scientific protective measures. At the same time, the construction unit should scientifically construct manholes, effectively protect the slope of the Protecting group ditch, reduce the accumulation, ensure the slope of the engineering ditch road and bridge, and make the road and bridge more stable.

5.4 Minimize the number of excavation surfaces as much as possible

To meet the needs of road and bridge excavation, the number of excavation faces should be minimized as much as possible to avoid undue risks to the working face. The deepening of the foundation has been disrupted. Adopting scientific drainage methods can effectively reduce the possibility of collapse in large quarries. The management personnel of the construction department should also strengthen the implementation of guidelines and use scientific testing methods to comprehensively evaluate the tensile status of the steel pipe pile support system. The successful completion of relevant monitoring work can avoid the serious impact of external environment on the bearing effect of pile steel plates, and will inevitably improve the excavation support level of road and bridge engineering.

5.5 Effective protection measures should be taken on the slope surface

By utilizing the excavation characteristics of this road and bridge project and pouring an appropriate amount of concrete, the slope can be effectively protected and the stability of the foundation slope can be continuously improved. In this road and bridge project, the excavation area of the foundation ditch is relatively large. By strengthening slope protection, the foundation ditch slope can be more stable and prevent large-scale collapse of the foundation ditch. Due to the complexity of the foundation pit construction process, the construction department must conduct effective inspections, carefully analyze various inspection data, and discover significant errors and defects in the maintenance, reinforcement, and adjustment work processes. Check if the impact of ground support on the cost of laying steel for underground projects has significantly improved. This effectively reduces the overall construction time of roads and bridges [6].

6. CONCLUSION

In the main construction of automobile bridge engineering trenches, the main material is steel plate structure, and the technical level directly affects the overall quality of the project. Excavated steel sheet piles have the characteristics of small footprint, high strength, and recyclability. They not only improve the quality of engineering, but also enhance the strength of roads and bridges and the ability to resist natural disasters, playing an important role in highway construction. Relevant industries support primary peat steel plate technology, strengthen research on this technology, standardize road and bridge construction technology, and effectively improve modern road and bridge quality measurement standards.

Drawing upon data related to China's grain output spanning from 1978 to 2020, this paper has successfully identified seven key impact indicators and established a comprehensive forecasting model. This model has proven to be a bastion of scientific rigor, effectiveness and reliability in predicting grain output. However, it's important to acknowledge that, like any research endeavor, this paper has its limitations. These limitations stem from factors such as data constraints and the inherent constraints of the study itself. To enhance the accuracy of our model, we can pursue more profound research in the following areas in the future: Expanding the sample data to encompass a larger volume with higher dimensions can enhance the model's credibility and robustness (Larger Data Volume and Higher Dimensionality). The multiple linear regression model can be refined using more scientifically rigorous methods, thereby improving its accuracy (Enhanced Correction of Multiple Linear Regression). Beyond the models employed in this paper, we can explore other predictive approaches, such as neural network models and the gray scale prediction method. The adoption of these alternative models can further elevate the accuracy of our predictions (Exploration of Additional Prediction Models). By addressing these avenues for improvement, we can continue to refine our forecasting capabilities and contribute to more precise predictions regarding China's grain output.

This paper conducts relevant research on China's grain production factors and forecasting. It proposes a combination of three different models based on the prediction model. The paper primarily addresses the following aspects:

Firstly, this paper provides a specific elaboration of the influential mechanisms of each factor affecting grain output. Ultimately, seven key indicators have been identified as the primary influencing factors. These indicators include grain sown area, effective irrigated area, total power of agricultural machinery, rural electricity consumption, fertilizer application, number of employed persons in the primary industry and the extent of disaster-affected areas. Additionally, relevant data have been thoroughly pre-processed for analysis.

Secondly, utilizing R software, we established three distinct models – multiple linear regression, random forest and support vector regression – to precisely fit China's grain production based on the latest data. Our analysis revealed that the random forest model exhibited the highest fitting accuracy, boasting an average prediction error of just 1.34%. The support vector regression model followed closely with a somewhat higher average prediction error of 1.98%, while the multiple linear regression model lagged behind with an average prediction error of 5.57%.The superiority of the random forest model extends beyond its fitting precision; it also provides essential insights into the significance of influencing factors on grain yield. In contrast, the multiple linear regression model carries substantial economic implications, making it incomparable to the support vector regression model.

Finally, to harness the strengths of each model, this paper endeavors to employ the inverse variance method in merging the three models, creating a prediction approach that is more scientifically sound, accurate and stable. The inverse variance method allocates rational weights to each model, resulting in a more resilient and dependable combined model. When the test set is input into this model, it yields an average prediction error of 3.27%, signifying a strong fit that aligns with our intended objectives. This amalgamated model not only fulfills its intended purpose but also holds valuable guiding significance in the prediction of China's grain output.

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